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Fluoroplastics

J. Drobny

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Source of original article →
Macromolecules
33, No.6, 21st March 2000, p.2171-83

Title →
EFFECT OF THERMAL HISTORY ON THE RHEOLOGICAL BEHAVIOR OF THERMOPLASTIC POLYURETHANES

Pil Joong Yoon; Chang Dae Han ← Authors and affiliation
Akron,University

The effect of thermal history on the rheological behaviour of ester- and ether-based commercial thermoplastic PUs (Estane 5701, 5707 and 5714 from B.F.Goodrich) was investigated. It was found that the injection moulding temp. used for specimen preparation had a marked effect on the variations of dynamic storage and loss moduli of specimens with time observed during isothermal annealing. Analysis of FTIR spectra indicated that variations in hydrogen bonding with time during isothermal annealing very much resembled variations of dynamic storage modulus with time during isothermal annealing. Isochronal dynamic temp. sweep experiments indicated that the thermoplastic PUs exhibited a hysteresis effect in the heating and cooling processes. It was concluded that the microphase separation transition or order-disorder transition in thermoplastic PUs could not be determined from the isochronal dynamic temp. sweep experiment. The plots of log dynamic storage modulus versus log loss modulus varied with temp. over the entire range of temps. (110-190C) investigated. 57 refs. ← Abstract

GOODRICH B.F. ← Companies or organisations mentioned

Location → USA

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Volume 4

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Volume 5

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Volume 6

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Volume 7

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Report 80	**Anti-Corrosion Polymers: PEEK, PEKK and Other Polyaryls**, G. Pritchard, Kingston University.
Report 81	**Thermoplastic Elastomers - Properties and Applications**, J.A. Brydson.
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Volume 8

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Volume 9

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Volume 10

Report 109	**Rubber Injection Moulding - A Practical Guide**, J.A. Lindsay.
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Volume 11

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Volume 12

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Volume 13

Report 145	**Multi-Material Injection Moulding**, V. Goodship and J.C. Love, The University of Warwick.
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Volume 14

Report 157	**Developments in Colorants for Plastics**, Ian N. Christensen.
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Report 167	**Polyolefin Foams**, N.J. Mills, Metallurgy and Materials, University of Birmingham.
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Volume 15

Report 169	**Engineering and Structural Adhesives**, David J. Dunn, FLD Enterprises Inc.
Report 170	**Polymers in Agriculture and Horticulture**, Roger P. Brown.
Report 171	**PVC Compounds and Processing**, Stuart Patrick.
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Volume 16

Report 181	**New EU Regulation of Chemicals: REACH**, D.J. Knight, SafePharm Laboratories Ltd.
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J.G. Drobny

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Contents

Aim and the Scope

The **aim** of this review is to acquaint the readers with the science and technology of fluoroplastics that represent a unique group of plastics used in many dynamic industries, including automotive, aerospace, wire and cable insulations, oil and gas recovery, semiconductor manufacture and others.

The **scope** of this review includes basic chemistry, properties (attributes and limitations), processing methods and equipment, applications, recent developments and trends.

1 Introduction

Fluoroplastics are defined as a family of thermoplastic resins analogous to polyethylene (PE) in which some or all of the hydrogen atoms attached to the carbon chain are replaced by fluorine or fluorinated alkyl groups. In some cases, other halogens such as chlorine are also part of the molecule. The best-known fluoroplastic is polytetrafluoroethylene (PTFE) a tough, flexible, crystalline polymer that retains its properties over a wide range of temperatures. PTFE exhibits a solvent and chemical resistance, which is the best of all the thermoplastics and has the lowest coefficient of friction of any known solid. One of its drawbacks is that it requires a processing technique different from typical thermoplastic resins. The rest of the fluoroplastics can be processed by melt-processing methods common in plastics technology.

PTFE was invented by Plunkett in 1938 and commercialised in 1947. The reason for this delay in commercialisation was its use in seals in the Manhattan Project. The remaining fluoroplastics were invented and commercialised during the next few decades. Current worldwide annual consumption of fluoroplastics is in excess of 90,000 tonnes. The consumption of PTFE amounts to about 70% of that, followed by polyvinylidene fluoride (PVDF) at approximately 20% of the total [a.1]. The overall annual growth of consumption of fluoroplastics over the period of the past few years is estimated to be in the range of 5-6%.

2 Basic Chemistry of Fluoroplastics

The chemistry of the majority of fluoroplastics is derived from compounds used in the refrigeration industry. The monomers for commercially important large-volume fluoropolymers are shown in **Table 1**. These can be combined to yield homopolymers, copolymers and terpolymers. The resulting products are resins with unique properties not achievable by other polymeric materials. In general, they exhibit the following properties:

- Chemical inertness
- Nonstick or non-wetting surface (hydrophobicity, low dirt pickup)
- Low coefficient of friction
- Resistance to elevated temperatures

The specific properties depend on the structure of the polymer, with considerable variations from the presence of atoms other than fluorine in the backbone of the polymer.

The main factor responsible for the previously mentioned properties is the very high strength of the C-F bond

Table 1 Monomers used in commercial fluoroplastics

Compound	Formula
Tetrafluoroethylene (TFE)	$CF_2 = CF_2$
Chlorotrifluoroethylene (CTFE)	$CF_2 = CClF$
Vinylidene fluoride (VDF)	$CH_2 = CF_2$
Vinyl fluoride (VF)	$CH_2 = CHF$
Ethylene (E)	$CH_2 = CH_2$
Hexafluoropropene (HFP)	$CF_3CF = CF_2$
Perfluoromethylvinylether (PMVE)	$CF_3OCF = CF_2$
Perfluoropropylvinylether (PPVE)	$CF_3CF_2CF_2OCF = CF_2$

(see **Table 2**). The polymer with the most pronounced 'fluoropolymeric' properties is PTFE, known under the original trade name of Teflon. Because of the large size and mutual repulsion of adjacent fluorine atoms, the PTFE macromolecule is a twisting helix, comprising 13 CF_2 groups every 180° turn (see **Figure 1**). This configuration is thermodynamically favoured over a planar zigzag (typical for PE) because of the mutual repulsion of fluorine atoms [a.2]. Currently available commercial fluoroplastics are listed in **Table 3**. They can be roughly classified into several categories according to their degree of crystallinity and amount of fluorine in their main chain as shown in **Table 4**.

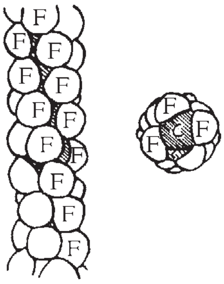

Figure 1

Schematic representation of the PTFE helix.
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3 Structure - Property Correlations

As pointed out earlier, fluoroplastics offer a variety of unique properties, in particular, a good to outstanding chemical resistance, and stability at

Table 2 Carbon bond energies

Bond	Bond Energy, kJ/mol
C – F	485
C – H	403
C – O	342
C – C	338
C – Cl	312
C – Br	269
C – I	232

Table 4 Categories of fluoroplastics

	Partially Fluorinated	Perfluorinated*
Crystalline	ETFE	PTFE
	PVDF	PFA
	PVF	FEP
	EFEP	-
Amorphous	FEVE**	CYTOP
		TEFLON AF

** Perfluorinated polymers contain only carbon and fluorine in the main chain*

*** Copolymer of fluoroethylene and alkylvinyl ether (fluorinated ethylene-vinyl ether)*

Table 3 Commercial fluoroplastics

Chemical name	Monomer(s) Used	Abbreviation
Polytetrafluoroethylene	TFE	PTFE
Polychlorotrifluoroethylene	CTFE	PCTFE
Polyvinylidene fluoride	VDF	PVDF
Polyvinyl fluoride	VF	PVF
Fluorinated ethylene propylene	TFE + HFP	FEP
Copolymer of tetrafluoroethylene and perfluoromethylvinyl ether	TFE + PMVE	MFA
Copolymer of tetrafluoroethylene and perfluoropropylvinyl ether	TFE + PPVE	PFA
Copolymer of ethylene and tetrafluoroethylene	E + TFE	ETFE
Copolymer of ethylene and chlorotrifluoroethylene	E + CTFE	ECTFE
Terpolymer of tetrafluoroethylene, hexafluoropropylene, and vinylidene fluoride	TFE + HFP + VDF	THV
Terpolymer of hexafluoropropylene, tetrafluoroethylene, and ethylene	TFE + HFP + E	HTE

elevated temperatures. Because of that, they have been used increasingly in applications where most hydrocarbon-based materials would fail, such as chemical processing, motor vehicle engines, nuclear reactors, in the manufacture of semiconductors, and space applications. On the other hand, they exhibit some deficiencies when compared with most engineering thermoplastics. Typically, they have poorer mechanical properties, higher permeability values for gases and often a considerably higher cost. Some of the specific shortcomings of commercial fluoroplastics are shown in **Table 5**. Knowing the advantages and disadvantages of individual materials and understanding how structure affects properties and performance is very important for proper selection of processing technology and for the suitability for specific practical applications. As pointed out earlier, the advantageous properties of fluorocarbon polymers are the result of the very strong bond between carbon and fluorine, the shielding of the carbon backbone by fluorine atoms and of the fact that they are fully saturated macromolecules [a.3]. The following sections will cover the correlation between structure and some of the fundamental properties of the most common commercial fluoroplastics.

3.1 General

PTFE has the conformation of a twisting helix as pointed out in the previous section. This morphology is conducive for PTFE molecules to pack like parallel rods. However, individual cylinders can slip past one another. This contributes to a relatively strong tendency of PTFE to cold flow. The mutual repulsion of fluorine atoms tends to inhibit the bending of the chain backbone. Therefore, the PTFE chain is very stiff. The outer sheath of fluorine atoms protects the carbon backbone thus providing the chemical inertness and stability. It also lowers the surface energy of the polymer giving PTFE a low coefficient of friction and nonstick properties [a.3, a.4].

The extremely high molecular weight of the PTFE polymer (in the order of 10^6 Daltons) results in a melt viscosity in the range 10^{10} to 10^{12} Pa-s, which is about six orders of magnitude higher than that of most common thermoplastic polymers and too high for melt processing methods used in the fabrication of common thermoplastics. Such an extremely high viscosity even suppresses a normal crystal growth. Thus, the virgin polymer has a degree of crystallinity in excess of 90% and the melting point is approximately 347 ºC. After being melted, even after slow cooling of the melt, the degree of crystallinity rarely reaches 70%. Moreover, the melting point is reduced to about 327 ºC and this lower melting point value is measured every time the polymer is remelted. The high melt viscosity is also a reason why PTFE has an exceptionally high continuous service temperature, namely 260 ºC.

Molecular weight also affects the crystallisation rate (decreases with increasing molecular weight) [a.5] and specific gravity. So-called standard specific gravity (SSG) is calculated from the number-average molecular weight (M_n) using the mathematical expression [a.6]:

$$SSG = 2.612 - 0.058 \log_{10} M_n$$

The exceptional chemical resistance, resistance to ultraviolet (UV) radiation and thermal stability of PTFE can be further explained by the fact that the C-F and C-C bonds in fluorocarbons are among the strongest known in organic compounds [a.7].

FEP, a copolymer of tetrafluoroethylene (TFE) and hexafluoropropylene (HFP) is essentially PTFE with

Table 5 Shortcomings of commercial fluoroplastics

Fluoropolymer	**Shortcoming**
PTFE	Is degraded by ionising radiation*, exhibits substantial creep
PVDF	Attacked or dissolved by ketones, low resistance to alkaline solutions
PCTFE	High processing temperatures, may degrade during processing
FEP	Low fatigue resistance, poor high-temperature properties
ETFE	Low resistance to elevated temperatures and to oxygen
PFA	Low heat deflection temperature
PVF	Low resistance to sunlight in the presence of aluminium

** Gamma rays, electron beam radiation*
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an occasional methyl side group attached. The methyl groups have an effect as defects in crystallites, therefore reducing the melting point, and also impede the slipping of the polymer chains past each other thus reducing the cold flow [a.8].

PFA is a copolymer of TFE and perfluoropropyl vinyl ether (PPVE) in the mole ratio approximately 100:1. Even such a small amount of comonomer is sufficient to produce a copolymer with a greatly reduced crystallinity. The relatively long side chains also markedly reduce the cold flow. **MFA**, a copolymer of TFE and PMVE has similar properties with somewhat lower melting point [a.8].

ETFE, a copolymer of TFE and ethylene has a higher tensile strength than PTFE, FEP and PFA because its molecular chains adopt a planar zigzag configuration [a.9]. A strong electronic interaction between the bulky CF_2 groups of one chain and the smaller CH_2 groups of an adjacent chain causes an extremely low creep [a.10].

PVDF comprises alternating CH_2 and CF_2 groups. These alternating units can crystallise with larger CF_2 groups adjacent to smaller CH_2 units on an adjacent chain [a.9]. This interpenetration gives rise to high modulus. In fact, PVDF has the highest flexural modulus of all fluoropolymers (see next). The alternating groups create a dipole that renders the polymer soluble in highly polar solvents, such as dimethylformamide (DMF), tetrahydrofuran, acetone and esters. Other consequences of this structure are a high dielectric constant and high dielectric loss factor and piezoelectric behaviour under certain conditions. The shielding effect of the fluorine atoms adjacent to the CH_2 groups provides the polymer with a good chemical resistance and thermal stability [a.8].

PCTFE contains a chlorine atom in the molecule that promotes the attractive forces between molecular chains. Since the chlorine atom has a greater atomic radius than fluorine, it hinders the close packing possible in PTFE, which results in a lower melting point and reduced propensity of the polymer to crystallise [a.11]. The chlorine atom present in **ECTFE**, a copolymer of ethylene and CTFE has a similar effect on its properties.

3.2 Mechanical Properties

Mechanical properties of fluoroplastics depend on whether they are fully fluorinated or contain hydrogen atoms in their structures. Generally, fluoroplastics with hydrogen in their structure have about 1.5 times the strength of fully fluorinated polymers and are about twice as stiff. Fully fluorinated polymers, on the other hand, exhibit greater elongation and higher maximum service temperature (see **Figures 2** and **3**).

PVDF has one of the highest flexural moduli among the fluoropolymers (**Figure 4**). Its high modulus can be intentionally reduced by copolymerisation with HFP (typically less than 15%). Such lower modulus copolymers have increased impact strength and elongation.

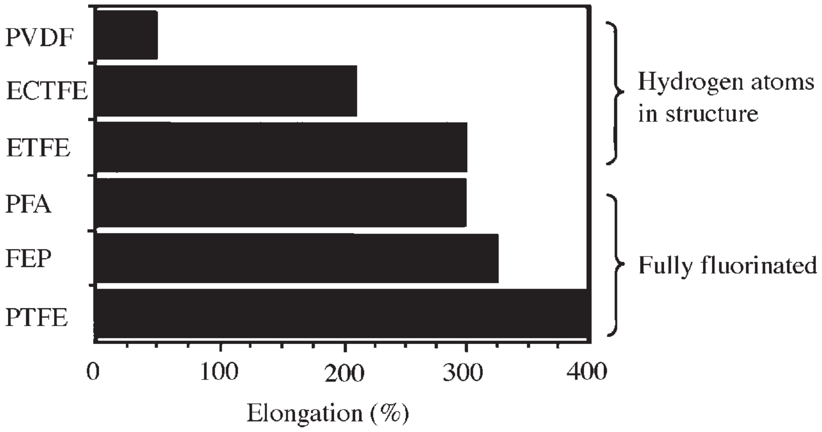

Figure 2

Values of elongation at break from commercial fluoroplastics (ASTM D638).
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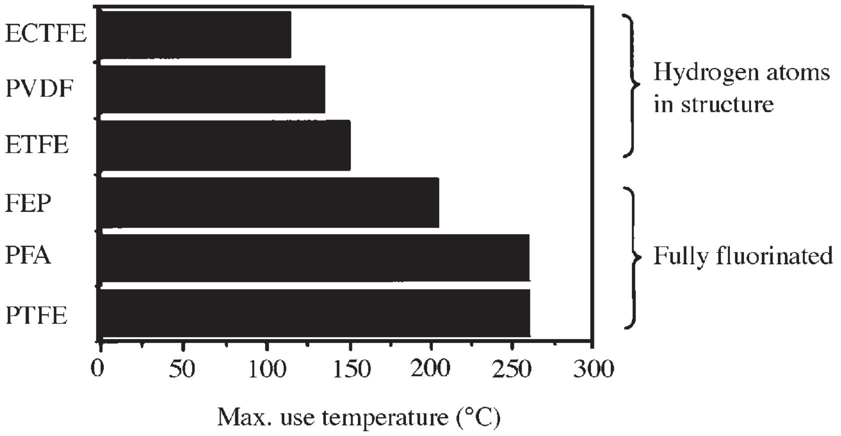

Figure 3

Maximum service temperature for commercial fluoroplastics (UL-746B).
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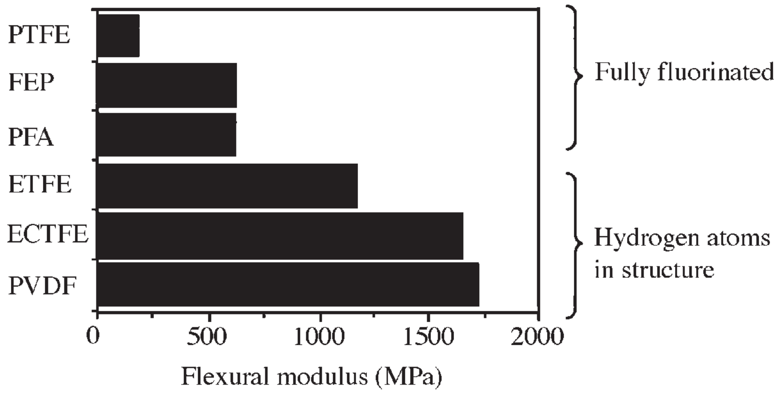

Figure 4

Values of flexural modulus (ASTM D790).
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PCTFE has better mechanical properties than PTFE because the presence of the chlorine atom in the molecule promotes the attractive forces between molecular chains as pointed out earlier. It also exhibits greater hardness, tensile strength and considerably higher resistance to cold flow than PTFE.

ECTFE and **ETFE** also possess relatively high moduli due to interchain attractive forces. **PTFE**, **FEP** and **PFA** exhibit low stiffness (despite the rigidity of their molecular chains) because of their very low intermolecular attractive forces [a.12].

3.3 Optical Properties

PTFE exhibits poor optical properties because of its high degree of crystallinity. **FEP** and **PFA** are in contrast to PTFE both melt-processible, however, also crystalline (degree of crystallinity between 50 and 70%). The crystallinity results in poor optical properties (low clarity) and a very poor solubility in organic solvents. The latter makes the preparation of thin optical coatings exceedingly difficult [a.13]. **THV fluoroplastics** are transparent to a broad band to light (UV to infrared) with an extremely low haze. The refractive index values of

THV Fluoroplastics are low and depend on the grade [a.14]. **TEFLON AF**, an amorphous fluoropolymer contains in its molecule a bulky dioxole ring, which hinders crystallisation. As a result, the polymer is amorphous and has an exceptionally high clarity and excellent optical properties. Its refractive index is the lowest of any plastic [a.15].

4 Properties of Individual Commercial Fluoroplastics

As shown in the previous section, many of the fundamental properties of the polymers depend on their structure, mainly on the nature of their monomeric units. This section will concentrate on the specific properties of individual fluoroplastics and how they relate to their processing behaviour and their utility for practical applications.

4.1 Polytetrafluoroethylene

4.1.1 Crystallinity and Melting Behaviour

As discussed in the previous section, the initial high degree of crystallinity, reported to be well over 90% can never be completely recovered after melting (i.e., sintering), presumably because of entanglements and other impediments caused by the extremely high molecular weight [a.16]. However, it has been established that rapidly cooled PTFE, although lower in the degree of crystallinity, has the same molecular conformation and basic crystalline structure, as does slowly cooled PTFE [a.17].

The true densities of crystalline and amorphous PTFE differ considerably. For 100% crystalline PTFE, densities of 2.347 at 0 ºC and 2.302 at 25 ºC were calculated from x-ray crystallographic data [a.18]. The density decrease of about 2% between these temperatures includes the decrease of approximately 1% due to the transition at 19 ºC, which results from a slight uncoiling of the helical conformation of molecules on heating through the transition. By contrast, the density of amorphous PTFE is not affected by the transition at 19 ºC and values around 2.00 have been reported from extrapolations of specific volume measurements to zero crystallinity [a.19].

The density of PTFE undergoes complicated changes during processing and can be monitored by the values of true specific volume. Discontinuity in such data show the transitions at 19 and 30 ºC and also the very pronounced transition at the crystalline melting point of 327 ºC of which the latter is due to the destruction of crystallinity [a.20]. The melting of the polymer is accompanied by a volume increase of approximately 30% [a.21]. The coefficient of linear expansion of PTFE has been determined at temperatures ranging from –190 to +300 °C [a.22]. The transitions observed by various investigators and their interpretations are listed in **Table 6** [a.23].

Effects of structural changes on properties, such as specific heat, specific volume and/or dynamic mechanical and electrical properties are observed at various temperatures.

Besides the transition at the melting point, the transition at 19 °C is of great consequence because it occurs around ambient temperature and significantly affects the product behaviour. Above 19 °C, the triclinic pattern changes to a hexagonal unit cell. Around 19 °C, slight untwisting of the molecule from a 180 degree twist per

Table 6 Transitions in PTFE

Temperature °C	Order	Region Affected	Type of Disorder
19	First	Crystalline	Angular displacement
30	First	Crystalline	Crystal disorder
90	First	Crystalline	
–90	Second	Amorphous	Onset of rotational motion around C- C bond
–30	Second	Amorphous	
130	Second	Amorphous	

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13 CF_2 groups to a 180 degree per 15 CF_2 groups occurs. At the first-order transition at 30 °C the hexagonal unit disappears and the rod-like hexagonal packing of the chains in the lateral direction is retained [a.24]. Below 19 °C there is almost a perfect three-dimensional order (triclinic), between 19 and 30 °C the chain segments are disordered and above 30 °C, the preferred crystallographic direction is lost and the molecular segments oscillate above their long axes with a random angular orientation of the lattice [a.25, a.26]. PTFE transitions occur at specific combinations of temperatures and mechanical or electrical vibrations and can cause wide fluctuations in the values of dissipation factor (see section 4.2.2 on Electrical Properties).

4.1.2 Mechanical Properties

Mechanical properties of PTFE at room temperature are similar to those of medium-density polyethylene, i.e., relatively soft with high elongation and remain at useful levels over a wide range of temperatures, from cryogenic (just above absolute zero) to 260 °C, its recommended upper use temperature [a.27]. Stress-strain curves of PTFE are strongly affected by the temperature; however, even at 260 °C its tensile strength is about 6.5 MPa [a.28].

Under a sustained load PTFE will creep (exhibit cold flow), which imposes limitations on PTFE in such applications as gasket material between bolted flange faces [a.28]. This tendency can be greatly reduced by the addition of mineral fillers, such as chopped glass fibres, bronze or graphite particles. These fillers also improve its wear resistance, but do not have any significant effect on its tensile strength [a.29]. Fillers can improve impact strength of the polymer significantly, but reduce its elongation [a.30].

In general, mechanical properties of PTFE depend on processing conditions, such as preforming pressure, sintering temperature and time, cooling rate and the degree of crystallinity. Improper sintering of PTFE leads to poorly coalesced particles and microvoids. Some properties, such as flexibility at low temperatures, coefficient of friction and stability at high temperature are relatively independent of the conditions during fabrication. Flex life, stiffness, impact strength, resilience and permeability depend greatly on moulding and sintering conditions [a.31]. A summary of mechanical properties of sintered conventional PTFE is in **Table 7**.

4.1.3 Surface Properties

The surface of PTFE material is smooth and slippery. It is considered to be a very low energy surface with γ_c = 18.5 mN/m [a.32] and can be therefore completely wetted by liquids with surface tensions below 18 mN/m, for example by solutions of perfluorocarbon acids in water [a.33]. The PTFE surface can be treated by alkali metals to improve its wettability and consequently the adhesion to other substrates [a.34] but this increases its coefficient of friction [a.35].

4.1.4 Absorption and Permeation

Because of the high chemical inertness of PTFE to the majority of industrial chemicals and solvents and its low wettability, it absorbs only small amounts of liquids at ambient temperatures and atmospheric pressure [a.36].

Gases and vapours diffuse through PTFE much slower than through most other polymers. The higher the degree

Table 7 Mechanical properties of PTFE

Property	ASTM Test Method	Value
Tensile strength, MPa	D638	20-35
Elongation at break, %	D638	300-550
Tensile modulus, MPa	D638	550
Flexural strength, MPa	D790	No break
Flexural modulus at 23 °C, MPa	D790	340-620
Impact strength, Izod, notched, J/m	D256	188
Compressive strength, MPa	D695	34.5

Reproduced with permission from S. Ebnesajjad, Fluoroplastics, Volume 1, Plastics Design Library, Norwich, NY, USA, 2000 of crystallinity, the lower is the rate of permeation. Voids greater than molecular size increase the permeability. Thus, it can be controlled by moulding PTFE articles to low porosity and high density. Optimum density for that is 2.16-2.195 [a.36]. Permeability increases with temperature due to an increase in activity of the solvent molecules and the increase in vapour pressure of the liquids. Swelling of PTFE resin and films is very low.

4.1.5 Electrical Properties

The *dielectric constant* of PTFE is 2.1 and remains constant within the temperature range from –40 to +250 °C within the frequency range from 5 Hz to 10 GHz. It changes somewhat, however, with density and factors that affect density. The dielectric constant was found not to change over two to three years of measurements [a.37].

The dissipation factor is affected by the frequency, temperature, crystallinity and void content of the fabricated structure. At certain temperatures the crystalline and amorphous regions become resonant. Because of the molecular vibrations, the applied electrical energy is lost by internal friction within the polymer and this leads to an increase in dissipation factor. The dissipation factor peaks for these resins correspond to well-defined transitions [a.37].

The volume resistivity of PTFE remains unchanged even after a prolonged soaking in water, because it does not absorb water.

The surface arc-resistance of PTFE resins is high and is not affected by heat ageing. They do not track or form a carbonised path when subjected to a surface arc in the air [a.38].

Electrical properties of sintered conventional PTFE are summarised in **Table 8**.

4.1.6 Thermal Stability

PTFE is exceptionally stable in both air and an inert atmosphere with no significant degradation or decomposition occurring below 440 °C. Due to such high inherent stability PTFE can be used continuously at 260 °C, at which temperature at least 50% of its mechanical properties are retained after 20,000 hours [a.39]. Further details on thermal degradation and products of thermal degradation are in Section 7.4.

4.1.7 Chemical Resistance

Chemical resistance of PTFE is best of all currently known polymers. It is resistant to strong inorganic acids, such as hot fuming nitric acid, hot fuming sulfuric acid and to *aqua regia* [a.39]. PTFE is attacked by molten alkali metals (e.g., molten sodium) and by elemental fluorine under extreme conditions of elevated temperatures and pressures [a.39]. It is insoluble in all known solvents.

4.1.8 Flame Resistance

PTFE exhibits an exceptional flame resistance and is the most flame-retardant polymer known. It is used as an additive to some thermoplastics to impart flame suppressant and non-dripping behaviour. The limiting oxygen index (LOI) of PTFE is 96% (that is, it only supports combustion in an almost pure oxygen atmosphere - 96% of oxygen by volume) [a.40].

4.1.9 Radiation Resistance

At ambient temperatures, PTFE is degraded rapidly when exposed to ionising radiation (i.e., gamma rays or high-energy electron beam radiation). Irradiation

Table 8 Electrical properties of PTFE

Property	ASTM Test Method	Value
Dielectric strength, short time, 2 mm, V/mm	D149	23,600
Surface arc resistance, s	D495	>300
Volume resistivity, ohm-cm	D257	$>10^{18}$
Surface resistivity, ohm/sq	D257	$>10^{16}$
Dielectric constant, at 60 to 2 x 10^9 Hz	D150	2.1
Dissipation factor, at 60 to 2 x 10^9 Hz	D150	0.0003

Reproduced with permission from Mechanical Design Bulletin (DuPont) in the presence of air leads to rapid scission of the polymeric chains. For example, it undergoes a 50% reduction of tensile strength when irradiated by a dose of 10 kGy [a.39]. This is utilised in the production of micropowders.

There is some evidence [a.41-43] that irradiation of PTFE above its melting range (330 - 340 °C) in a vacuum results in a significant improvement in tensile strength and elongation at 200 °C and in an increase of tensile modulus at ambient (room) temperature. This clearly indicates crosslinking in the molten state, similar to effects caused by irradiation of PE. At temperatures above 350 °C, thermal depolymerisation is increasingly accelerated by irradiation and prevails over crosslinking at yet higher temperatures [a.44]. A fairly detailed discussion of the process is given in [a.45, 438].

4.1.10 Modified PTFE

Relatively new PTFE technology is represented by modified PTFE that is designed to overcome the limitations of conventional PTFE, namely poor creep resistance (tendency to cold flow) difficult welding and a high level of microvoids [a.46]. These shortcomings are alleviated by a significant reduction of melt viscosity (by a factor of 10) and simultaneously suppressing crystallinity through the incorporation of bulky side groups into the main chain. The modifier is a comonomer added in amounts less than 0.1%. An example is perfluoropropylvinyl ether.

Modified PTFE offers the following advantages [a.47]:

- Improved welding, due to improved flow - the bond strength approaches the strength of the material itself.
- Reduced permeation due to the reduction of the level of microvoids resulting from improved coalescence of particles during sintering.
- Reduced creep and increased stiffness gives better sealing in applications such as seals and gaskets, particularly at elevated temperatures.
- Significant improvement of electrical insulation properties (dielectric strength) due to reduced level of microvoids.
- Smoother surfaces with higher gloss and low porosity.

Comparison of modified and conventional (unmodified PTFE) is shown in **Table 9.**

4.1.11 Forms of PTFE

PTFE is offered in several forms, each of them having distinct properties, processing technology and application.

Granular resins are produced by free-radical polymerisation of TFE in aqueous media with little or no dispersing agent, with a trace of comonomers. The reaction mixture is agitated vigorously and the product precipitates in a granular form [a.48]. The finished product has a particle size in the range 10 to 700 μm and an apparent density of 200 to 700 g/l. Granular resins are also offered *presintered* (with an improved flow) and *filled* (with improved properties of the raw polymer) using fillers such as glass fibres, powdered metals, and graphite [a.48]. Granular resins are processed mainly by moulding and ram extrusion (see Chapter 5).

Fine powder resins are produced by free-radical polymerisation in aqueous media using the correct type and amount of dispersant, with mild agitation. The product is a colloidal dispersion with oval shaped polymer particles with the longer dimension being less than 0.5 μm. The dispersion is subsequently coagulated into fine powders. Fine powders are mainly processed by paste extrusion or calendering (see Chapter 5).

Aqueous dispersions are made essentially by the same polymerisation process as fine powder resins with the difference that the polymer particles are smaller (0.2 μm). The resulting colloidal dispersion is stabilised by the addition of nonionic or anionic surfactants and then concentrated to the solids content of 60-65%. After further modification with other chemical agents it is sold as a product with a solids content of 60% and specific gravity around 1.51 [a.48]. PTFE dispersions are used for coating fabrics and metal substrates, for impregnation of fibres and fabrics, for the production of films, laminates and filaments (see Chapter 5).

PTFE micropowders are prepared mainly by irradiation of PTFE by high-energy electron beam [a.49] or by controlled polymerisation to a lower molecular weight [a.50]. They are used as additives for plastics, elastomers, coatings, printing inks, and so on (see Chapter 6).

Manufacturers of PTFE and corresponding trade names are given in **Table 10**.

Table 9 Comparison of modified PTFE and conventional PTFE

Property	ASTM Test Method	Modified PTFE	Conventional PTFE
Tensile strength, MPa	D4894	31	34
Elongation at break, %	D4894	450	375
Specific gravity	D4894	2.17	2.16
Deformation under load @ 23 °C, %			
3.4 MPa	D695	0.2	0.7
6.9 MPa		0.4	1.0
13.8 MPa		3.2	8.2
Deformation under load, %			
6.9 MPa @ 25 °C	D695	5.3	6.7
3.4 MPa @ 100 °C		5.4	8.5
1.4 MPa @ 200 °C		3.6	6.4
Void content of typical parts, %	FTIR	0.5	1.5
Dielectric strength, kV/mm (76.2 μm film)	D149	208	140
Weld strength*, %	D4894	66-87	Very low
Permeation of perchloroethylene			
Vapour	Comparative rates	2	5
Liquid		4	13
Permeation of hexane			
Vapour	Comparative rates	0.2	3.4
Liquid		0	23.4

** Specimens welded after sintering*
FTIR: Fourier Transform Infrared Spectroscopy
Reproduced with permission from DuPont Teflon® NXT Data Sheet

Table 10 Producers of PTFE

Company Name	Trade Name
Asahi Glass Co., Ltd. (AGC) - Japan	Fluon PTFE
Daikin Industries, Ltd. - Japan	Polyflon PTFE
DuPont - USA	Teflon
Dyneon, LLC - USA	Dyneon PTFE
JSC Halogen - Russia	Fluoroplast
Shandong Dongyue Chemical Co. - China	PTFE
Solvay Solexis SpA - Europe	Algoflon PTFE
Zaklady Azotowe - Poland	Tarflen

4.2 Copolymers of Tetrafluoroethylene and Hexafluoropropylene (FEP)

The copolymerisation of TFE and HFP produces a copolymer that is often referred as FEP. The copolymerisation introduces a branched structure and results in the reduction of the melting point of the homopolymer from 327 °C to about 260 °C [a.48]. Another consequence of that is a significant reduction of crystallinity, which may vary between 70% for virgin polymer and 30 and 50% for moulded parts depending on processing conditions - mainly the cooling rate after melting. The melting point is the only first order transition observed in FEP. Melting increases the volume by 8% [a.51].

4.2.1 Mechanical Properties

Mechanical properties of FEP are in general similar to those of PTFE with the exception of the continuous service temperature, which is 204 °C, which is lower when compared to that of PTFE (260 °C). Unlike PTFE, FEP does not exhibit a marked volume change at room temperature because it is lacking the first-order transition at 19 °C. FEP resins are useful above –267 °C and are highly flexible above –79 °C [a.52].

The static *friction* decreases with increasing load and the static coefficient of friction is lower than the dynamic coefficient [a.53] The coefficients of friction are independent of fabrication conditions.

Perfluorinated ethylene-propylene tends to *creep* and this has to be considered when designing parts for service under continuous stress. Creep can be significantly reduced by the use of suitable fillers, such as glass fibres or graphite. Graphite, bronze and glass fibres also improve wear resistance and stiffness of the resin. The choice of fillers to be used for the improvement of properties of FEP and their amounts are limited, however, the main reason is that such mixtures are difficult to process [a.54].

FEP resins have a very *low energy surface* and are therefore very difficult to wet. Surface preparation for improved wetting and bonding of FEP can be done by a solution of sodium in liquid ammonia or naphthalenyl sodium in tetrahydrofuran [a.54], by the exposure to corona discharge [a.55] or to amines at elevated temperatures in an oxidising atmosphere [a.56].

FEP resins exhibit a very good *vibration damping* at sonic and ultrasonic frequencies. However, to use this property for the welding of parts, the thickness of the resin must be sufficient to absorb the energy produced [a.54].

4.2.2 Electrical Properties

Perfluorinated ethylene propylene has outstanding electrical properties, practically identical to those of PTFE within its recommended service temperature. Its volume resistivity remains unchanged even after prolonged soaking in water.

The dielectric constant of FEP has a constant value at lower frequencies, but at frequencies 100 MHz and higher, it drops slightly with increasing frequency. Its dissipation factor has several peaks as a function of temperature and frequency. The magnitude of the dissipation peak is greater for FEP than for PTFE because the FEP structure is less symmetrical. The dielectric strength is high and unaffected by heat ageing at 200 °C [a. 57]. The electrical properties of FEP are listed in **Table 11.**

4.2.3 Chemical Properties

FEP resists most chemicals and solvents, even at elevated temperatures and pressures. Acid and bases are not absorbed at 200 °C and exposures of one year. Organic solvents are absorbed only little, typically 1% or less, even at elevated temperatures and long exposure times. The absorption does not affect the resin and its properties and is completely reversible. The only chemicals reacting with FEP resins are fluorine, molten alkali metals, and molten sodium hydroxide [a.58]. Moreover, FEP is also susceptible to attack by concentrated perchloric acid [a.59]

Gases and vapours permeate through FEP at a rate, which is lower than for most plastics. It occurs only by molecular diffusion, because the polymer was melt processed and does not contain microvoids as does PTFE after sintering. For the permeation through FEP films an inverse relationship between permeability and film thickness applies [a.60].

Table 11 Typical values of electrical properties of FEP

Property	Value	ASTM Method
Dielectric strength short time, 0.2 cm thickness, V/cm	23.6	D149
Surface arc resistance, s	> 300	D495
Volume resistivity, ohm-cm	$> 10^{18}$	D257
Dielectric constant, 60 Hz to 2 GHz	2.1	D150
Dissipation factor, 60 Hz to 2 GHz	$2^{-12} \times 10^{-4}$	D150
Surface resistivity, ohm/sq	10^{16}	D257

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4.2.4 Optical Properties

FEP films transmit more UV, visible and infrared radiation than ordinary window glass. They are considerably more transparent to the infrared and UV spectra than glass. The refractive index of FEP films is in the range 1.341 to 1.347 [a.61].

4.2.5 Thermal Stability

FEP begins to undergo thermal degradation at temperatures above 380 °C. The relatively low thermal stability of FEP when compared to PTFE is due to steric strain at the trifluoromethyl branch points. The mechanism of thermal degradation involves elimination of HFP from the FEP chains followed by unzipping of the PTFE sequences [a.59].

4.2.6 Radiation Resistance

Ionising radiation causes degradation of FEP. In air FEP degrades at rates comparable to PTFE, however, in absence of air the degradation rate of PTFE is an order of magnitude lower than that of PTFE [a.59]. Essentially, irradiated FEP tends to undergo both crosslinking and chain scission at similar rates, so mechanical properties are not greatly impaired [a.59].

4.2.7 Other Properties

Products made from FEP resins resist the effects of weather, and UV radiation. For example, FEP films do not undergo any significant reduction in light transmission or tensile strength even after 15 years of direct exposure in Florida. Its flame resistance is comparable to that of PTFE with the LOI of FEP being 96% [a.59].

4.2.8 Forms of FEP

Commercial FEP resins are available as pellets, powder and as aqueous dispersions with 54 to 55% solids content. FEP manufacturers offer several grades of solid resins and aqueous dispersions with varied processing characteristics, and with varied physical and mechanical properties of finished products.

4.3 Copolymers of Tetrafluoroethylene and Perfluoroalkylethers (PFA and MFA)

Copolymers of TFE and PPVE (PFA) and of TFE and PMVE (MFA) exhibit nearly the same unique properties as PTFE at temperatures ranging from extremely low to extremely high. Since they can be relatively easily processed by conventional methods for thermoplastics into film and sheets without microporosity, they have a distinct advantage over PTFE in certain applications, such as corrosion protection and anti-stick coatings [a.62]. These polymers are semi-crystalline and the degree of crystallinity depends on the fabrication conditions, particularly on the cooling rate. General properties of PFA and MFA are listed and compared to FEP in **Table 12**.

The copolymerisation of TFE and the perfluoroalkylvinyl ethers is generally performed in aqueous media in a

Table 12 General properties of perfluorinated melt processable polymers

Property	ASTM Test	Unit	PFA	MFA	FEP
Specific gravity	D792	g/cm^3	2.12-2.17	2.12-2.17	2.12-2.17
Melting temperature	D2116	°C	300-310	280-290	260-270
Coefficient of linear thermal expansion	E831	1/K x 10^{-5}	12-20	12-20	12-20
Specific heat	-	kJ/kg/K	1.0	1.1	1.2
Thermal conductivity	D696	W/K.m	0.19	0.19	0.19
Flammability	UL94	-	V-0	V-0	V-0
Oxygen Index	D2863	%	> 95	> 95	> 95
Hardness, Shore D	D2240	-	55-60	55-60	55-60
Friction coefficient (on steel)	-	-	0.2	0.2	0.3
Water absorption	D570	%	< 0.03	< 0.03	< 0.03

Reproduced with permission from M. Pozzoli, G. Vita, and V. Arcella in Modern Fluoropolymers, Ed., J. Scheirs, John Wiley and Sons, Chichester, UK, 1997 similar fashion as the polymerisation of PTFE fine powders and FEP.

4.3.1 Physical and Mechanical Properties

Commercial grades of PFA have a melting point in the range from 300 to 315 °C depending on the content of PPVE. The degree of crystallinity is typically 60% [a.63].

There is only one first-order transition at –5 °C and two second-order transitions, one at 85 °C and one at –90 °C [a.63].

In general, mechanical properties of PFA are very similar to those of PTFE within the range from –200 to +250 °C. Above 200 °C the mechanical properties of PFA are better than those of FEP [a.64]. The mechanical properties of PFA and MFA at room temperature are practically identical, differences become obvious only at elevated temperatures, because of the lower melting point of MFA.

In contrast to PTFE with measurable void content, the melt processed PFA is intrinsically void-free. Because of that, lower permeation coefficients should result because permeation occurs by molecular diffusion. This is indeed the case but the effect levels off at higher temperatures [a.65].

The most remarkable difference between PTFE and PFA is the considerably lower resistance to deformation under load (cold flow) of the latter. In fact, addition of even minute amounts of PFA to PTFE improves its resistance to cold flow [a.63].

PFA has improved flex fatigue when compared to FEP, resulting in a longer flexural life. It also produces better weld strength of injection moulded parts than FEP [a.64].

4.3.2 Electrical Properties

PFA and MFA exhibit considerably better electrical properties than most traditional plastics. In comparison to the partially fluorinated polymers they are only slightly affected by temperature up to their maximum service temperature [a.66].

The value of the dielectric constant remains at 2.04 over a wide range of temperature and frequencies (from 100 Hz to 1 GHz). The dissipation factor at low frequencies (from 10 Hz to 10 kHz) decreases with increasing frequency and decreasing temperature. In the range from 10 kHz to 1 MHz, temperature and frequency have little effect, while above 1 MHz the dissipation factor increases with the frequency [a.67].

4.3.3 Chemical Properties

PFA and MFA have an outstanding chemical resistance even at elevated temperatures. They resist strong mineral acids, inorganic bases and inorganic oxidising agents and most of the organic compounds and their mixtures common in the chemical industry. However, they react with fluorine and molten alkalis [a.67]. Elemental sodium as well as other alkali metals react with PFA and MFA as with other perfluoropolymers by removing fluorine from them. This reaction has a practical application for improving surface wettability and adhesive bonding of perfluorocarbon polymers to other substrates [a.68].

The absorption of water and solvents by PFA and MFA is in general very low [a.68]. Permeability is closely related to absorption and depends on temperature, pressure and the degree of crystallinity. Since these resins are melt-processed, they are usually free of voids and therefore exhibit much lower permeability than PTFE. Permeation through PFA occurs via molecular diffusion [a.69].

4.3.4 Optical Properties

Generally, fluorocarbon films exhibit high transmittance in the UV, visible, as well in the infrared regions of the spectrum. This property depends on the degree of crystallinity and the crystal morphology in the polymer. For example, 0.025 mm thick PFA film transmits more than 90% of visible light (wavelength 400 to 700 nm). A 0.2 mm thick MFA film was found to have a high transmittance in the UV region (wavelength 200 to 400 nm). The refractive indexes of these films are close to 1.3 [a.70].

4.3.5 Other Properties

Flame resistance of perfluoroalkoxy copolymers is high. They are self-extinguishing and classified as 94 V0 (in accordance with UL 94), which is the same as the classification for PTFE. The LOI of PFA is in excess of 95% [a.71].

Radiation resistance of PFA and MFA like that of other perfluoropolymers is low. The main effect of ionising radiation is the reduction of tensile strength and even more on elongation at break. Above 50 kGy the retention of elongation at break is lower than 5%, while at 500 kGy both PFA and MFA are degraded [a.68]

4.3.6 Forms of PFA and MFA

PFA and MFA are available in pellet and powder form as well as aqueous dispersions with typically 60 wt.% contents and stabilised with 5% surfactants [a.72].

4.4 Copolymers of Ethylene and Tetrafluoroethylene (ETFE)

Copolymers of ethylene and tetrafluoroethylene (ETFE) are comprised essentially of alternating ethylene and TFE units. They have an excellent balance of physical, chemical, mechanical and electrical properties, are easily fabricated by melt processing techniques but have found little commercial use, because they exhibit a poor resistance to cracking at elevated temperatures [a.73]. Incorporation of certain monomers, so-called modifiers in amounts 1-10 mol% markedly improves the cracking resistance, while maintaining the desirable properties of the copolymer [a.74, a.75]. The monomer ratio in the copolymer has an effect on the polymer structure and properties, mainly on the degree of crystallinity and on melting point. As normally produced, ETFE has about 88% of alternating sequences and a melting point of 270 ºC [a.76].

4.4.1 Physical and Mechanical Properties

ETFE exhibits an alpha transition at about 110 ºC, where the physical properties of ETFE begin to decline and more closely resemble perfluoropolymer properties at the same temperature. Other transitions occur at –120 ºC (gamma) and about –25 ºC (beta) [a.77].

ETFE exhibits exceptional toughness and abrasion resistance over a wide temperature range and a good combination of high tensile strength, high impact strength, flex and creep resistance, combining mechanical properties of hydrocarbon engineering polymers with the chemical and thermal resistance of perfluoropolymers. Friction and wear properties are good and can be improved by incorporating fillers such as fibreglass or bronze powders. For example, by adding 25% of glass fibres, the dynamic coefficient of friction is reduced from about 0.5 to about 0.3. Fillers also improve creep resistance and increase the softening temperature [a.75]. Typical properties of ETFE are summarised in **Table 13.**

Continuous upper service temperature of commercial ETFE is 150 °C [a.78]. Physical strength can be maintained at even higher temperatures when the polymer is crosslinked by peroxide or ionising radiation [a.79]. Highly crosslinked resins can be subjected to temperatures up to 240 ºC for short periods of time [a.78].

Table 13 Typical properties of ETFE

Property	**ASTM Method**	**Unit**	**Value**
Tensile strength	D638	MPa	40-47
Elongation at break	D638	%	150-300
Compressive strength	D695	MPa	17
Flexural modulus	D790	MPa	1,200
Hardness, Shore D	D2240	-	63-72
Coefficient of friction on steel	D1894	-	0.23
Specific gravity	D792	-	1.70-1.72
Water absorption, 24 h	D570	%	0.005-0.007
Melting point	D3418	°C	255-280
Continuing service temperature	-	°C	150
Surface resistivity	D257	ohm/sq	> 1015
Volume resistivity	D257	Ohm.cm	> 1017
Dielectric strength, 0.25 mm thick	D149	kV/mm	64

Reproduced with permission from Tefzel, Properties Handbook, Publication RWJ223 (11/03), DuPont, Wilmington, DE, USA [193]

4.4.2 Electrical Properties

ETFE exhibits excellent electrical properties. Its dielectric constant is low and essentially independent of frequency. Dissipation factor is low, but increases with frequency and can also be increased by crosslinking. Dielectric strength and resistivity are high and are unaffected by water. Irradiation and crosslinking in general increase dielectric loss [a.78].

4.4.3 Chemical Properties

Modified ETFE has excellent resistance to most common solvents and chemicals [a.80]. It is not hydrolysed by boiling water and weight gain is less than 0.03% in water at room temperature. Strong oxidising acids, such as nitric acid and some organic bases cause depolymerisation at high concentrations and high temperatures [a.78]. ETFE is also an excellent barrier to hydrocarbons and oxygenated components of automotive fuels [a.78].

4.4.4 Thermal Stability

ETFE resins have a good thermal stability, however, for high temperature applications thermal stabilisers are often added [a.81]. A wide variety of compounds, mostly metal salts, such as copper oxides and halides, aluminum oxide and calcium salts will act as sacrificial sites for oxidation. Addition of certain salts can alter the decomposition from oligomer formation to dehydrofluorination. Iron and other transition metal salts accelerate the dehydrofluorination. Hydrofluoric acid itself destabilises ETFE at elevated temperatures and the degradation becomes self-accelerating. For that reason, extrusion temperatures higher than 380 ºC should be avoided [a.82].

4.4.5 Radiation Resistance

Ionising radiation crosslinks ETFE. Crosslinking of ETFE is more likely than main chain cleavage, and since at low radiation levels the rate of crosslinking approximately matches the rate of cleavage, the tensile properties are relatively unaffected. For that reason ETFE is being used for wire coatings and moulded parts in the nuclear energy industry [a.82]. At a higher level of radiation, however, the tensile elongation of ETFE is severely affected and drops sharply.

4.4.6 Flame Resistance

ETFE resins do not support combustion in air and have typically a limiting oxygen index (LOI) of about 30-31%. LOI depends on monomer ratio in the polymer and it increases gradually as the fluorocarbon content is increased to the alternating composition and then increases more rapidly to the LOI values for PTFE [a.82].

4.4.7 Forms of ETFE

The most common commercial forms of ETFE and modified ETFE are powders, beads and melt-extruded pellets and an aqueous dispersion (recently introduced by DuPont).

4.5 Polyvinylidene Fluoride (PVDF)

Polyvinylidene fluoride homopolymer is a semicrystalline polymer. Its degree of crystallinity can vary from 35% to more than 70%, depending on the method of preparation and thermomechanical history [a.83]. The degree of crystallinity greatly affects the toughness and mechanical strength as well as the impact resistance of the polymer. Other major factors influencing the properties of PVDF are molecular weight, molecular weight distribution, and extent of irregularities along the polymer chain and the crystalline form. Like other linear polyolefins, crystalline forms of PVDF involve lamellar and spherulitic forms. The differences in the size and distribution of the domains as well as kinetics of crystal growth are related to the method of polymerisation [a.83].

PVDF exhibits a complex crystalline polymorphism, which cannot be found in other known synthetic polymers. There are a total of four distinct crystalline forms: alpha, beta, gamma and delta. These are present in different proportions in the material, depending on a variety of factors that affect the development of the crystalline structure, such as pressure, intensity of the electric field, controlled melt crystallisation, precipitation from different solvents and seeding crystallisation e.g., surfactants. The alpha and beta forms are most common in practical situations. Generally, the alpha form is generated in normal melt processing; the beta form develops under mechanical deformation of melt-fabricated specimens. The gamma form arises under special circumstances and the delta form is obtained by distortion of one of the phases under high electrical fields [a.83]. The density of PVDF in the alpha crystal form is 1.98 g/cm^3; the density of amorphous PVDF is 1.68 g/cm^3. Thus the typical density of commercial products in the range from 1.75 to 1.78 g/cm^3 reflects a degree of crystallinity around 40%.

The structure of PVDF chain, namely alternating CH_2 and CF_2 groups has an effect on its properties which combine some of the best performance characteristics of both PE $(-CH_2-CH_2-)_n$ and PTFE $(-CF_2-CF_2-)_n$. Certain commercial grades of PVDF are copolymers of VDF with small amounts (typically less than 6%) of other fluorinated monomers, such as HFP, CTFE and TFE. These exhibit somewhat different properties than the homopolymer.

4.5.1 Physical and Mechanical Properties

PVDF exhibits excellent mechanical properties (see **Table 14**) and when compared to perfluorinated polymers, it has much higher resistance to elastic deformation under load (creep), much longer life in repeated flexing and improved fatigue resistance [a.84, 85]. Its mechanical strength can be greatly increased by orientation [a.83]. Some additives, such as glass spheres and carbon fibres [a.86] increase the strength of the base polymer.

4.5.2 Electrical Properties

Typical values of electrical properties of the homopolymer without additives and treatments are shown in the **Table 15.** The values can be substantially changed by the type of cooling and post-treatments, which determine the morphological state of the polymer. Dielectric constants as high as 17 have been measured on oriented samples that have been subjected to high electrical fields (poled) under various conditions to orient the polar crystalline form [a.87].

The unique dielectric properties and polymorphism of PVDF are the source of its high piezoelectric and pyroelectric activity [a.88, a.89]. The relationship between ferroelectric behaviour, which includes piezoelectric and pyroelectric phenomena and other electrical properties of the polymorphs of PVDF, is discussed by Robinson [a.89].

The structure yielding a high dielectric constant and a complex polymorphism also exhibits a high dielectric loss factor. This excludes PVDF from applications as an insulator for conductors of high frequency currents since the insulation could heat up and possibly even melt. On the other hand, because of that, PVDF can be readily melted by radiofrequency or dielectric heating and this can be utilised for certain fabrication processes or joining [a.90, (440)]. High-energy radiation crosslinks PVDF and the result is the enhancement of mechanical properties. This feature makes it unique among vinylidene polymers, which are typically degraded by high-energy radiation [a.87].

4.5.3 Chemical Properties

PVDF exhibits an excellent resistance to most inorganic acids, weak bases, and halogens, oxidising agents (even at elevated temperatures) and to aliphatic, aromatic and chlorinated solvents. Strong bases, amines, esters and ketones cause its swelling, softening and dissolution depending on conditions [a.91]. Certain

Table 14 Typical properties of PVDF homopolymer

Property	ASTM Method	Unit	Value
Tensile strength at 25 °C	D638	MPa	30-50
Elongation at break at 25 °C	D638	%	50-250
Yield point at 25°	D638	MPa	38-52
Flexural modulus	D790	MPa	900-1100
Hardness, Shore D	D2240	-	77-80
Specific gravity	D792	-	1.75-1.79
Melting point (crystalline)	-	°C	160-190
Coefficient of friction on steel	-	-	0.14-0.17
Water absorption	-	%	0.04
Thermal degradation temperature	-	°C	390

Table 15 Electrical properties of PVDF homopolymer		
Property	**Unit**	**Value**
Dielectric strength, 0.125 mm thick	kV/mm	63-67
Surface resistivity	ohm/sq	> 10^{14}
Volume resistivity	ohm.cm	> 10^{14}
Dielectric constant 60 Hz 103 Hz 106 Hz 109 Hz	 - - - -	 9-10 8-9 8-9 3-4
Dissipation factor 60 Hz 103 Hz 106 Hz 109 Hz	 - - - -	 0.03-0.05 0.005-0.02 0.03-0.05 0.09-0.11
Reproduced with permission from J.E. Dohany and J.S. Humphrey in Encyclopedia of Polymer Science and Technology, Volume 17, John Wiley & Sons, New York, 1989.		

esters and ketones can act as latent solvents for PVDF in dispersions. Such systems solvate the polymer as the temperature is raised during the fusion of the coating, resulting in a cohesive film [a.92].

PVDF is among the few semicrystalline polymers that exhibit thermodynamic compatibility with other polymers [a.93], in particular with acrylic or methacrylic resins [a.94, (442)]. The morphology, properties and performance of these blends depends on the structure and composition of the additive polymer as well as on the particular PVDF resin. These aspects have been studied and are reported in some detail in [a.95]. For example, polyethyl acrylate is miscible with PVDF, but polyisopropyl acrylate and homologues are not. Strong dipolar interactions are important to achieve miscibility with PVDF, as suggested by the observation that polyvinyl fluoride is incompatible with PVDF [a.96, (441)].

4.5.4 Forms of PVDF

PVDF is supplied as pellets, powder and aqueous dispersions.

4.6 Polychlorotrifluoroethylene (PCTFE)

The inclusion of the relatively large chlorine molecule into the polymeric chain reduces the tendency to crystallise. Commercially available grades include a homopolymer, which is mainly used for special applications and copolymers with small amounts (less than 5%), of vinylidene fluoride [a.97]. The products are supplied as powder, pellets, and pellets containing 15% glass fibre and as dispersions. Low molecular weight polymer is available as oil or grease. The oil is used to plasticise PCTFE [a.98].

4.6.1 Physical and Mechanical Properties

As long as the thermally induced crystallisation (see previously) is avoided, PCTFE exhibits excellent mechanical properties. It also has an excellent resistance to creep [a.96]. The addition of glass fibres (typically 15%) improves high temperature properties and increases hardness, but also increases brittleness [a.97].

4.6.2 Chemical Properties

PCTFE has an excellent chemical resistance, especially the resistance to most very harsh environments, particularly to strong oxidising agents, such as fuming oxidising acids, liquid oxygen, ozone and others, and to sunlight. PCTFE alone also has a good resistance to ionising radiation that is further improved by copolymerisation with small amounts of VDF (see previously) [a.99. The homopolymers and copolymers with VDF exhibit outstanding barrier properties [a.100].

4.6.3 Optical Properties

PCTFE does not absorb visible light and it is possible to produce optically clear sheets and parts up to 3.2 mm thick by quenching from melt [a.99, a.100].

4.6.4 Thermal Properties

PCTFE is suitable for service at extremely low temperatures, however, at elevated temperatures it is inferior to other fluoroplastics with the exception of PVDF. Its melting point is relatively low at 211 °C, and it exhibits thermally induced crystallisation at temperatures below its melting point, which results in brittleness [a.99]. PCTFE exhibits a low thermal stability in the molten state. This requires a great care during processing in order to maintain high enough molecular weight necessary for good mechanical properties of the fabricated parts [a.99].

4.7 Copolymer of Ethylene and Chlorotrifluoroethylene (ECTFE)

A commercial polymer with an overall CTFE to ethylene ratio of 1:1 contains ethylene blocks and CTFE blocks of less than 10 mol% each. Also modified copolymers produced commercially exhibit improved high-temperature stress cracking. Typically, the modified copolymers are less crystalline and have lower melting points [a.101]. Modifying monomers are hexafluoroisobutylene (HFIB), perfluorohexylethylene, and PPVE [a.102].

4.7.1 Properties of ECTFE

ECTFE resins are moderately stiff, tough and exhibit a resistance to creep. The exhibit a good chemical resistance, which is similar to PCTFE. The melt temperature depends on the monomer ratio in the polymer and is in the range 235-245 °C. ECTFE has an outstanding weathering resistance as do most fluoroplastics. Service temperatures range from –100 °C to + 150 °C. It also resists ionising radiation up to doses of 1000 kGy [a.102].

4.8 Terpolymers of Tetrafluoroethylene, Hexafluoropropylene and Vinylidene Fluoride (THV Fluoroplastic)

The driving force for the development of THV fluoroplastic was the requirement for a fluoropolymer that could be used as a coating for polyester fabrics and provide protection similar to that of PTFE or ETFE in outdoor exposure. An additional requirement was that it could be used with polyvinylchloride (PVC) coated polyester fabric without significantly compromising overall flexibility [a.103].

Chemically, THV fluoroplastic (referred to as THV) is a terpolymer of TFE, HFP and VDF produced by emulsion polymerisation. The resulting dispersion is either processed into powders and pellets or concentrated with emulsifier and supplied in that form to the market [a.104]. Currently, the manufacturer is Dyneon and there are essentially nine commercial grades (five dry grades and four aqueous dispersions) available that differ in their monomer ratios and consequently in melting points, chemical resistance and flexibility.

4.8.1 Properties

THV has a unique combination of properties that include relatively low processing temperatures, bondability (to itself and other substrates), high flexibility, excellent clarity and low refractive index and efficient electron beam crosslinking [a.104]. It also exhibits properties associated with fluoroplastics, namely very good chemical resistance, weatherability, low friction, and low flammability.

The melting temperatures of the THV commercial products range from 120 °C for THV-200 to 185 °C for THV-X 610. The lowest melting grade has the lowest chemical resistance and is easily soluble in ketones and ethyl acetate, it is the most flexible and easiest to crosslink by electron beam of all grades. The highest melting grade THV-500 has the highest chemical resistance and resistance to permeation [a.104].

THV Fluoroplastic can be readily bonded to itself and to many plastics and elastomers and unlike other fluoroplastics does not require surface treatment, such as chemical etching or corona treatment. However, in some cases tie-layers are required to achieve good bonding to other materials [a.105].

THV is transparent a broad band of light (UV to infrared) with an extremely low haze. Its refraction index is very low, and depends on the grade [a.106].

Typical properties of the standard dry grades are summarised in **Table 16**, and the properties of THV dispersions are in **Table 17.**

4.8.2 Forms of THV Fluoroplastics

THV fluoroplastics are available in powder, agglomerate and pellet form and as aqueous dispersions [a.107].

4.9 Polyvinyl Fluoride (PVF)

4.9.1 General Properties

PVF exhibits excellent resistance to weathering, outstanding mechanical properties and inertness towards a wide variety of chemicals, solvents, and staining agents, excellent hydrolytic stability, and high dielectric strength and dielectric constant [a.108].

Table 16 Typical properties of THV Fluoroplastics*

Property	**Unit**	**ASTM Method**	**THV Grade**				
			THV 220	**THV X 310**	**THV 410**	**THV 500**	**THV X 610**
Specific gravity	g/cm^3	D792	1.95	1.97	1.97	1.98	2.04
Melting range	°C	D4591	120	140	155	165	185
Thermal decomposition in air	°C	TGA	420	430	430	440	440
Limiting oxygen index (LOI)	%	D2863	> 65	> 65	> 65	> 75	> 75
Tensile strength**	MPa	D638	20	24	28	28	28
Elongation at break	%	D638	600	500	500	500	500
Flexural modulus	MPa	D790	80	100	180	210	490
Hardness, Shore D	-	D2240	44	50	53	54	58
Dielectric constant at 23 °C							
1 MHz	-	D150	5.7	5.2	5.0	4.8	4.7
9.4 MHz			2.7	2.5	2.5	2.5	2.4
E-Beam cured high temperature resistance	°C	NA	> 150	NA	NA	NA	NA

** Not for specification purposes*
*** Measured on extruded film*
TGA: Thermogravimetric analysis
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Table 17 Physical properties of THV aqueous dispersions*

Property	**Test Method ISO/ASTM**	**Unit**	**THV 220D**	**THV 340D**	**THV 340C**	**THV 510D**
Solids content	12086/D4441	%	31	34	50	32
pH	ISO 1148/E70	-	2.5	7	9.5	2
Melting point	DIN ISO 3146/ D4591	°C	120	145	145	165
Melt index, 265 °C/5 kg	DIN 53735/D1238	g/10 min	20	40	40	10
Average particle size	ISO 13321	nm	95	90	90	90
Density	D1298	g/cm^3	1.21	1.23	1.32	1.21
Viscosity (D = 210 s^{-1})	DIN 54453	MPa-s	34	20	76	21
Surfactant	-	-	ionic	ionic	ionic	-

** Nominal values, not for specification purposes*
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4.9.2 Chemical Properties

Films of PVF retain their form and strength even when boiled in strong acids and bases. At ordinary temperatures, the film is not affected by many classes of common solvents, including hydrocarbon and chlorinated solvents. It is partially soluble in a few highly polar solvents above 149 ºC. It is impermeable to greases and oils [a.109].

4.9.3 Optical Properties

Transparent PVF films are essentially transparent to solar radiation in the near UV, visible and near infrared regions of the spectrum [a.109].

4.9.4 Weathering Resistance

PVF films exhibit an outstanding resistance to solar degradation. Unsupported transparent PVF films have retained at least 50% of their tensile strength after ten years in Florida facing south at 45º. Pigmented films properly laminated to a variety of substrates impart a long service life. Most colors exhibit no more than five National Bureau of Standards (NBS) units (Modified Adams Color Coordinates) colour change after 20 years vertical outdoor exposure. Additional protection of various substrates against UV attack can be achieved with UV absorbing PVF films [a.109].

4.9.5 Electrical Properties

PVF films exhibit high dielectric constant and a high dielectric strength [a.110]. Typical electrical properties for standard PVF films are shown along with its physical properties in **Table 18.**

4.9.6 Thermal Stability

The polymer is processed into films routinely at temperatures near or above 204 ºC and for short times as high as 232 to 249 ºC using ordinary industrial ventilation. At temperatures above 204 ºC or upon prolonged heating, film discoloration and evolution of small amounts of hydrogen fluoride vapour will occur. The presence of Lewis acids (such as BF_3 complexes) in contact with PVF is known to catalyse the decomposition of the polymer at lower than normal temperatures. A thorough study of degradation of PVF films is reported in [a.111, (439)].

PVF films are available in large variety under the trade name TEDLAR PVF from DuPont. Type 1 film has controlled shrinkage for surfacing fibreglass-surfaced polyester panels and truck trailer bodies, Type 2 clear film exhibits high tensile strength and high flex, Type 3, the standard film is available in clear and pigmented forms. A clear film, Type 4, has high elongation and high tear resistance. Type 5 TEDLAR film has been developed for applications where deep draw and

Table 18 Properties of PVF measured on films

Property	Unit	Value
Melting point	°C	185-190
Density	-	1.38-1.57
Tensile strength	MPa	40-120
Elongation at break	%	115-250
Tensile modulus	MPa	1700-2600
Impact strength	kJ/m	10-22
Tear strength	kJ/m	174-239
Coefficient of thermal expansion	K^{-1}	5×10^{-5}
Dielectric constant at 1 MHz	-	4.8
Dielectric strength, 0.1 mm thick film	kV/mm	120-140

Reproduced with permission from Technical Information Bulletin TD-31, DuPont, 1979 and Technical Information Bulletin TD-1A, DuPont, 1974 texturing are required. Its ultimate elongation is almost twice of that of standard Type 3 film. Thickness of commercially available PVF films ranges from 12.5 to 50 μm.

TEDLAR films are supplied with different surface characteristics. 'A' (one side adherable) and 'B' (both sides adherable) surfaces are used with adhesives for bonding to a wide variety of substrates. These surfaces can be bonded with a variety of adhesives, including acrylics, polyesters, epoxies, elastomeric adhesives and pressure sensitive mastics. The 'S' surface has excellent anti-stick properties and is being used as a mould release film for parts made from epoxies, phenolics, elastomers and other polymeric materials [a.110].

4.10 Terpolymer of Hexafluoropropylene, Tetrafluoroethylene and Ethylene (HTE Fluoroplastic)

4.10.1 Properties of HTE Fluoroplastic

HTE Fluoroplastic has a unique combination of features [a.107]:

- Relatively low processing temperature (260 °C at the die), which can reduce the need for corrosion resistant processing equipment
- Excellent chemical resistance
- Good electrical insulation properties
- Good tensile strength
- Good permeation resistance to chemical vapours and fuels
- High LOI compared to ETFE
- High light transmission in the visible and UV ranges
- Excellent dimensional stability and toughness

Typical properties of this material are summarised in **Table 19**.

HTE Fluoroplastics are supplied in pellet form.

5 Processing of Fluoroplastics

5.1 Processing of PTFE

There is a distinct difference between the processing methods used for PTFE and those used for the remaining fluoroplastics. The reason for that is the extremely high melt viscosity of PTFE, which does not allow the degree of flow required for the melt processing methods used for

Table 19 Typical properties of HTE Fluoroplastics*

Property	**Unit**	**ASTM Method**	**HTE X 1510**	**HTE X1705**
Specific gravity	g/cm^3	D792	1.85	1.75
Melting point	°C	D4591	160	210
Glass transition temperature	°C	DSC	35	65
Limiting oxygen index (LOI)	%	D2863	46	33
Tensile strength	MPa	D638	32	44
Elongation at break	%	D638	520	450
Flexural modulus	MPa	D790	655	1040
Hardness, Shore D	-	D2240	61	66
Melt flow index (265 °C/5kg)	g/10 min	D1238	10	4
Dielectric constant at 23 °C, 1 MHz	-	D150	2.3	2.2
Dissipation factor, at 23 °C, 1 MHz	-	D150	0.006	0.004

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most thermoplastics. Thus, depending on the form of the resin, PTFE is processed by different methods. *Granular resins* are processed by methods that are similar to those used in powder metallurgy or by ram extrusion. Each of these methods requires a specific grade of resin. *Fine powders* are processed in the form of a ‘paste’ prepared by mixing the resin with a hydrocarbon lubricant. *Aqueous dispersions* are processed by methods, such as dipping, coating, impregnation, casting, and so on. The remaining fluoroplastics are essentially processed by melt-processing methods, such as extrusion, injection moulding, film casting, blown film extrusion, and so on. More detailed discussion of individual methods is given in the following sections.

5.1.1 Processing of Granular Resins

5.1.1.1 Compression Moulding

The simplest method of fabrication of products from PTFE granular resins is compression moulding. There are essentially four different techniques used depending on the shape and size of the manufactured part [a.112]:

- Billet/block moulding (rectangular and cylindrical parts, weighing from several grams to hundreds of kilograms).
- Sheet moulding (flat sheets, weighing few hundred grams to a few tens of kilograms).
- Automatic moulding (small round parts, weighing a few grams to a few hundred grams).
- Isostatic moulding (parts with complex geometry, weighing tens of grams to tens of kilograms).

In the most common and simplest process the resins are compressed (‘preformed’) at ambient temperature (preferably above 20 °C) in a mould placed in a hydraulic press (an example is shown in **Figure 5**). The *preform* or *billet* has to have sufficient mechanical integrity for handling and *sintering* (heating above the crystalline melting point of the resin). Flat sheets are preformed in a similar fashion.

In *hot compression moulding* the resin is moulded in a mould placed into an oven. This method is often used for filled resins [a.113].

Automatic moulding is a process for automatic charging of resin into the mould followed by compression. It is suitable for the fabrication of small and simple parts (rings, seals, spacers etc.).

Isostatic moulding is a method in which the powder is loaded in a closed flexible mould (often made from polyurethane). It is used for the moulding of complex shapes by the placement of mandrels into the flexible bladder (membrane) that is part of the mould. The mould is placed into an autoclave containing a liquid that can be compressed to the pressure required for preforming [a.114, a.115].

A compression moulding method called *coining* is used for parts, which are too complicated to be produced by machining. In coining, a sintered moulding is heated up to the melting point and then it is quickly pressed into a mould cavity and held under pressure until it solidifies [a.115].

In almost all the previous methods sintering of the preforms follows.

The purpose of the sintering operation is to convert the preform into a product with increased strength and reduced fraction of voids. Massive billets are generally sintered in an air-circulating oven heated to 365-380 °C. Both the sintering temperature and time have a critical

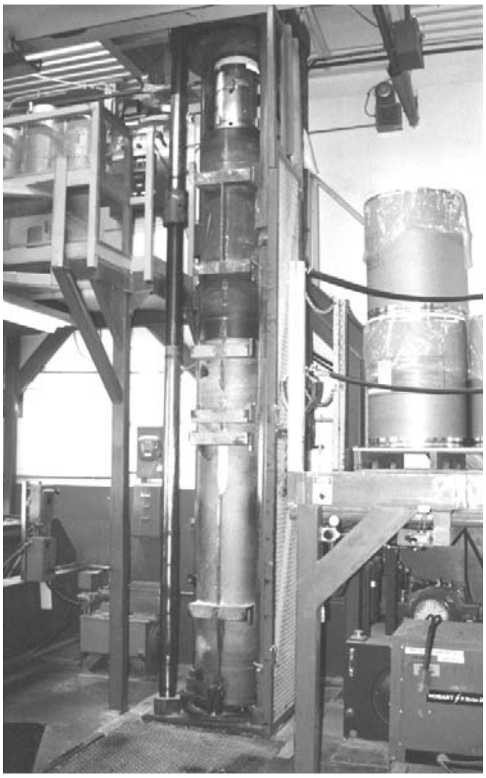

Figure 5

Hydraulic press for PTFE billets.
Courtesy Drobny Polymer Associates.

effect on the degree of coalescence, which in turn affects the final properties of the product. Medium size billets are shown in **Figure 6**.

Billets are almost always subjected to some kind of finishing. The most frequent finishing is by machining. The machinery used for PTFE is the same as for other plastics. The achievable dimensional tolerances depend mainly on the quality of the cutting edge of the tools used, which controls the heat generation. At any rate, cooling is necessary to remove excess heat. To achieve very close tolerances, parts have to be stress-relieved prior to machining above the expected service temperature. The common practice is to use a holding time of 1 hour per 25 mm of thickness followed by slow cooling.

Films and sheets are produced by *skiving*, which is 'peeling' of the billet in a similar fashion as wood veneer. A grooved mandrel is pressed into a billet and the assembly is mounted onto a lathe. A sharp cutting tool is used to skive a continuous tape of a constant thickness. The arrangement is shown in **Figure 7**. The range of thickness films and sheets produced by skiving is typically from about 25 μm to 3 mm.

Figure 6

Medium size sintered PTFE billets.
Courtesy Drobny Polymer Associates.

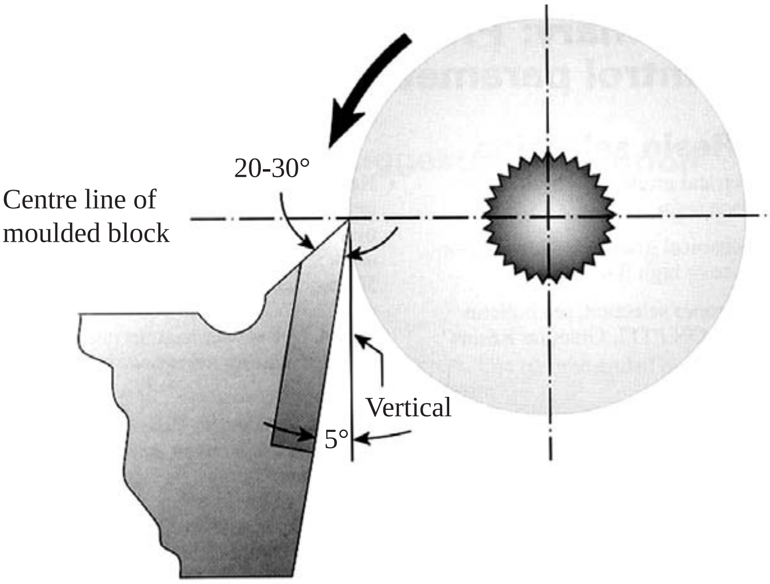

Figure 7

Schematic of skiving PTFE.
Courtesy DuPont.

5.1.1.2 Ram Extrusion

Ram extrusion is a process to produce PTFE extrudates of continuous lengths. Granulated resins used in ram extrusion must have good flow characteristics so that they can be fed readily to the extruder die tube. Presintered and agglomerated PTFE powders with bulk density ranging typically from 675 to 725 g/l are used for this process [a.116].

The resin is fed into one end of a straight die tube of uniform diameter where it is compacted by a ram and forced through the tube, which incorporates a heated sintering zone. The ram is then withdrawn - the die tube re-filled by the resin and the cycle is repeated. Thus the compacted powder is forced stepwise through the die to its heated section where it is sintered and then through a cooler section where it is cooled and eventually emerges in a continuous length. A rise in temperature and excessive working, such as severe shearing or agitation have an adverse effect on the flow of the powder. The temperature adjacent to the top of the die tube and in the feed system should be in the range 21- 30 °C [a.117].

The powder is preformed to a void-free condition during the preforming stage and as such is moved through the die tube. The process maintains pressure on the molten PTFE in the sintering zone to coalesce the resin particles. The rate of compaction has to be slow enough to allow the air mixed with the resin to escape.

During the *sintering*, the powder is heated by conduction. Thus the time needed to heat it up to the sintering temperature depends on the size and shape of the extrudate as well as on its heat transfer properties. Temperature settings in the sintering zone are from 380 to 400 °C, although for large diameter rods where the centre takes much longer time than the surface to reach sintering temperature, the setting can be as low as 370 °C to avoid degradation of the surface [a.118]. Since the majority of properties depend on the degree of crystallinity, the cooling rate that effects it has to be closely controlled to achieve the desired results. The effect of cooling rate on the degree of crystallinity is in **Table 20.**

Granular PTFE resins are most frequently extruded as rods or tubes, but it is possible to produce extrudates of noncircular cross-sections.

Table 20 Effect of cooling rate on PTFE crystallinity

Cooling Rate °C/min	% Crystallinity
Quenched in ice water	45
5	54
1	56
0.5	58
0.1	62

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5.1.2 Processing of Fine Powders

Fine powder resins are extremely sensitive to shear and the sheared polymer cannot be processed. Because of that they have to be handled with a great care during transport and processing.

Most commonly, fine powder resins are processed in the form of a ‘paste’. Such a paste is prepared by mixing the powder with 15-25% hydrocarbon lubricant, such as kerosene, white oil, or naphtha, with the resultant blend appearing much like the powder alone [a.119].

Fine powder resins are shipped in specially constructed drums that hold 23 kg of resin. These shallow, cylindrical drums are designed to minimise compaction and shearing of the resin during shipment and storage. To further assure that the compaction is kept at an absolute minimum, the resin must be kept at a temperature below 19 °C, its transition point during shipping and warehouse storage. Prior to blending with lubricants, the resin should be stored below its transition temperature for 24 hours. A safe storage temperature for most resins is 15 °C.

Lubricants enable PTFE fine powders to be processed on commercial equipment. Liquids with a viscosity between 0.5 x 10^{-3} and 5 x 10^{-3} Pa-s are preferred, although more viscous liquids are used occasionally. When selecting a lubricant, its ability to be incorporated easily into the blend and to vapourise completely and rapidly in a later processing step without leaving residues, which would discolor the product or adversely affect its properties is important. The amounts of lubricant added are typically 16 to 19% of the total weight of the mix.

For coloured products, pigments may be added during blending. These can be added dry, directly to the powder prior to the addition of the lubricant, or as a wet blend in the lubricant. In the latter case the pigment dispersion is added with the remaining lubricant.

The blending of the fine powders with the lubricant must be performed in an area in which the temperature is maintained below the PTFE transition temperature of 19 °C and the relative humidity should be kept at approximately 50%. A high level of cleanliness and an explosion-proof environment are additional requirements to assure high quality and safety. The blending is most commonly done in twin shell blenders.

The properly aged lubricated powder is usually *preformed* at room temperature into a billet of the size required by the equipment in which it is processed later. Preforming removes air from the material and compacts is so that it has a sufficient integrity for handling during the manufacturing process. The finished preform is rather fragile and must be stored in rigid tube for protection against damage and contamination.

The *extrusion step* is performed at temperatures above 19 °C, the first transition point of the resin, where it is highly deformable and can be extruded smoothly. The resin preform is placed in the extrusion cylinder, which is kept at a temperature of 38 °C, and kept there for several minutes to heat up to the higher temperature.

Unsintered rod and tape for packing, unsintered tape for thread sealing and cable wrapping together represent one of the largest applications for this technology. Other applications are sintered thin-walled tubing and wire coating.

Extruded rod can be used either for packaging or converted into tape by calendering. The rod for packaging is sometimes used with the lubricant still in it, sometimes without it. If the lubricant is to be removed, this may be done in a simple in-line oven immediately after the extruder, or in a separate batch oven.

5.1.3 Processing of PTFE Aqueous Dispersions

The major utility of PTFE aqueous dispersions is that they allow processing of PTFE resin, which cannot be processed as ordinary polymeric melt, due to its extraordinarily high melt viscosity or as solution because it is insoluble. Thus PTFE dispersions can be used to coat fabrics and yarns, impregnate fibres, non-woven fabrics and other porous structures, to produce anti-stick and low friction coatings on metals and other substrates and to produce cast films.

Surfactants are an essential ingredient for sufficient wetting of various substrates including sintered PTFE and for the formation of continuous films by uniform spreading on substrates such as metals, glass, ceramics and PTFE. Generally, 6-10% of nonionic surfactant (e.g., alkylaryl polyether alcohol) based on polymer content is sufficient to impart wetting and film-forming properties. Sometimes a small amount of a fluorosurfactant (typically below 0.1% of the polymer content) can be added to increase the efficiency of the nonionic surfactant.

To convert a dispersion into a sintered PTFE film, four distinct steps are required: *casting* (dipping or flowing out) onto a supporting surface, *drying* to remove water, *baking* to remove the surfactant and *sintering* to obtain a clear coherent film.

For a successful production of a cast film, the dispersion has to wet the supporting surface and spread uniformly. In drying, the thickness of the deposited layer is very important. If the deposit is too thick, it develops fissures and cracks, referred to as ‘mudcracking’. These flaws cannot be eliminated in the sintering step. Thus, for each formulation there is a *critical cracking thickness*, which represents a limit below which cracking will not occur in a single application. It depends on the particle size range, amount of surfactant used and the solids content. For thicker films multiple coats have to be applied. For a properly formulated dispersion recoating over an unsintered or sintered coating is not a problem.

5.1.3.1 Impregnation

Properly compounded PTFE dispersions are suitable for impregnation because of their low viscosity, very small particles and ability to wet the surfaces. The surfactant aids the capillary action and wetting interstices in a porous material. After the substrate is dipped and dried it may or may not be sintered. This depends on the intended application. In fact, the unsintered coating exhibits sufficiently high chemical resistance and anti-stick property. If required, the coated substrate may be heated to about 290 °C for several minutes to remove the surfactant. Lower temperatures and longer times are used if the substrate cannot tolerate such a high temperature. In some cases the impregnated material is calendered or compressed in a mould to compact the PTFE resin and to hold it in place.

5.1.3.2 Fabric Coating

The largest proportion of PTFE dispersions is used for coating glass fabric. Equipment used for that purpose is a vertical *coating tower* consisting of three independently heated zones, namely the drying zone, baking zone and sintering zone (see **Figure 8**). There are several systems for heating these zones and the choice of the heating system depends on the type of product to be made. The most common heating is by circulating hot air heated by gas burners. Air can be also heated by circulating hot oil. Infrared heating is another choice and its use has been growing over the past decade.

A typical coating line consists of fabric let-off, the coating tower and a take-up for the coated goods. Some lines also include a festoon (accumulator) to avoid the need for stopping the line if the web is being spliced or if the take-up has to be stopped for a roll change or a problem. The take-up may be arranged as a turret for a faster roll change.

A stainless steel dip tank is on the bottom of the coating tower. Inside the tank is a submerged roll, sometimes called a ‘dip bar’ which may be made from stainless steel or PTFE [a.120]. The roll may be locked or rotated. A rotating bar frequently has sleeve bearings, which are lubricated by the liquid in the tank. Some designs use multiple rolls (typically three) - this arrangement reduces differences in pickup between the two sides of the web.

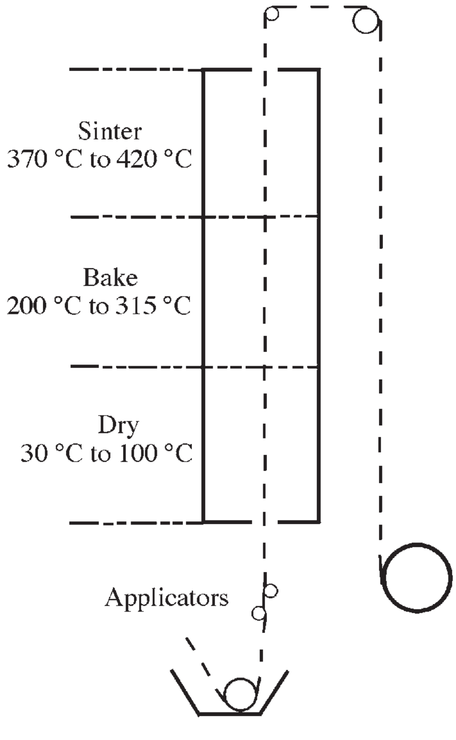

Figure 8

Schematic of a PTFE coating tower.
Courtesy DuPont.

If the process requires wiping of the excess liquid from the web, applicators of different design are used. The most wiping is achieved by sharp knives, the least with horizontally opposed, spring-loaded fixed-gap metering rolls [a.121]. In actual industrial practice the most common wiping devices are round - edged knives, wire wound rods (‘Meyer rods’) with varied wire diameter and smooth bars. The larger the wire diameter, the greater the thickness of the coating that is applied. Free dipping, i.e., without wiping is another possibility. The amount of coating can be also controlled by the amount of solids and by viscosity and to a degree by the web speed.

The temperatures in the individual zones of a coating tower may vary according to the type of fabric being coated. However, the goal is to remove water and other volatile components from the coating without boiling and before the web reaches the baking zone and then to remove surfactant in the baking zone. The sintering is almost instantaneous once the temperature is above the crystalline melting point of the PTFE resin. Typical air temperature ranges in the individual zones are:

Drying zone: 30 to 100 °C

Baking zone: 250 to 315 °C

Sintering zone: 370 to 400 °C

If any of the zones are heated by infrared systems, the surface temperature of the heating elements is set and controlled to attain the required temperature.

Glass and aramid fabrics (e.g., Kevlar or Nomex) are currently the only fabrics, which can withstand the high temperatures required for the sintering of PTFE resin. Thus, they can be coated by it without being degraded greatly in the process. Glass fabrics come with a starch-based treatment (sizing) that is necessary in the weaving operation. However, this treatment interferes with the coating and has to be removed by ‘heat cleaning’, which means that the fabric is heated to high temperatures to burn off the starch and other organic compounds used in the sizing. This operation is frequently the first pass of the coating process, in which the glass fabric passes through the tower without being coated. In some contemporary designs an infrared (IR) heater is placed between the let-off and the dipping tank. This way the treatment is removed in this heater and the fabric can be coated immediately. This heater also often contains a vacuum cleaner, which removes any loose contaminants from the surface of the fabric.

To obtain PTFE coated fabrics that can be heat-sealed or laminated at lower temperatures, a thin coat of diluted aqueous dispersions of FEP or PFA is applied on top of the PTFE coating.

5.1.3.3 Film Casting

As pointed out earlier, PTFE homopolymer cannot be processed by melt extrusion because of its extremely high melt viscosity. Thus other methods were found to prepare films such as skiving from compression moulded and sintered billets (see Section 5.1.1) and by casting from dispersions. The original method for casting films from PTFE dispersions employs polished stainless steel belts, which are dipped into a properly compounded dispersion. The thin coating of the liquid is then dried and the dry powdery layer is subjected to baking and sintering. To obtain a good quality film the thickness of the film has to be below the critical value to prevent mudcracking.

The equipment used is again a vertical coater with heated zones, very similar to the coating tower for fabric [a.122]. The speed of the belt is slow, about 0.3 to 1 m/min and there are no applicators used to remove excess dispersion. The amount of coating picked up by the belt is controlled mainly by the solids content of the dispersion and by the belt speed. A production machine is built with multiple stages. Thus after a film is sintered it is recoated in the next stage. At the end of the machine, there is a device designed to strip the films from both sides of the belt and wind them up onto rolls.

The advantage of this method is that each layer can be made from a different type of dispersion. For example, clear and pigmented layers can be made or the top layer can be prepared from a FEP or PFA dispersion to obtain films that can be heat-sealed or laminated. In fact, films with both heat-sealable surfaces can be produced by this method. In such an instance, PFA is applied as the first coat onto the belt and FEP as the last coat. The reason for that is that PFA can be stripped from the steel belt, whereas FEP would adhere to it and is impossible to strip. Another possibility is to make films with an unsintered last coat, which can be used for lamination with substrates coated with unsintered PTFE using the lamination method described earlier.

An improved process and equipment for cast PTFE films have been developed which has considerably higher productivity than the method and equipment described previously [a.123]. It is essentially a vertical coater with multiple stages. The carrier belt has to be made from a material of low thermal mass, which can tolerate repeated exposure to the sintering temperature and has surface properties such, that it can be wetted by the dispersion, yet the film can be stripped without being stretched. There are several possible belt materials, but KAPTON H was found to be particularly suitable because of its heat resistance, dimensional stability and surface characteristics [a.123]. The production speeds used in this process are 3 to 10 m/min.

5.1.3.4 Other Processing Methods for PTFE Aqueous Dispersions

PTFE aqueous dispersions are applied onto *metal substrates* by spraying, dipping, flow coating, electrodeposition or coagulation to provide chemical resistance, nonstick and low friction surfaces. After coating, the parts are dried and sintered.

Nonstick cookware and *bakeware* are made from dispersions specifically formulated for that purpose with the use of a primer for the metal. Recently developed coating formulations are ‘One Coat Systems’ that do not require metal priming [a.124]. Some proprietary non-stick coating formulations use a combination of PTFE with other engineering polymers dispersed in organic solvents.

PTFE *fibres* are made by spinning from aqueous dispersions, which are mixed with matrix-forming medium and forced through a spinneret into a coagulating bath. Then the matrix material is removed by heating and the fibres are sintered and oriented (drawn) in the molten state to develop their full strength [a.125].

Another application of PTFE dispersions is the preparation of a variety of *compositions* with other materials, such as mineral fillers, polymers in powdered form by co-coagulation. The dispersion of the other component is blended with the PTFE dispersion and the blend is then coagulated. The resulting composition can be processed by extrusion with lubricants (see processing of fine powders) or by compression moulding [a.126].

5.2 Processing of Melt Processible Fluoroplastics

FEP resins are available in low melt viscosity, as extrusion grade, in intermediate viscosity, high melt viscosity and as aqueous dispersions [a.127].

They can be processed by processing techniques commonly used for thermoplastics, such as extrusion, injection moulding, rotational moulding, dip and slush moulding, powder and fluidised bed coating [a.128] and can be expanded into foams [a.129]. Compression and transfer moulding of FEP resins can be done but with some difficulty. Extrusion of FEP is used for primary insulation or cable jackets, for tubing and films. Aqueous dispersions are processed in a similar fashion as the PTFE dispersions (see Section 5.1.3).

Processing temperatures used for FEP resins are usually up to 427 °C, at which temperatures highly corrosive products are generated. Because of that, the parts of the processing equipment that are in contact with the melt must be made of special corrosion-resistant alloys to assure a trouble-free operation.

PFA can be processed by standard techniques used for thermoplastics, such as extrusion and injection moulding and transfer moulding at temperatures up to 425 ºC. High processing temperatures are required because PFA has a high melt viscosity with an activation energy lower than most thermoplastics, this being 50 kJ/mol [a.130]. Extrusion and injection moulding are done at temperatures typically above 390 ºC and relatively high shear rates. For these processing methods PFA grades with high melt flow indices (MFI), i.e., with lower molecular weights are used. Although PFA is thermally a very stable polymer, it still is subject to thermal degradation at processing temperatures, the extent of which depends on temperature, residence time and the shear rate. Thermal degradation occurs mainly from the end groups, chain scission becomes evident at temperatures above 400 ºC depending on the shear rate. Thermal degradation usually causes discoloration and bubbles [a.130]. PFA can be extruded into films, tubing, rods and foams [a.129].

Transfer moulding of PFA is done at temperatures in the range 350-380 ºC and at lower shear rates. At these conditions chain scission does not occur. The gaseous products evolving from the thermal degradation of the end groups are practically completely dissolved in the melt since the moulded parts are cooled under pressure. For transfer moulding, PFA resins with a lower MFI, i.e., higher molecular weights are preferred [a.130]. Because at the high processing temperatures large amounts of highly corrosive products are generated, the parts of the equipment have to be made from corrosion-resistant alloys to assure a trouble-free operation.

A copolymer of TFE and perfluoromethylvinyl ether (MFA) is processed in a similar way - the only difference being that the processing temperatures are somewhat lower than those for PFA, because the former has a melting temperature about 20 ºC lower.

ETFE copolymers can be readily fabricated by a variety of melt processing techniques [a.131]. They have a wide processing window, in the range 280-340 ºC and can be extruded into films, tubing, and rods or as thin coating on wire and cables. Injection moulding of ETFE into thin sections is considerably easier than injection moulding of melt processible perfluoropolymers since the former has critical shear rate at least two orders of magnitude greater than perfluoropolymers. When moulding thick sections (thickness greater than 5 mm) it is important to consider melt shrinkage occurring during freezing that can be as high as 6% [a.132].

Coatings can be prepared by hot flocking, by dipping the heated part into a fluidised bed of ETFE powder and removing it to cool. ETFE coatings can also be applied by other powder coating methods (e.g., electrostatically) or by spraying of water or solvent-based suspensions followed by drying and baking [a.132].

Welding of ETFE parts can be done easily by spin welding, ultrasonic welding and conventional butt-welding using flame and ETFE rod. The resins bond readily to untreated metals, but chemical etch corona and flame treatment can be used to increase adhesion further [a.133].

ETFE resins are very often compounded with varied ingredients (such as fibreglass or bronze powder) or modified during their processing. The most significant modification is crosslinking by peroxides or ionising radiation. The crosslinking results in improved mechanical properties, higher upper use temperatures and a better cut-through resistance without significant sacrifice of electrical properties or chemical resistance [a.132]. The addition of fillers improves creep resistance, improves friction and wear properties and increases softening temperature [a.134].

PVDF resins for melt processing are supplied as powders or pellets with a rather wide range of melt viscosities. Lower viscosity grades are used for injection moulding of complex parts, while the low viscosity grades have high enough melt strength for the extrusion of profiles, rods, tubing, pipe, film, wire insulation and monofilament. PVDF extrudes very well and there is no need to use lubricants or heat stabilisers [a.135]. The equipment for the melt processing of PVDF is the same as that for PVC or polyolefins since during normal processing of PVDF no corrosive products are formed. Extrusion temperatures vary between 230 to 290 °C, depending on the equipment and the profile being extruded. Water quenching is used for wire insulation, tubing and pipe, whereas sheet and cast film from slit dies are cooled on polished steel rolls kept at temperatures between 65 and 140 °C. Monofilament is extrusion spun into a water bath and then oriented and heat set at elevated temperatures [a.136]. PVDF films can be monoaxially and biaxially oriented.

PVDF resins can be moulded by compression, transfer and injection moulding in conventional moulding equipment. The mould shrinkage can be as high as 3% due to the semicrystalline nature of PVDF. Moulded parts often require annealing at temperatures ranging between 135 and 150 °C to increase dimensional stability and release internal stresses [a.136].

Parts from PVDF can be machined, sawed, coined, metallised and fusion bonded easier than most other thermoplastics. Fusion bonding usually yields a weld line that is strong as the part. Adhesive bonding of PVDF parts can be done - epoxy resins produce good bonds [a.136]. Because of a high dielectric constant and loss factor, PVDF can be readily melted by radiofrequency and dielectric heating. This is the basis for some fabrication and joining techniques [a.137, (440)].

PVDF can be coextruded and laminated, but the process has its technical challenges in matching the coefficients of thermal expansion, melt viscosities and layer adhesion. Special tie-layers, often from blends of polymers compatible with PVDF are used to achieve bonding [a.138, a.139].

PCTFE is processed by most of the techniques used for thermoplastics. Processing temperatures can be as high as 350 °C for injection moulding with melt temperatures leaving the nozzle in the range 280-305 °C. In compression moulding, process temperatures up to 315 °C and pressures up to 69 MPa are required. PCTFE is susceptible to degradation at temperatures as low as 250 °C. In fact, there is only a narrow margin between its degradation and processing temperatures. Careful temperature control during the melt processing of PCTFE is necessary since the processing temperatures of PCTFE (typically 230 to 315°C) are very close to the decomposition temperature of the polymer [a.140].

The most common form of **ECTFE** is hot cut pellets, which can be used in all melt processing techniques, such as extrusion, injection moulding, blow moulding, compression moulding, and fibre spinning [a.141]. ECTFE is corrosive in melt, the surfaces of machinery that come in contact with the polymer must be lined with a highly corrosion resistant alloy, such as, for example Hastelloy C-276. Recently developed grades with improved thermal stability and acid scavenging can be processed on conventional equipment [a.142].

Electrostatic powder coating using fine powders and rotomoulding and lining using very fine pellets are other processing methods. Formulated primers are used to improve adhesion and moisture permeability for powder coated metal substrates. For roto-lining, primers are usually not used [a.143].

THV Fluoroplastic (THV) can be processed by virtually any method generally used for thermoplastics, including extrusion, co-extrusion and tandem extrusion, blown film extrusion, blow-moulding, skived film, injection moulding, vacuum forming, and solvent casting (only THV-200).

Generally, processing temperatures for THV are comparable to those used for most thermoplastics. In extrusion, melt temperatures at the die are in the 230-250 °C range. These relatively low processing temperatures open new options for combinations of different melts (coextrusion, cross-head extrusion, co-blow moulding) with thermoplastics as well as with various elastomers [a.144]. Another advantage of the low processing temperatures is that they are generally below the decomposition temperature of the polymer, thus there is no need to protect the equipment against corrosion. Yet, as with any fluoropolymer, it is necessary to prevent long residence times in equipment and to purge the equipment after the process is finished. Also, appropriate ventilation is necessary. THV was found to be suitable for coextrusion with a variety of materials into multi-layer structures [a.145].

THV can be readily processed by blow moulding alone or with polyolefins. The olefin layer provides a structural integrity while THV provides chemical resistance and considerably reduced permeation [a.144].

In injection moulding, THV is processed at lower temperatures than other fluoropolymers, typically at 200 to 300 °C with mould temperatures being 60 to 100 °C. Generally standard injection moulding equipment is used [a.146].

THV can be readily bonded to itself and other plastics and elastomers. It does not require surface treatment, such as chemical etch or corona treatment to attain good adhesion to other polymers, although in some cases tie-layers are necessary. For bonding THV to elastomers an adhesion promoter is compounded to the elastomer substrate [a.147].

Aqueous THV dispersions can be used for coating substrates such as polyester fabrics or PVC because of the low melting temperatures of the base resins.

Polyvinyl fluoride is considered to be a thermoplastic, but it cannot be processed by conventional thermoplastic techniques because it is unstable above its melting point. However, it can be fabricated into self-supporting films and coatings by using latent solvents (see next) [a.148]. It can be compression moulded but this method is not commonly used because it not practical for a large volume production [a.149]. Because of a large number of hydrogen bonds and a high degree of crystallinity, PVF is insoluble at room temperature. However, some highly polar latent solvents, such as propylene carbonate, DMF, dimethyl acetamide, butyrolactone, and dimethyl sulfoxide dissolve it above 100 °C [a.148]. The use of latent solvents is the basis of processes to manufacture films and coatings. A latent solvent suitable for that has to have the appropriate volatility to allow the polymer particles to coalesce before complete evaporation.

Structurally modified PVF has been extruded [a.150]. Thin films are manufactured by extrusion of a dispersion of PVF in a latent solvent [a.151]. Such dispersion usually contains pigments, stabilisers, plasticisers, and flame retardants and deglossing agents if needed. The solvent is removed by evaporation. The extruded film can be biaxially oriented and the solvent is removed by evaporation only after the orientation is completed.

Homopolymers and copolymers of vinyl fluoride can be applied to substrates as dispersion in a latent solvent or water or by powder coating. Usually, the substrate does not need to be primed [a.152]. The dispersions may be applied by spraying, reverse roll coating, dip coating or centrifugal casting. Another method is dipping a hot article into the dispersion below 100 °C. PVF films are most frequently produced by casting on a continuous moving belt.

PVF films often require a surface treatment to improve bonding to other materials. These include flame treatment [a.153], electric discharge [a.154], chemical etching and plasma treatment [a.155].

HTE Fluoroplastics are suitable for processing by extrusion and injection moulding.

Typical temperature settings for *extrusion* are 165 °C in zone one, 210 °C in zone two, 230-235 °C in zone three, 235-245 °C in zone four, and 235-255 at the die [a.156]. Although this material may not require corrosion protection of the processing equipment in all applications, in some cases, where there are excessive residence times at melt processing temperatures, and individual processing conditions, run times and equipment maintenance schedule, corrosion protection may be a justified precaution. The best corrosion protection is provided by special nickel-alloy materials, but often nickel plating is sufficient.

Typical temperature settings for *injection moulding* for the barrel range from 220 to 240 °C and typical mould temperatures range from 40 to 60 °C. Recommendations for the corrosion protection are the same as for extrusion [a.156].

6 Applications for Commercial Fluoroplastics

6.1 Applications for PTFE

About one half of the PTFE resin produced is used in *electrical and electronic* applications [a.157] with the major use for insulation of hookup wire for military and aerospace electronic equipment. PTFE is also used as insulation for airframe and computer wires, as tubing and in electronic components. PTFE tape is being used for wrapping coaxial cables.

Large quantities of PTFE are used in the *chemical industry* in the fluid-conveying systems as gaskets, seals and moulded packing, bellows, hose and lined pipe [a.158] and as lining of large tanks or process vessels. PTFE is also used in laboratory apparatus. Compression moulded parts are made in many sizes and shapes. Unsintered tape is used for sealing threads of pipes for water and other liquids. Pressure sensitive tapes with silicone or acrylic adhesives are made from skived or cast PTFE films or thin PTFE coated glass fabrics.

PTFE coated glass fabric are used in architectural applications, such as roofing membranes for stadiums, airports, shopping centres as well as in radomes (**Figure 9**).

Other applications of PTFE coated fabrics are belts for the manufacture of tiles, for food processing (baking, cooking) as release sheets on hamburger grills, as release sheets in heat sealing machines, in filters, etc.

PTFE coated aramid fabrics are used in special laminated structures for protection of military personnel against chemical agents.

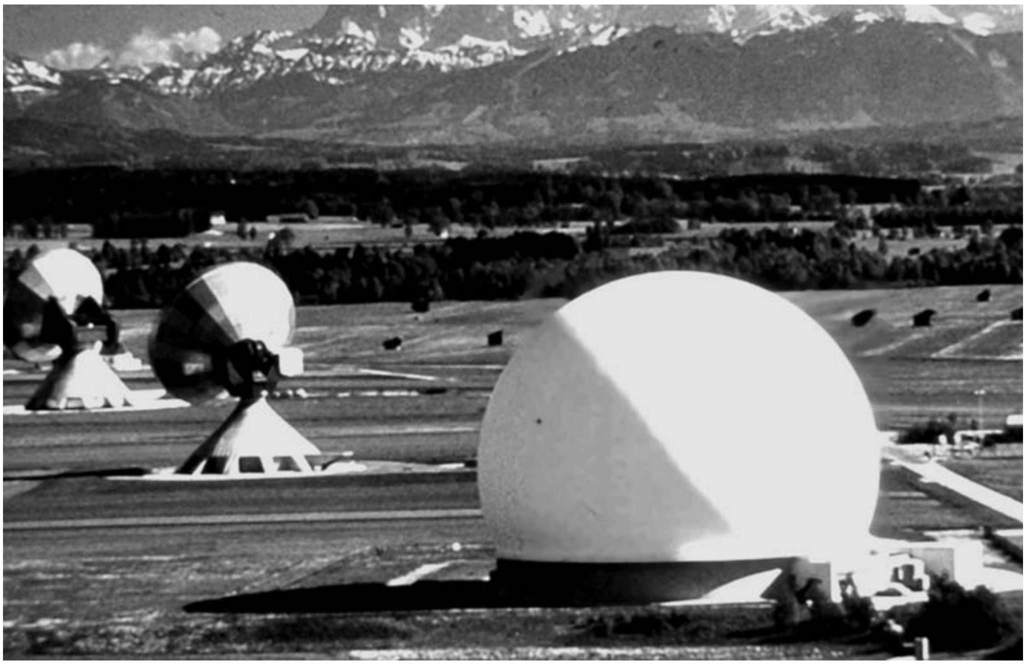

Figure 9

Radome from PTFE coated fabric.
Courtesy Chemfab Corporation.

Because of its very low friction coefficient, PTFE is used for *bearings*, ball- and roller bearing components and sliding bearing pads in static and dynamic load supports [a.158]. Piston rings of filled PTFE in non-lubricated compressors permit operation at lower power consumption or at increased capacities [a.159].

Modified PTFE (e.g., Teflon NXT) because of its improved processing, improved permeation, less porosity and better electrical insulation than standard PTFE (see Section 4.1.10) is used in pipe and vessel linings, gaskets and seals, fluid handling components, manifolds, wafer processing, electric and electronic industries, and in a variety of compression moulded thin-walled parts, sheets, and billets.

Since PTFE is highly inert and nontoxic, it is used in *medical applications* for cardiovascular grafts, heart patches, ligaments for knees and others [a.159] and in medical devices for diagnostics.

Highly porous *expanded membranes* are prepared by a process based on the fibrillation of high molecular weight PTFE (for example GORETEX [a.160]). Since they have a high permeability for water vapour and none for liquid water, it is combined with fabrics and used for breathable waterproof garments and camping gear. Another use for these membranes is for special filters, analytical instruments and in fuel cells [a.161].

Micropowders, PTFE homopolymers with molecular weight significantly lower than normal PTFE (see Section 4.1.11) are commonly used as additives in a large number of applications where they provide nonstick and/or sliding properties. They are added to plastics, printing inks, lubricants, paints and lacquers [a.162].

6.2 Applications for Melt Processable Fluoroplastics

6.2.1 Applications for FEP

FEP is used in large amounts in *electrical* applications, such as hookup wires, interconnecting wires, thermocouple wires, computer wires, plenum cables and moulded parts for electrical and electronic components. *Chemical* applications include lined tanks, lined pipes and fittings, heat exchangers, braided hose, gaskets, bellows, component parts of valves and laboratory ware [a.163]. *Mechanical* uses include antistick applications such as conveyor belts and roll covers. FEP film is used in *solar-collector windows* because of its lightweight, excellent weather resistance, high transparency and easy installation [a.163]. FEP film is also used for heat-sealing of PTFE coated fabrics, such as, for example, architectural fabric. Special FEP coatings are used in medical applications, often combined with PTFE dispersions or with PTFE micropowders. FEP is also applied by powder coating to different parts.

6.2.2 Applications for PFA and MFA

Perfluoroalkoxy resins are used in high-temperature *electrical* insulation and in components and parts requiring long flex life [a.164]. Typical applications are in hook-up wires, local area network (LAN) cables, primary insulation or jacketing of communication cables. Certain grades are used in the *chemical* industry for process equipment, liners, specialty tubing and moulded articles. Other applications are bellows and expansion joints, liners for valves, pipes, pumps and fittings. Extruded PFA films can be oriented and used for such specialised applications [a.165]. PFA resins can be processed into injection moulded, blow-moulded and compression moulded components. Thin-walled MFA tubes can be treated to be converted into heat-shrinkable tubes [a.166]. High purity grades are used in the semiconductor industry for demanding chemical applications [a.165]. Coated metal parts can be made by powder coating and chemical tanks and vessels can be protected by rotolining with MFA [a.166].

6.2.3 Applications for ETFE

ETFE is used in *electrical* applications for heat resistant insulations and jackets of low voltage power wiring for mass transport systems, for wiring in chemical plants and control and instrumentation wiring for utilities [a.167]. Because ETFE exhibits an excellent cut-through and abrasion resistance, it is used in airframe wire and computer hookup wire. Electrical and electronic components, such as sockets, connectors and switch components are made by injection moulding [a.168]. ETFE has excellent mechanical properties, therefore it is used successfully in seal glands, and pipe plugs, corrugated tubing, fasteners and pump vanes [a.167]. Its radiation resistance is a reason for its use in *nuclear industry* wiring [a.169]. ETFE's lower density provides a weight advantage over perfluoropolymers in aerospace wiring [a.169].

Because of its excellent chemical resistance, ETFE is used in the *chemical* industry for valve components, packings, pump impellers, laboratory ware and battery and instrument components and for oil well, down-hole cables [a.169].

Heat resistant grades of ETFE are used as insulation and jackets for heater cables and automotive wiring and for other wire applications, where the temperature may be as high as 200 °C for short periods of time, or where wires or cables are under repeated mechanical stress at temperatures up to 150 °C [a.167]. Another use is wiring for fire alarm systems in high-rise buildings and skyscrapers.

Injection moulded parts such as electrical connectors and sockets, distillation column plates and packing, valve bodies, pipe and fitting linings are easily made because ETFE exhibits a low shear sensitivity and wide processing window [a.170].

ETFE can be extruded continuously into tubing, piping and rod stock. An example of application of extruded tubing is automotive tubing, which takes advantage of its chemical resistance, mechanical strength and resistance to permeation of hydrocarbons. A high weld factor (more than 90%) is utilised in butt welding of piping and sheet lining of large vessels [a.166]. An example of an ETFE lined part is shown in **Figure 10.**

Carbon-filled ETFE resins (about 20% carbon) exhibit antistatic dissipation and are used in self-limiting heater cables and other antistatic or semiconductive applications [a.170].

Thin ETFE films are used in greenhouse applications because of their good light transmission, toughness and resistance to UV radiation [a.170]. Biaxially oriented films have excellent physical properties and toughness that are equivalent to those of polyester films [a.171].

Figure 10

ETFE lined part for the chemical process industry. *Courtesy DuPont.*

ETFE resins in the powder and bead form are rotationally moulded into varied structures, such as pump bodies, tanks and fittings and linings, mostly for the chemical process industries. Inserts can be incorporated to provide attachment points or reinforcement [a.170]. Adhesion to steel, copper and aluminum can be up to 3 kN/m peel force [a.172].

Certain grades of ETFE are used for extruded foams with void contents from 20 to 50%. The closed foam cells are 0.02 to 0.08 mm in diameter. Special grades of ETFE processed in the gas-injection, foaming process may have void contents up to 70%. Foamed ETFE is used in electrical applications, mainly in cables, since it exhibits lower apparent dielectric constant and dissipation factor and reduces cable weight.

6.2.4 Applications for PVDF

Polyvinylidene fluoride is widely used in the *chemical* industry in fluid handling systems for solid and lined pipes, fittings, valves, pumps, tower packing, tank liners and woven filter cloth. Because of its approval by the Federal Drug Administration for food contact, it can be used for fluid-handling equipment and filters in the food, pharmaceutical and biochemical industries see **Figures 11 and 12**. It also meets the high standards for purity, required in the manufacture of semiconductors and therefore is used for fluid handling systems in the semiconductor industry [a.173]. PVDF is also used for the manufacture of microporous and ultrafiltration membranes [a.174, a.175].

In the *electrical and electronic* industries PVDF is used as a primary insulator on computer hookup wire (**Figure 13**). Irradiated (crosslinked) PVDF jackets are used for industrial control wiring [a.176] and self-limiting, heat-tracing tapes used for controlling the temperature of process equipment as well as ordnance [a.177, a.178, (443)]. Extruded and irradiated heat-shrinkable tubing is used to produce termination devices for aircraft and electronic equipment [a.179]. Because of its very high dielectric constant and dielectric loss factor, the use of PVDF insulation is limited to only low frequency conductors. Under certain conditions PVDF films become piezoelectric and pyroelectric. The piezoelectric properties are utilised in soundproof telephone headsets, infrared sensing, a respiration monitor, a high fidelity electric violin, hydrophones, and keyboards and printers [a.180].

PVDF-based protective coatings are used on commercial and residential buildings (**Figure 14**).

Figure 11

PVDF high purity parts.
Courtesy Arkema.

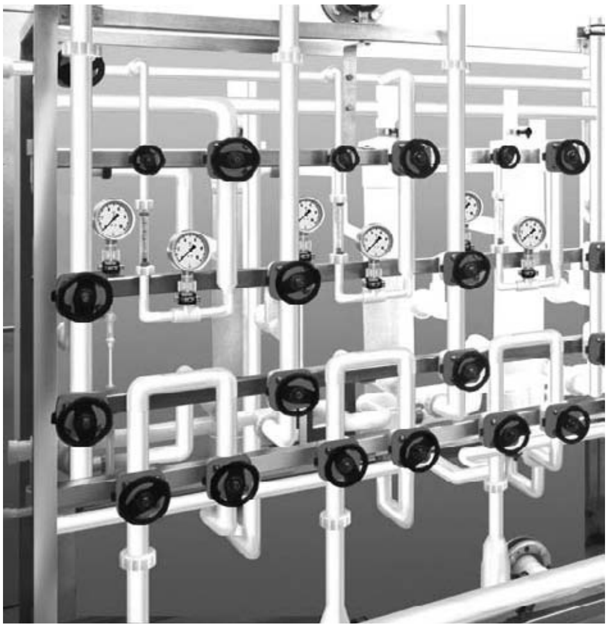

Figure 12

PVDF manifold.
Courtesy Arkema.

6.2.5 Applications for PCTFE

A major application for PCTFE is in specialty films for packaging for applications where there are high moisture barrier demands, such as pharmaceutical blister packaging and healthcare markets.

In electroluminiscent lamps PCTFE film is used to encapsulate phosphor coatings, which provide an area light when electrically excited. The film acts as a

Figure 13

PVDF wiring.
Courtesy Arkema.

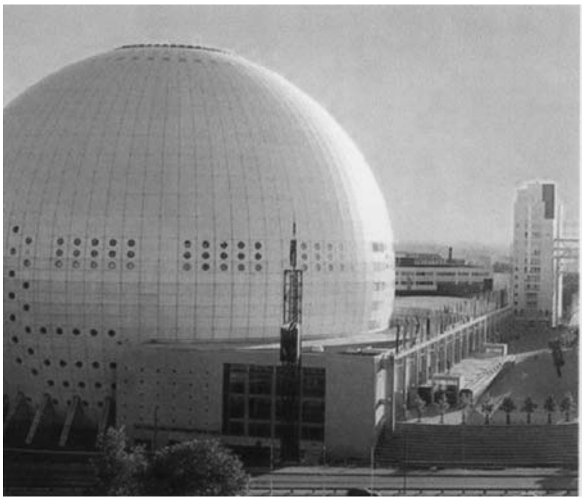

Figure 14

PVDF-based protective coating on the building of Stockholm Globe Arena.
Courtesy Arkema.

water vapour barrier protecting the moisture sensitive phosphor chemicals. Electroluminiscent lamps are used in aircraft, military, aerospace, automotive, business equipment applications and in buildings. Another use for PCTFE films is for packaging of corrosion-sensitive military and electronic components. Because of their excellent electrical insulation properties these films can be used to protect sensitive electronic components, which may be exposed to humid or harsh environments. They can be thermoformed to conform to any shape and detail. PCTFE films are also used to protect the moisture sensitive liquid crystal display (LCD) panels of portable computers [a.181].

PCTFE films can be laminated to a variety of substrates, such as PVC, glycol-modified polyethylene terephthalate (PETG), amorphous polyethylene terephthalate (APET) or polypropylene. Metallised films are used for electronic dissipative and moisture barrier bags for sensitive electronic components (**Figure 15**) and for packaging of drugs (**Figure 16**) and medical devices.

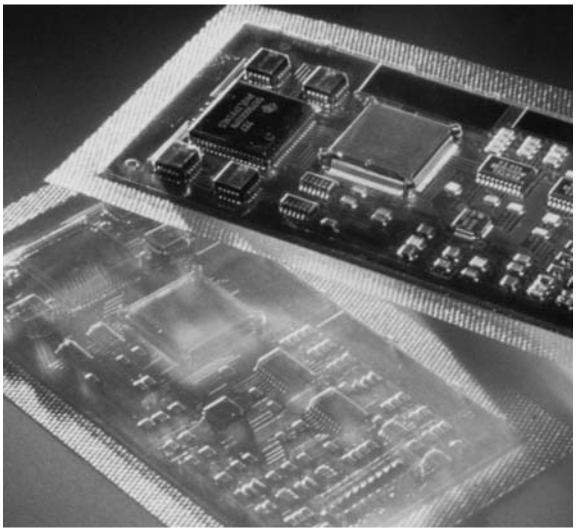

Figure 15

Packaging of electronic component with barrier films from PCTFE.
Courtesy Honeywell.

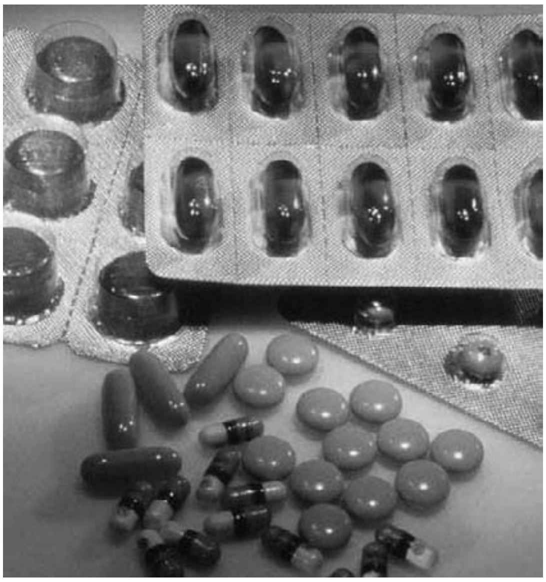

Figure 16

Packaging of drugs with barrier films from PCTFE.
Courtesy Honeywell.

Other applications for PCTFE are in pump parts, transparent sight glasses, flowmeters, tubes and linings in the chemical industry and for laboratory ware [a.182].

6.2.6 Applications for ECTFE

The single largest application for ECTFE has been as *primary insulation and jacketing* [a.183] in voice and copper cables used in building plenums [a.184]. In automotive applications, ECTFE is used for jackets of cables inside fuel tanks for level sensors, for hookup wires and in heating cables for car seats. Chemically foamed ECTFE is used in some cable constructions [a.185].

In the *chemical* process industry it is often used in chlorine/caustic environment in cell covers, outlet boxes, lined pipes and tanks. In the pulp and paper industries, pipes and scrubbers for bleaching agents are lined with ECTFE. Powder-coated tanks, ducts and other components are used in the semiconductor and chemical process industries. Monofilament made from ECTFE is used for chemical-resistant filters and screens [a.186].

ECTFE melt-blown fibre can be converted into a non-woven web or fabric that is used for separating water from petroleum products as well as for separation of very stable emulsions.

Other applications include rotomoulded tanks and containers for the storage of corrosive chemicals, such as nitric or hydrochloric acids. Extruded sheets can be thermoformed into various parts, such as battery cases for heart pacemakers [a.186].

ECTFE is compatible with liquid nitrogen and also with hydrazine-based rocket fuels. This combined with its excellent low-temperature and cryogenic properties have led to its use in aerospace applications such as gaskets for liquid oxygen and other propellants, in components for manned space vehicles and aircraft cabins, for convoluted tubing, abrasion resistant braid and hose for expandable conduit for space suits [a.187]. ECTFE film is used as release sheet in the fabrication of high-temperature composites for aerospace applications. Braided cable jackets made from monofilament strands are used in military and commercial aircraft as a protective sleeve for cables [a.188].

6.2.7 Applications for THV Fluoroplastics

Because THV is highly flexible, resistant to chemicals and automotive fuels and has good barrier properties it is used as a permeation barrier in various types of flexible hose in *automotive* applications and in the *chemical* process industry. Liners and tubing can be made from an electrostatic dissipative grade of THV, which is sometimes required for certain automotive applications [a.189].

THV is used for wire and cable jacketing which is often crosslinked by electron beam to improve its strength and increase its softening temperature. It is also used as primary insulation in less demanding applications, where high flexibility is required [a.190].

The low refractive index of THV (1.355) is utilised in light tubes and communication optical fibre applications where high flexibility is required. Its optical clarity and impact resistance makes it suitable for laminated safety glass for vehicles, clear windows on tents and sailboards and tents, windows and doors in psychiatric and correctional institutions. An additional advantage is that the film does not burn or support combustion, which may be a major concern in some applications [a.191].

Other applications for THV Fluoroplastics are flexible liners (drop-in liners or bag liners) used in chemical process industries and other industries, blow moulded containers, where it enhances the resistance to permeation when combined with a less expensive plastic (e.g., high-density polyethylene), which provides the structural integrity [a.210, (402)]. Optical clarity, excellent weatherability and flexibility make THV suitable as a protection of solar cell surface in solar modules [a.192].

Aqueous dispersions of THV are used for coating outdoor fabrics since the base resins provide excellent protection against weathering. Typical applications are awnings, tarpaulins, and shade cloth. The base substrate (usually PVC) can be laminated with THV at relatively low temperatures. Moreover, such laminates are inherently fire resistant [a.193]. Another application of aqueous THV dispersions is for coating of fabric used for protective clothing and garments for personnel working in chemical processing industries [a.193].

6.2.8 Applications for PVF

Polyvinyl fluoride is almost exclusively used as film for lamination with a large variety of substrates. Its main function is as a protective and decorative coating. PVF films can be made transparent or pigmented with a variety of colours and can be laminated to hardboard, paper, flexible PVC, polystyrene, rubber, polyurethane and other substrates [a.194]. These laminates are used for wall coverings, aircraft cabin interiors, pipe covering, duct liners, etc. For covering metal and rigid PVC, the film is first laminated to flat, continuous metal or vinyl sheets using special adhesives and then the laminate is formed into the desired shapes. The laminates are used for exterior sidings of industrial and residential buildings. Other applications are highway sound barriers [a.195], automobile truck and trailer siding [a.196], vinyl awnings and backlit signs [a.197].

On metal or plastic, PVF surfaces serve as a primer coat for painting or adhesive joints [a.198]. PVF films are used as a release sheet for bag moulding of composites from epoxide, polyester and phenolic resins and in the manufacture of circuit boards [a.199]. Other uses of PVF films are in greenhouses, flat-plate solar collectors and in photovoltaic cells. Dispersions of PVF are used for coating the exterior of steel hydraulic brake tubing for corrosion protection [a.198].

6.2.9 Applications for HTE Fluoroplastics

HTE product line is suitable for automotive and aerospace wiring, complementing ETFE [199]. HTE fluoroplastic has similar abrasion resistance and cut-through to ETFE, but it can be processed on standard extrusion equipment and offers a higher LOI than ETFE. Another application of HTE is in loose-fit tank liners [a.200].

7 Current Trends and New Developments

7.1 Applications

In general, fluoropolymers provide solutions to the industry demands for higher service temperatures, better electrical properties, improved flame resistance, and reduced smoke generation.

Increasingly, in the *automotive* industry, more electronic systems are being introduced that require more sensors and regulators. Automotive applications demand a relatively high chemical resistance, dependable service at low and high temperatures, and a good abrasion resistance. Fluoropolymers can meet all of the requirements. Traditionally, both ETFE and PTFE have been used, although the trend is to utilise both PFA and FEP to meet the new demands.

In the *aerospace* industry, too, there is an increasing demand for high performance electrical insulations with a high degree of fire safety and light weight. Here the trend is for foamed fluoroplastics, e.g., FEP.

In *telecommunications* similar requirements are placed on insulation materials in addition to low dielectric losses. Thus, even here fluoropolymers are capable of meeting them.

The trends in *appliance wiring* are towards increasing the service temperature.

In *semiconductor equipment* the requirements are: a very high purity of the material with little or no outgassing, flexibility and chemical resistance.

Besides ETFE, which has been the mainstay in most of the applications described previously, because of its excellent insulating properties, abrasion resistance, and cut-through resistance, THV and HTE have been also used successfully. HTE particularly, has an abrasion resistance and cut-through resistance similar to those of ETFE, but it can be processed on standard extrusion equipment (i.e., that commonly used for polyolefins), and has a higher LOI than ETFE [a.156]. THV is available in an ultra-high purity grade making it well suited for semiconductor applications.

PTFE, the largest-volume fluoroplastic is facing increasing competition from other fluoropolymers. Strongest gains are expected for FEP, which will be driven by accelerating production of semiconductors and wire and cable. PVDF is also expected to post above-average gain mainly from the improvements in semiconductor and wire and cable production, as well as its increasing use in construction coatings [a.201]. Additional growth of fluoroplastics is expected due to the growth in fuel cells, lithium and zinc-air batteries [a.202].

7.2 Polymerisation

The most significant development in polymerisation of fluoropolymers is the use of supercritical carbon dioxide as the solvent for monomers (originally used for TFE), replacing chlorofluorocarbons that are environmentally unacceptable. Additional benefits are: the removal of toxic initiator residues, and degradation products by supercritical CO_2, and the possibility to create new morphologies due to solubility of supercritical carbon dioxide in the fluoropolymer. Mixtures of TFE and CO_2 are much safer and can be operated at higher polymerisation pressures than TFE by itself [a.203]. There is a possibility to use supercritical carbon dioxide in the polymerisation of vinylidene chloride [a.204].

Another trend in the polymerisation process is to reduce or completely remove surfactants based on perfluorooctanoic acid (PFOA), which is suspected to be carcinogenic [a.205, 206] (see next). Another approach is to use bifunctional fluorinated surfactants with molecular weights in the range 600-1000 [a.207].

Polymerisation methods producing *core-shell* particles should yield polymers with improved processing and physical properties [a.208, 209].

7.3 Processing

One of the major breakthroughs in PTFE processing is the discovery of melt-processible PTFE compositions [a.210, (402)]. The principle is mixing of conventional high molecular weight and high viscosity PTFE with micropowders (low molecular weight and low viscosity PTFE). Certain composition ratios will have an intermediate viscosity, and can be extruded or compression moulded as standard melt-processable polymers. The melt processable PTFE can be melt-compounded with fillers, pigments and dyes [a.211]. The compositions and methods of preparing them are subject of a patent [a.212].

The excellent compatibility of supercritical carbon dioxide and fluoropolymers has been exploited in preparing compositions by swelling fluoropolymers by supercritical carbon dioxide at high temperatures and pressures. The resulting compositions can be processed by moulding, extrusion, and other methods. In addition, such compositions can be sintered at considerably lower temperatures [a.213].

Surface modification of fluoropolymers either by ionising radiation (gamma radiation or electron beam radiation) [a.214, a.215] or by chemical reactions [a.216] introduces reactive sites for additional chemical reactions and/or improves wear [a.214].

A variety of fluoropolymer *coatings* is offered by the industry, For example, low-melting copolymers of HFP-TFE can be deposited from solutions in perfluorinated solvents. Thin coatings of such polymeric solutions are optically clear, durable, and have a very good adhesion to many substrates, such as many plastics and glass [a.214]. Certain grades of THV are also suitable for solvent-based coatings with similar properties and so are aqueous THV dispersions [a.156]. Patented coatings based on PTFE and modified PTFE [a. 217] provide crack-free films with an excellent adhesion to steel and other metals (e.g. aluminium), with low friction coefficient, good wear resistance, and good scratch resistance.

7.4 Other

A major environmental and health issue is currently the toxicity of PFOA and its salts used in the polymerisation process and in processing of the majority of fluoropolymers [a.218, a.219] and issues involving the use of PTFE coating on cookware and its thermal degradation [a. 220, a.221, a.222, a.223].

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www.arkemagroup.com
KYNAR, KYNAR Flex – PVDF (Homopolymers and Copolymers)
VOLTALEF PCTFE

Asahi Glass Company
www.agc.co.jp
FLUON ETFE
FLUON PFA
FLUON PTFE
WHITCON TL- PTFE Micropowders

Daikin Industries Ltd.
www.daikin.com
NEOFLON EFEP
NEOFLON PCTFE
NEOFLON ETFE
NEOFLON FEP
NEOFLON PFA
POLYFLON PTFE

DuPont
www.dupont.com
TEDLAR - PVF
TEFLON - PTFE
TEFLON FEP
TEFLON PFA
TEFLON NXT - Modified PTFE
TEFZEL - ETFE
ZONYL FLUOROADDITIVES - PTFE Micropowders

Dyneon LLC
www.dyneon.com
DYNEON ETFE
DYNEON FEP
DYNEON HTE FLUOROTHERMOPLASTIC
DYNEON PFA
DYNEON PTFE
DYNEON TFM - Modified PTFE
DYNEON THV FLUOROTHERMOPLASTIC
DYNEON PTFE MICROPOWDERS

Honeywell
www.honeywell.com
ACLAR - PCTFE Films
ACLON- PCTFE Resin

JSC Halogen
www.halogen.ru
FLUOROPLAST - PTFE

Kureha Chemical Co., Ltd.
www.kureha.co.jp
KF POLYMER - PVDF

Shandong Dongyue Chemical Co.
www.dongyuechem.com
PTFE

Solvay Solexis SpA
www.solvaysolexis.com
ALGOFLON PTFE
HALAR ECTFE
HYFLON MFA
HYFLON PFA
HYLAR PVDF
POLYMIST PTFE - Micropowders

Zaklady Azotowe
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Acronyms and Abbreviations

APET	Amorphous polyethylene terephthalate
ASTM	American Society for Testing and Materials
CTFE	Chlorotrifluoroethylene
DIN	Deutsches Institut für Normung eV (German Institute for Standardisation)
E	Ethylene
ECTFE	Copolymer of ethylene and chlorotrifluoroethylene
EFEP	Ethylene-tetrafluoroethylene-hexafluoropropylene-fluoroterpolymer
ETFE	Copolymer of ethylene and tetrafluoroethylene
FEP	Fluorinated ethylene-propylene (copolymer of tetrafluoroethylene and hexafluoropropylene)
FEVE	Fluorinated ethylene vinyl ether
FTIR	Fourier transform infrared spectroscopy
HFIB	Hexafluoroisobutylene
HFP	Hexafluoropropylene
HTE	(Fluoroplastic) - terpolymer of hexafluoropropylene, tetrafluoroethylene and ethylene
IR	Infrared
ISO	International Organisation for Standardisation
LAN	Local area network
LOI	Limiting oxygen index
MFA	Copolymer of tetrafluoroethylene and tetrafluoroethylene and perfluoromethyl vinyl ether)
Mn	Number average molecular weight
NBS	National Bureau of Standards
PCTFE	Polychlorotrifluoroethylene
PE	Polyethylene
PETG	Glycol-modified polyethylene terephthalate
PFA	Perfluoroalkoxy polymer (copolymer of tetrafluoroethylene and perfluoropropyl vinyl ether)
PFOA	Perfluorooctanoic acid
PMVE	Perfluoromethyl vinyl ether
PPVE	Perfluoropropyl vinyl ether
PTFE	Polytetrafluoroethylene
PVC	Polyvinyl chloride
PVDF	Polyvinylidene fluoride
PVF	Polyvinyl fluoride
SSG	Standard specific gravity
TFE	Tetrafluoroethylene
TGA	Thermogravimetric analysis
THV	(Fluoroplastic) Terpolymer of tetrafluoroethylene, hexafluoropropylene and vinylidene fluoride
UL	Underwriter’s Laboratory
UV	Ultraviolet
VDF	Vinylidene fluoride
VF	Vinyl fluoride

Abstracts from the Polymer Library Database

Item 1
Journal of Polymer Science: Polymer Physics Edition
43, No.20, 15th Oct.2005, p.2862-73
ELASTIC PROPERTIES AND MECHANICAL RELAXATION BEHAVIORS OF PVDF (POLY(VINYLIDENE FLUORIDE)) AT TEMPERATURES BETWEEN -20 AND 100 DEGREES CELSIUS AND AT 2MHZ ULTRASONIC FREQUENCY
Guney H Y
Kocaeli,University

The elastic properties and mechanical relaxation behaviour of poly(vinylidene fluoride) were investigated as a function of temperature at a constant ultrasonic frequency, and the temperature dependence of storage and loss elastic constants were determined. The observed relaxation peaks for the longitudinal and transverse modes are discussed in comparison with literature values. 44 refs.

TURKEY

Accession no.957954

Item 2
Food Additives and Contaminants
22, No.10, Oct.2005, p.1023-31
PERFLUOROCHEMICALS: POTENTIAL SOURCES OF AND MIGRATION FROM FOOD PACKAGING
Begley T H; White K; Honigfort P; Twaroski M L; Neches R; Walker R A
US,Food & Drug Administration; Maryland,University

Potential sources of the biopersistent perfluorochemicals, perfluorooctane sulphonate (PFOS) and perfluorooctanoic acid (PFOA) found at trace levels in human serum were investigated. The migration of PFOS from oil/moisture-resistant paper coatings based on perfluorochemicals, and of PFOA from poly(tetrafluoroethylene) non-stick coatings used in cookware was studied using LC-MS analysis of food simulants and the results are discussed. 23 refs.

USA

Accession no.958020

Item 3
Polymer
46, No.26, 2005, p.12546-55
HIGH STRAIN RATE COMPRESSIVE BEHAVIOUR OF POLYCARBONATE AND POLYVINYLIDENE DIFLUORIDE
Siviour C R; Walley S M; Proud W G; Field J E
Cambridge,University

Details are given of the compressive stress-strain properties of polycarbonate and PVDF. The results were obtained using a split Hopkinson pressure bar and Instron testing machine and supported by dynamic mechanical analysis measurements. The dependence of the yield stress on both strain rate and temperature was linked to the relaxations in the materials. 33 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.958490

Item 4
International Polymer Science and Technology
32, No.9, 2005, p. T/30-3
MULTI-PLY SHEETS MADE FROM ORIENTED POLYIMIDE-FLUOROPLASTIC FILMS
Vlasov S V; Miichenko I P
Lomonosov M.V.,Moscow Academy of Fine Chemical Engineering; Tsiolkovskii,K.E.,Russian State Technological University; MATI

Multi-ply sheets were obtained whose mechanical properties were controlled by the laying at different angles of uniaxially oriented polyimide-fluoroplastic films with a different degree of stretching, and including structures with different thicknesses of the reinforcing polyimide base. The sheets were shown to acquire new properties and retain the old properties inherent in both polyimide and fluoroplastic. Characteristics of the specimens produced are given. 8 refs. (Article translated from Plasticheskie Massy, No.1, 2005, p.30-2)

RUSSIA

Accession no.955491

Item 5
Macromolecules
38, No.26, 27th Dec.2005, p.10829-35
EXCIMER FORMATION BY ELECTRIC FIELD INDUCTION AND SIDE CHAIN MOTION ASSISTANCE IN POLYFLUORENES
Hsin-Hung Lu; Ching-Yang Liu; Tzu-Hao Jen; Jin-Long Liao; Hao-En Tseng; Chih-Wei Huang; Ming-Chin Hung; Show-An Chen
Taiwan,National Tsing Hua University

The reasons for variations in the electroluminescence spectrum during continuous operation of polyfluorene based devices is studied. Measurements on field induction-thermally stimulated current and electroluminescence over a wide temperature range demonstrate that electric field induction accompanied by side-chain motion can lead to formation of excimers which contribute to the growth of a green component in the electroluminescence spectrum. 52 refs.

TAIWAN

Accession no.955630

Item 6
Polymer
46, No.24, 2005, p.10626-36

HIGH MOLECULAR WEIGHT GRAFT STABILISERS FOR DISPERSION POLYMERISATION OF VINYLIDENE FLUORIDE IN SUPERCRITICAL CARBON DIOXIDE. THE EFFECT OF ARCHITECTURE

Tai H; Wang W; Howdle S M
Nottingham,University

A group of high molecular weight fluorinated and non-fluorinated graft stabilisers were synthesised by thermal ring-opening esterification of anhydride copolymers. Methyl vinyl ether-maleic anhydride copolymers and maleic anhydride-octadecene copolymers were reacted with alcohols and were characterised using NMR, FTIR, and thermal analysis. Their phase behaviour in supercritical carbon dioxide, vinylidene fluoride was also studied. The effect of stabiliser architecture on the molecular weight and morphology of the PVDF polymer product was investigated. GPC and SEM were used to characterise molecular weight and morphology of PVDF polymers. 30 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.956060

Item 7
Macromolecules
38, No.20, 4th Oct.2005, p.8316-26

ORIGINAL PENTAFLUOROSULPHANYL-CONTAINING FLUORINATED COPOLYMERS BASED ON VINYLIDENE FLUORIDE

Kostov G; Ameduri B; Sergeeva T; Dolbier W R; Winter R; Gard G L
Montpellier,Ecole Nationale Superieure de Chimie; Florida,University; Portland State University

The radical co- and terpolymerisation of fluorinated monomers bearing a pentafluorosulphanyl group with vinylidene fluoride (VDF) and hexafluoropropene (HFP) was studied. The pentafluorosulphanyl-bearing monomers did not homopolymerise under radical initiation but they did copolymerise and terpolymerise with VDF (and with VDF and HFP) in solution in the presence of radical initiators to form copolymers with pentafluorosulphanyl side groups. The degree of fluorine substitution on the ethylenic unit of the pentafluorosulphanyl monomers affected their reactivity, their relative incorporation in the copolymers and the molar masses of the resulting terpolymers. The higher the degree of fluorine substitution in the monomer, the higher the molecular weight and also, the greater the yield of the reaction. The yield also increased with increasing amount of initiator. The thermal stabilities and glass transition temperatures of the polymers were investigated. 50 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; USA; WESTERN EUROPE

Accession no.956210

Item 8
Journal of Functional Polymers
18, No.3, Sept.2005, p.430-3
Chinese

INFLUENCE OF SOLVENTS ON THE PVDF MEMBRANE PROPERTIES

Lu Yin; Zhang Lin; Ren Yuan-long; Wang Ji-zhong
Ningbo,University; Zhejiang,University

The action of solvent on a PVDF membrane prepared by the phase separation method was examined. The phase separation data were measured by the cloud point method for a 0.12 mole fraction solution of PVDF with solvents of DMSO, DMF, DMA, NMP and TMP, respectively. The advanced velocity of the phase separation front line when the casting solution was contacted with water was measured by the microscopic photo method. The pore size of membrane was measured by the bulb point method. The results showed that DMSO, TMP and DMA were good solvents for casting PVDF membrane by the phase separation method. 9 refs.

CHINA

Accession no.956354

Item 9
Journal of Polymer Science: Polymer Chemistry Edition
43, No.21, 1st Nov.2005, p.5312-22

SYNTHESIS OF FLUORINATED OLIGOMERS FOR SUPERCRITICAL CARBON DIOXIDE APPLICATIONS

Bilgin N; Baysal C; Menceloglu Y Z
Sabanci,University

The syntheses of various fluorine-based surfactants for supercritical carbon dioxide media-based applications were achieved by the radical polymerisation of mainly acrylate-based monomers. A difunctional fluorinated initiator was synthesised from 4,4’-azobis-4-cyanovaleric acid and a fluorinated alcohol. It was used for polymerisation reactions carried out to obtain triblock co-oligomers consisting of fluorinated side blocks and a hydrocarbon intermediate block. It was shown experimentally that solubility efficiency was affected by specific interactions between carbon dioxide and the oligomers, which were determined by the nature and the size of the inner block, and by the relative chain length of the fluorinated side blocks. 35 refs.

TURKEY

Accession no.956480

Item 10
Polymer International
54, No.12, Dec.2005, p.1581-8

METHACRYLOXYETHYL PHOSPHATE-GRAFTED EXPANDED POLYTETRAFLUOROETHYLENE MEMBRANES FOR BIOMEDICAL APPLICATIONS

Wentrup-Byrne E; Grondahl L; Suzuki S
Queensland,University of Technology;
Queensland,University

Methacryloxyethyl phosphate was graft polymerised onto expanded PTFE membranes using gamma-irradiation and the influence of dose rate, monomer concentration and solvent (methanol or MEK) thereon investigated. The resulting membranes were characterised by X-ray photoelectron spectroscopy, FTIR spectroscopy, scanning electron microscopy and weight gain measurements and overall graft yield, surface coverage, surface morphology and substrate swelling discussed. 30 refs.

AUSTRALIA

Accession no.955102

Item 11
Polymer International
54, No.12, Dec.2005, p.1620-5

SYNTHESIS, CHARACTERIZATION AND PROPERTIES EVALUATION OF COPOLYMERS OF 2,3,4,5,6-PENTAFLUOROSTYRENE AND N-PHENYLMALEIMIDE

Agarwal S; Becker M; Tewes F
Philipps-Universitat

Copolymers of 2,3,4,5,6-pentafluorostyrene and N-phenylmaleimide were synthesised by free-radical polymerisation using AIBN as polymerisation initiator under thermal heating and microwave heating conditions. Copolymerisation parameters were determined using the Fineman-Ross method and the copolymers were characterised by NMR spectroscopy, GPC, DSC, TGA and contact angle measurements. The copolymers were found to exhibit high hydrophobicities and high Tgs and heat stabilities dependent upon the content of N-phenylmaleimide in the copolymer. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.955107

Item 12
Reactive and Functional Polymers
65, No.1-2, 2005, p.127-34

THE PREPARATION AND THE APPLICATION OF GRAFTED POLYTETRAFLUOROETHYLENE FIBER AS A CATION EXCHANGER FOR ADSORPTION OF HEAVY METALS

Jun Fu Wei; Zhi Peng Wang; Jing Zhang; Yue Ying Wu; Zheng Pu Zhang; Chun Hua Xiong
Nankai,University; Tianjin,Polytechnic University; Hangzhou,Zhejiang Gongshang University

The preparation of a weakly acidic cation exchange fibre prepared by 60Co irradiation grafting of acrylic acid onto polytetrafluoroethylene (PTFE) fibres is described. The exchange capacity is 3.06 mmol/g. The acidity of the grafted fibre is stronger than the commercially available weakly acidic exchange resin, D-152. The grafted fibre shows excellent selectivity towards Cu(II), La(III) and Pb(II) in both static and dynamic adsorption when nine kinds of metal ion coexist in solution. The fibres can be regenerated using HCl. 20 refs.

CHINA

Accession no.953647

Item 13
Materials Science
41, No.1, Jan.-Feb.2005, p.131-4

ANTIFRICTION MATERIALS BASED ON POLYTETRAFLUOROETHYLENE FOR HINGED JOINTS OF PIPELINES

Kostornov A G; Molyar A G; Nenakhov A V; Nechiporenko O Yu
Ukraine,Antonov Aviation Scientific & Technical Complex

Hinges of pipelines used as air systems in aircraft were coated with PTFE filled with from 5 to 35 wt.% of molybdenum disulphide, colloidal graphite and GK-1 black lead. The frictional properties of the coatings against titanium alloys, titanium nitride and stainless steel were investigated and the effects of the fillers thereon examined. 6 refs.

RUSSIA

Accession no.954091

Item 14
Polymer Materials Science and Engineering
21, No.5, Sept.2005, p.14-8
Chinese

RESEARCH PROGRESS IN FLUORINE-CONTAINING ACRYLATE POLYMER

Li Jun; Chen Qing-min
Nanjing,University

The film-forming ability and loose network structure of fluorine-containing acrylate polymers are described, together with their characteristics of low surface energy, water and oil repellency, rust resistance, and high thermal and oxidation resistance. The research progress in fluorine-containing acrylate polymers and the structures underlying their water and oil repellency are discussed. The number of carbons in fluorine-containing acrylate polymers and its influence on the properties are also considered. Commonly-used methods of characterisation and applications are summarised. 27 refs.

CHINA

Accession no.954229

Item 15
Polymer Materials Science and Engineering
21, No.5, Sept.2005, p.63-6
Chinese

PREPARATION AND CHARACTERIZATION OF FLUOROALKYL METHACRYLATE COPOLYMER EMULSION

Lin Yi; Yu Zi-li; Xu Bin
Sichuan,University

A copolymer latex containing 1,1,5-trihydroperfluoropentyl methacrylate (OFPMA) was prepared by emulsion polymerisation of OFPMA with butyl acrylate and methyl methacrylate using a mixture of sodium dodecylsulphate and OP emulsifying agent as emulsifier. The copolymer was characterised by FTIR and PMR spectroscopies. The solvent resistance of latex films was investigated and the latex stability was observed. Surface properties of the copolymer film were investigated by contact angle measurement. The results showed that the surface free energy of copolymer film decreased significantly and could reach 25.12 mJ/sq m when the concentration of OFPMA used in copolymerisation was 20%. Through annealing treatment, the surface free energy of the copolymer film decreased to 23.52 mJ/sq m. 9 refs.

CHINA

Accession no.954242

Item 16
Journal of Membrane Science
262, No.1-2, 1st Oct.2005, p.81-90

SURFACE MODIFICATION OF MICROPOROUS PVDF MEMBRANES BT ATRP

Singh N; Husson S M; Zdyrko B; Luzinov I
Clemson,University

A method was developed for converting commercially-available, microporous membranes into ion-exchange membranes using primary anchoring polymer (mono)layers and graft polymerisation from the surfaces of the membranes. Atom transfer radical polymerisation (ATRP) was used to modify the membranes with pyridinium exchange groups. Polymerisation time was used as the independent variable to manipulate the amount of grafted poly(2-vinylpyridine) on the membrane surface. The results indicated that, by changing polymerisation time, it was possible to tune the ion-exchange capacity and the average pore size in rational ways. Furthermore, membranes with initially broad pore size distributions had narrower pore size distributions following polymerisation. A polymerisation time of 24h reduced the pore diameter polydispersity from 2.05 to 1.44. A polymerisation time of 8 h resulted in a static ion-exchange capacity of 0.0732 mmol/g(0.0732 meq/g) of dry membrane.

USA

Accession no.954333

Item 17
International Polymer Science and Technology
31, No. 6, 2004, p.T/21-4

ORGANIC LIGHT FILTERS BASED ON COPOLYMERS OF FLUOROALKYL METHACRYLATES CONTAINING COPPER AND COBALT SALTS

Koryagina E L; Arkhireev V P; Volkova T A
Kazan,State Technological University

Organic light filters are noted for a great variety of spectral characteristics owing to the possibility of introducing different light-transmitting additives into the polymer matrix. However, a serious obstacle to the effective use of such light filters is the inadequate resistance of their spectral characteristics under conditions of the action of different external factors. The development therefore, of polymeric light filters with stable optical properties is the focus of this article. New copolymers of fluoroalkyl methacrylates containing as light transmitting additives, copper and cobalt salts were investigated as possible use as light filters with stable spectral characteristics. This work includes a study of how the optical characteristics and also the photo and heat resistance of fluoroalkyl methacrylates with copper and cobalt salts are influenced by the chemical structure of the polymer matrix, the nature of the anion of the salt, and the concentration of the salt. 8 refs. (Article translated from Plasticheskie Massy, No. 8, 2003, pp. 41-3).

RUSSIA

Accession no.926615

Item 18
Journal of Applied Polymer Science
94, No.2, 15th Oct.2004, p.553-7

MELT PROCESSING OF COMPOSITES OF PVDF AND CARBON BLACK MODIFIED WITH CONDUCTING POLYMERS

Zucolotto V; Avlyanov J; Gregorio R; Mattoso L H C
Sao Paulo,University; EEONYX Co.

Details are given of the preparation of conductive composites from PVDF and an additive made via deposition of polyaniline or polypyrrole on carbon black particles. Electrical conductivity was determined. The composites were examined using TGA and X-ray diffraction. 18 refs.

BRAZIL

Accession no.926872

Item 19
Journal of Polymer Research
11, No.3, 2004, p.217-24

NAFION/PTFE COMPOSITE MEMBRANES FOR FUEL CELL APPLICATIONS

Yu T L; Lin H-L; Shen K-S; Huang L-N; Chang Y-C;
Jung G-B; Huang J C
Yuan Ze,University

The preparation of composite membranes by impregnation of porous poly(tetrafluoroethylene) membranes with Nafion (perfluorosulphonate ionomer) solution, and their characterisation by SEM, TGA, DSC, ionic conductivity, tensile testing and gas permeability, is described. The physical properties and fuel cell performance of the composite membranes were compared with those for Nafion membranes and the results are discussed. 21 refs.

TAIWAN

Accession no.927578

Item 20

Progress in Colloid and Polymer Science

126, 2004, p.64-7

WETTING OF A POLY(TETRAFLUOROETHYLENE) SURFACE BY AQUEOUS SOLUTIONS OF PERFLUOROPOLYETHER CARBOXYLIC SALTS OF DIFFERENT CHAIN LENGTH

Carignano G; Chittofrati A; Pieri R; Visca M
Solvay Solexis

The wetting of a poly(tetrafluoroethylene)(PTFE) surface by aqueous solutions of perfluoropolyether carboxylic acid salts of different chain lengths was investigated by surface tension and dynamic contact angle measurements. The effects of PTFE-solution contact time and relative rates of adsorption of the surfactants on contact angle measurements are discussed. 9 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.927600

Item 21

ACS Polymeric Materials: Science and Engineering. Fall Meeting. Volume 89. Proceedings of a Conference held New York, 7th-11th Sept.2003.
Washington, D.C., ACS,Div.of Polymeric Materials and Science and Engineering, 2003, p.568-9, CD-ROM, 012

DEGRADATION PROCESSES IN FLUORINATED POLYMERS FOR SPACE APPLICATIONS

Chipara M; Hui D; Chipara M D; Balascuta S
Indiana,University; New Orleans,University
(ACS,Div.of Polymeric Materials Science & Engng.)

The degradation of polytetrafluoroethylene, poly(vinylidene fluoride), and composites based on fluorinated polymers and carbon black in a simulated, low orbit space environment (exposure to ionising radiation and atomic oxygen) was investigated. Samples were irradiated in air at room temperature by protons accelerated up to 205 MeV, and by gamma irradiation, and studied by electron spin resonance. The samples were characterised by measurements of polymer DC conductivity and tensile properties. It was concluded that the competition between radiation-induced degradation and oxidation in fluorinated polymers eliminates their use in environments in which they are exposed to radiation in the presence of oxygen. 6 refs.

USA

Accession no.927683

Item 22

Polymer Journal (Japan)

36, No.9, 2004, p.716-27

CRYSTALLIZATION IN BINARY BLENDS OF POLYTETRAFLUOROETHYLENE WITH PERFLUORINATED TETRAFLUOROETHYLENE COPOLYMER

Endo M; Ohnishi A; Kutsumizu S; Shimizu T; Yano S
Gifu,University; Daikin Industries Ltd.

The miscibility and crystallisation behaviour of blends of PTFE and copolymers of tetrafluoroethylene with either hexafluoropropylene or perfluoropropylvinyl ether were investigated by DSC and X-ray diffraction. Crystallisation behaviour was examined in terms of molecular structure, molec.wt., crystallisation rate, method of blending and comonomer concentration. 26 refs.

JAPAN

Accession no.927812

Item 23

Macromolecules

37, No.20, 5th Oct.2004, p.7663-8

ANTIFOULING POLYMER MEMBRANES WITH SUBNANOMETER SIZE SELECTIVITY

Akthakul A; Salinaro R F; Mayes A M
MIT; Pall Corp.

Details are given of thin film composite PVDF membranes coated with amphiphilic vinylidene fluoride-oxyethylene methacrylate graft copolymers. TEM and thermal analysis revealed that these materials molecularly self-assemble into discontinuous nanophase domains of semicrystalline PVDF, providing structural integrity, and polyethylene oxide, providing selective transport channels of defined size. The molecular sieving capability was demonstrated through separation of like-charged organic dyes. 35 refs.

USA

Accession no.928635

Item 24

Macromolecules

37, No.20, 5th Oct.2004, p.7772-83

FIBRILLAR STRUCTURE OF NAFION. MATCHING FOURIER AND REAL SPACE STUDIES OF CORRESPONDING FILMS AND SOLUTIONS

Rubatat L; Gebel G; Diat O
CEA

Nafion structures were characterised over a large range of length scales using both scattering and microscopy techniques. An intrinsic fibrillar structure is suggested from an analysis of experimental data from dry membrane to aqueous dispersion. The fibrils correspond to elongated polymeric aggregates surrounded with the ionic charges. Aggregates were hydrated and dispersed in a colloidal suspension by using swelling and temperature treatment. 80 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.928648

Item 25
Macromolecules
37, No.20, 5th Oct.2004, p.7799-807
SYNTHESIS AND SOLUBILITY OF LINEAR POLYTETRAFLUOROETHYLENE-CO-VINYL ACETATE IN DENSE CARBON DIOXIDE. EXPERIMENTAL AND MOLECULAR MODELING RESULTS
Baradie B; Shoichet M S; Shen Z; McHugh M A; Hong L; Wang Y; Johnson J K; Beckman E J; Enick R M
Toronto,University; Virginia,Commonwealth University; Pittsburgh,University

Supercritical carbon dioxide was used as a reaction medium to synthesise random copolymers of tetrafluoroethylene and vinyl acetate. The molecular modelling results showed that the interaction of carbon dioxide with acetate side group was not affected by the presence of fluorine in the polymer backbone. The solubility of the semi fluorinated copolymers was attributed to the enhanced binding between carbon dioxide and the semi fluorinated backbone of the copolymer when the carbon dioxide molecule can access both the fluorinated and hydrogenated parts of the backbone simultaneously. 47 refs.

CANADA; USA

Accession no.928650

Item 26
Journal of Polymer Science: Polymer Chemistry Edition
42, No.20, 15th Oct.2004, p.5180-8
FREE-RADICAL POLYMERIZATION OF DIOXOLANE AND DIOXANE DERIVATIVES: EFFECT OF FLUORINE SUBSTITUENTS ON THE RING OPENING POLYMERIZATION
Weihong Liu; Mike F; Yinzhong Guo; Koike Y; Okamoto Y
New York,Polytechnic University; Yokohama,Keio University; ERATO

Five partially fluorinated and perfluorinated dioxolane and dioxane derivatives were synthesised to study the effects of fluorine substituents on the free-radical polymerisation mechanism. 2-Difluoromethylene-1,3-dioxolane, 2-difluoromethylene-4-methyl-1,3-dioxolane, perfluoro-2-methylene-4-methyl-1,3-dioxolane, 2-difluoromethylene-1,3-dioxane and perfluoro-3-methylene-1,3-dioxane were studied. The polymers were characterised by intrinsic viscosity, FTIR, proton and carbon-13 NMR, DSC and TGA. Ring opening to give polyesters and vinyl addition to give polyacetals were competing reactions during the polymerisation but the monomers showed a reduced tendency towards ring-opening compared with their non-fluorinated analogues, proceeding instead primarily by vinyl addition. The polymers were chemically and thermally stable and soluble in fluorinated solvents. 10 refs.

JAPAN; USA

Accession no.928811

Item 27
Composites Science and Technology
65, No.2, 2005, p.241-56
NONDESTRUCTIVE DAMAGE DETECTION AND INTERFACIAL EVALUATION OF SINGLE-FIBERS/EPOXY COMPOSITES USING PZT, PVDF AND P(VDF-TRFE) COPOLYMER SENSORS
Park J-M; Kong J-W; Kim D-S; Yoon D-J
Gyeongsang,National University; Korea,Institute of Machinery & Materials; Korea,Research Institute of Standards & Science

Piezoelectric poly(vinylidene fluoride) and poly(vinylidene fluoride-co-trifluoroethylene) copolymer films were compared with lead zirconate titanate as embedded or surface-mounted acoustic emission sensors in the non-destructive damage sensing and interfacial evaluation of single-glass or basalt fibre/epoxy composites. The sensitivity of the various materials towards fibre fracture, matrix crack and interfacial debonding signals are discussed. 22 refs.

SOUTH KOREA

Accession no.929367

Item 28
ACS Polymeric Materials: Science and Engineering. Fall Meeting. Volume 89. Proceedings of a conference held New York, 7th-11th Sept.2003.
Washington, D.C., ACS,Div.of Polymeric Materials and Science and Engineering, 2003, p.763-4, CD-ROM, 012
PLASTICIZATION, MELTING BEHAVIOUR AND POST-PLASTICIZATION MORPHOLOGY OF POLYVINYLIDENE FLUORIDE IN SUPERCRITICAL CARBON DIOXIDE
Shenoy S L; Fujiwara T; Wynne K
Virginia,Commonwealth University
(ACS,Div.of Polymeric Materials Science & Engng.)

The plasticisation and melting behaviour of PVDF in supercritical carbon dioxide is reported. Post-plasticised thermal properties and morphology of PVDF is also discussed. Characterisation was undertaken using DSC and atomic force microscopy. 11 refs.

USA

Accession no.929521

Item 29

Journal of Applied Polymer Science

94, No.4, 15th Nov.2004, p.1466-72

PREPARATION OF FLUOROACRYLATE NANOCOPOLYMER BY MINIEMULSION POLYMERIZATION USED IN TEXTILE FINISHING

Huang P-Y; Chao Y-C; Liao Y-T

Taipei,National University of Technology

Latex based on fluoroacrylate and other comonomers was prepared via miniemulsion polymerisation in the presence of stearyl trimethylammonium chloride and azobisamidinopropane dihydrochloride. Light transmittance properties were investigated. The water repellency of the copolymer was tested on polyester fabrics. 22 refs.

CHINA

Accession no.929563

Item 30

Macromolecules

37, No.17, 24th Aug.2004, p.6606-18

TEMPERATURE DEPENDENCE OF THE FREE VOLUME IN FLUOROELASTOMERS FROM POSITRON LIFETIME AND PVT EXPERIMENTS

Dlubek G; Sen Gupta A; Pionteck J; Krause-Rehberg R; Kaspar H; Lochhaas K H

ITA Institut fuer Innovative Technologien GmbH; Halle,Martin-Luther-Universitat; Dresden,Institute of Polymer Research; Dyneon GmbH & Co.KG; Santiniketan,Central University

The microstructure of the free volume in fluoroelastomers, together with its temperature dependence, was studied by means of pressure-temperature-volume (PVT) experiments and by positron annihilation lifetime spectroscopy (PALS). The fluoroelastomers investigated were a tetrafluoroethylene-perfluoro(methyl vinyl ether) copolymer and a vinylidene fluoride-hexafluoropropylene copolymer. The mean size and size distribution of free volume holes were calculated from the distribution of the ortho-positronium annihilation rate. These distributions were correlated with theoretical models describing the thermal volume fluctuation. The hole number density was estimated by comparing specific total and free volumes with the mean hole volume. Indications were found that ortho-positroniums may prefer larger holes with a weight approximately proportional to the hole volume. Apparent discrepancies between Simha-Somcynsky equation of state modelling and the PALS results were discussed. The estimated fluctuation volume decreased above the glass transition temperature with increasing temperature. The Interpretation of the PALS results was discussed. 61 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; INDIA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.929805

Item 31

Polymer International

54, No.1, Jan.2005, p.226-32

CRYSTAL TRANSFORMATION AND THERMOMECHANICAL PROPERTIES OF POLYVINYLIDENE FLUORIDE/CLAY NANOCOMPOSITES

Pramoda K P; Mohamed A; Phang I Y; Liu T

Singapore,Institute of Materials Research & Engineering

The crystal transformation and thermomechanical properties of melt-intercalated PVDF/clay nanocomposites are reported. TGA and DSC were used to study the thermal properties of the nanocomposites with various clay concentrations. Results were compared with data from FTIR and X-ray diffraction. 30 refs.

SINGAPORE

Accession no.931725

Item 32

Advanced Composites Letters

13, No.3, 2004, p.145-50

PEI/PTFE NANOCOMPOSITES AS A MATRIX FOR GLASS FIBRE-REINFORCED COMPOSITES

Grozdanov A; Errico M E; Avella M; Bogoeva-Gaceva G

Skopje,St.Cyril & Methodius University; Napoli,Istituto di Chimica e Tecnologica dei Polimeri

The preparation of nanocomposites of poly(etherimide) with nanoparticles of poly(tetrafluoroethylene) by solution blending, and their use as a matrix for glass fibre-reinforced composites is described. The composites were characterised by DSC, TGA, flexural testing, DMTA and SEM, and the results are discussed in terms of improved thermal stability and thermal resistance. 9 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; MACEDONIA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.932822

Item 33

Macromolecules

38. No.2, 25th Jan.2005, p.355-63

POLYMERIZATION OF VINYLIDENE FLUORIDE IN SUPERCRITICAL CARBON DIOXIDE. EFFECTS OF POLYDIMETHYLSILOXANE MACROMONOMER ON MOLECULAR WEIGHT AND MORPHOLOGY OF POLYVINYLIDENE FLUORIDE

Tai H; Wang W; Martin R; Liu J; Lester E; Licence P; Woods H M; Howdle S M

Nottingham,University; Solvay Research & Technology

The batch homopolymerisation of vinylidene fluoride in supercritical carbon dioxide was studied using diethyl peroxydicarbonate as a free radical initiator. Experiments were carried out to investigate the effects of monomer concentration, initiator concentration, and agitation. The use of PDMS as initiator and its influence on morphology and molecular weight of PVDF are discussed. Polymer morphology and particle size distribution wee examined using SEM. Data for DSC, TGA and NMR are also presented. 46 refs.

BELGIUM; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.932964

Item 34

Macromolecular Materials and Engineering

289, No.12, 15th Dec.2004, p.1053-8

MISCIBILITY AND CRYSTALLIZATION BEHAVIOURS OF POLYAMIDE 6/ POLYTETRAFLUOROETHYLENE BLENDS

Song R; Zhao J; Stamm M

Chinese Academy of Sciences; Dresden,Institute of Polymer Research

Details are given of the preparation of nylon-6/PTFE blends via reactive extrusion. Their miscibility and crystallisation were investigated by X-ray diffraction, DSC, and dynamic mechanical thermal analysis. 26 refs.

CHINA; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.933062

Item 35

Macromolecules

37, No.21, 19th Oct.2004, p.8128-34

MOLECULAR MOTION OF PEROXY RADICALS AT ENDS OF ISOLATED AND NONISOLATED POLYETHYLENE CHAINS TETHERED ON POWDER SURFACE OF POLY(TETRAFLUOROE THYLENE) IN A VACUUM

Sakaguchi M; Yamamoto K; Miwa Y; Hara S; Sugino Y; Okamoto S; Sakai M; Shimada S

Nagoya,University; Nagoya,Institute of Technology; Japan,Institute for Molecular Science

The molecular motion of peroxy radicals at the ends of isolated PE chains (IPE) and non-isolated PE chains (NIPE) tethered on the powder surface of PTFE was studied in a vacuum between 3.4 and 223K by ESR and the results were fitted using a spectral simulation. The IPE and NIPE chains were produced by radical polymerisation of ethylene initiated by PTFE radicals located on the surface. The isotropic and anisotropic tumbling motions of the ends of IPE chains on the PTFE surface were observed and their activation energies were estimated. At 223K, the anisotropic tumbling motion mode of all the ends of IPE chains on the PTFE surface converted into a free rotational motion mode in which the ends protruded from the PTFE surface. The ends of the IPE chains did not interact with neighbouring inter- and intrachains of IPE. However, the isotropic and anisotropic tumbling motions of the ends of NIPE chains on the PTFE surface were slower than those of IPE chains. The slow and anisotropic rates of the ends of the NIPE chains on the PTFE surface were due to interactions with both neighbouring intra- and interchains of NIPE. 32 refs.

JAPAN

Accession no.933107

Item 36

Journal of Polymer Science: Polymer Chemistry Edition

42, No.21, 1st Nov.2004, p.5354-71

FLUOROPOLYETHERS END-CAPPED BY POLAR FUNCTIONAL GROUPS. IV. A NOVEL APPROACH TO THE EVALUATION OF REACTIVITIES OF HYDROXY-TERMINATED ETHOXYLATED FLUOROPOLYETHERS IN THE TIN(IV)-CATALYZED REACTIONS WITH ISOPHORONE DIISOCYANATE

Khomko E; Mashlyakovskiy L; Tonelli C

St.Petersburg,State Technical Institute; Solvay Solexis

Urethane end group formation kinetics have been studied under a range of conditions. The aim of the study was to examine the effect of catalyst (dibutyltin dilaurate - DBTDL) concentration and reagent concentration on a series of gamma,omega-bis(hydroxy)-terminated fluoropolyethers. These were reacted with isophorone diisocyanate (IPDI) in hexafluoroxylene or tetrahydrofuran. A range of reaction conditions was established under which the reaction rate was found to be proportional to the square root of catalyst concentration. Rate coefficients were determined and it was found that reaction rate increased with molecular weight of the diol. 24 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; RUSSIA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.933200

Item 37

E-Polymers

No.2, 2005, p.1-12

POLING OF BETA-POLY(VINYLIDENE FLUORIDE): DIELECTRIC AND IR SPECTROSCOPY STUDIES

Sencadas V; Costa C M; Moreira V; Monteiro J; Mendiratta S K; Mano J F; Lanceros-Mendez S

Minho,Universidade; Aveiro,Universidade

The effects of poling on the electrical and thermomechanical properties of films of beta-poly(vinylidene fluoride) were investigated by dielectric spectroscopy and FTIR. The results are discussed in terms of the piezoelectric properties of the polymer and reorientation of the crystalline dipoles along the poling field together with optimisation of the alpha to beta transformation. 20 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.933823

Item 38
Journal of Polymer Science: Polymer Chemistry Edition
43, No.3, 1st Feb.2005, p.552-61
CHEMICAL ALTERATION OF POLY(TETRAFLUOROETHYLENE) TEFLON INDUCED BY EXPOSURE TO VACUUM ULTRAVIOLET RADIATION AND COMPARISON WITH EXPOSURE TO HYPERTHERMAL ATOMIC OXYGEN
Everett M L; Hoflund G B
Florida,University

Reduction of the fluorene to carbon ratio of polytetrafluoroethylene from 1.98 to 1.65 after two hours, and 1.6 after 74 hours, exposure to ultraviolet radiation under vacuum was observed by analysis with X-ray photoelectron spectroscopy (XPS). New chemical states of carbon were formed as fluorene was removed, and relative amounts of these depended on the fluorene content near the polymer surface. Exposure of the modified material to oxygen revealed very little oxygen chemiadsorption, indicating a fully saturated structure. By comparison, exposure to hypothermal atomic oxygen gave a structure that adsorbed higher amounts of oxygen and had very different XPS spectra. 45 refs.

USA

Accession no.934073

Item 39
Journal of Materials Science
40, No.4, 15th Feb.2005, p.955-64
MELT-STATE SHEAR FLOW AND ELASTICITY OF A THERMOPLASTIC FLUOROSULPHONATED-PTFE COPOLYMER
Haworth B; Gilbert M; Myers D J B
Loughborough,University

An investigation was carried out into the rheological properties of a perfluorosulphonated PTFE copolymer, a precursor of Nafion. Model coefficients for shear viscosity were determined as a function of apparent shear rate and temperature and die swell and melt fracture measurements were performed to evaluate the elastic properties of the thermoplastic precursor. The melt-state flow properties of the precursor and the effect of process conditions thereon were also examined and discussed in relation to changes in crystal structure at elevated temperatures. 23 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.934280

Item 40
Journal of Materials Science
40, No.4, 15th Feb.2005, p.1035-6
HARD ELASTICITY OF POLY(VINYLIDENE FLUORIDE) FIBERS
Du C; Zhu B; Xu Y
Zhejiang,University

Polyvinylidene fluoride fibres were prepared by melt spinning at 260C followed by annealing and characterised by wide angle and small-angle X-ray scattering. The mechanical properties of the fibres were determined by tensile testing and elastic recovery determined along the stretched direction of the fibres under 5 cycles of loading and unloading at a deformation rate of 3 mm/min at 20C. The fibres were considered to have the characteristics of hard elasticity, which was related to stacked lamellar structures. 12 refs.

CHINA

Accession no.934283

Item 41
Materials and Manufacturing Processes
20, No.1, 2005, p.23-34
INVESTIGATION OF THE ELECTROCHEMICAL CORROSION RESISTANCE OF HYBRID NI-SIC-FLUOROPOLYMER COMPOSITE COATINGS
Szeptycka B; Gajewska A
Warsaw,Institute of Precision Mechanics

Nickel-PTFE coatings and hybrid composite coatings prepared from nickel, silicon carbide and PTFE were produced by electrodeposition and characterised by scanning electron microscopy, energy-dispersive X-ray analysis and cyclic voltammetry. The effects of the dispersed ceramic and polymer particles on the electrochemical corrosion resistance of the coatings were examined and the relationship between the composition and structure of the coatings and their resistance to corrosion assessed and compared. 19 refs.

EASTERN EUROPE; POLAND

Accession no.934331

Item 42
Macromolecular Rapid Communications
26, No.2, 21st Jan.2005, p.75-81
NOVEL PARTIALLY FLUORINATED COPOLYMERS: EVIDENCE OF THE EFFECT OF FLUORINE ON THE REACTIVITY OF THE UNFLUORINATED COMONOMER UNITS
Lazzari M; Scalarone D; Castelvetro V; Signori F; Chiantore O
Torino,Universita; Pisa,University

A series of copolymers with various fluorine contents and distributions was synthesised by the free-radical copolymerisation of vinyl or propenyl ethers with acrylic or methacrylic monomers substituted with fluorine in the main chain or in the ester groups. The copolymers were irradiated with artificial solar light and the effect of the fluorinated moieties on the overall stability and reactivity of the copolymers with atmospheric oxygen investigated. 10 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.934451

Item 43
International Journal of Polymer Analysis and Characterization
9, No.1-3, Jan.-June 2004, p.29-37
SEPARATION AND SIMULTANEOUS MOLECULAR WEIGHT DETERMINATION OF PVDF IN PVDF/PMMA BLENDS BASED ON ADSORPTION/SIZE EXCLUSION
Moyses S; Polinski F
Atofina Chemicals Inc.

The determination of the molecular weight distribution of poly(vinylidene fluoride)(PVDF) in a blend of PVDF with poly(methyl methacrylate)(PMMA) by GPC using analysis conditions under which the PMMA component does not elute from the chromatography column is described. Application of the method to the characterisation of PVDF paints is discussed. 3 refs.

USA

Accession no.935039

Item 44
Macromolecular Materials and Engineering
290, No.1, 14th Jan.2005, p.66-71
SYNTHESIS OF BLOCK COPOLYMERS CONTAINING CHAIN-CONTROLLED ARAMID AND FLUOROETHYLENE SEGMENTS
Korematsu A; Furuzono T; Kishida A
Japan,National Cardiovascular Center Research Institute

The synthesis of novel fluoroethylene-aramid block copolymers from NH2-terminated aramid oligomers and either tetrafluorosuccinic acid or difluorosuccinic acid by a two-stage solution polycondensation procedure is described and their characterisation by IR spectroscopy, NMR spectroscopy and gel permeation chromatography is reported. The molecular structure and number-average molec.wt. of the copolymers are discussed and the effect of the fluoroethylene segments on the solubility of the copolymers is examined. 19 refs.

JAPAN

Accession no.935301

Item 45
Polymer Bulletin
53, No.3, 2005, p.181-92
NOVEL NAFION/HYDROXYAPATITE COMPOSITE MEMBRANE WITH HIGH CRYSTALLINITY AND LOW METHANOL CROSSOVER FOR DMFCS
Park Y; Yamazaki Y
Tokyo,Institute of Technology

A highly crystalline Nafion/hydroxyapatite (HA) composite membrane was produced to suppress methanol crossover in direct methanol fuel-cell (DMFC) applications. The diffusivity of water and methanol in the membrane were evaluated by a water-methanol sorption/desorption test and by methanol permeation experiments. The water-methanol diffusivity and methanol crossover for the composite membranes decreased with increasing proportions of HA. The structural variation was investigated by wide-angle x-ray scattering techniques. The crystallinity of the composite membranes increases with increasing proportion of HA, whereas the water uptake decreases gradually. A diffusion-cell study showed that the permeability to methanol was reduced in the composite membranes, suggesting that a high crystallinity and a low water uptake in the composite membrane result in a suppression of methanol crossover as a result of the incorporation of HA into the Nafion structure. 48 refs.

JAPAN

Accession no.936889

Item 46
ANTEC 2004. Proceedings of the 62nd SPE Annual conference held Chicago, Il., 16th-20th May 2004.
Brookfield, Ct., SPE, 2004, p.355-9, CD-ROM, 012
CHEMICAL COUPLING OF RUBBER POLYMERS WITH MODIFIED PTFE MICRO POWDER DURING THE RUBBER MIXING
Haberstroh E; Linhart C; Lehmann D; Klupfel B; Hufenbach W; Kunze K
Aachen,Institut fur Kunststoffverarbeitung; Dresden,Institute of Polymer Research; Dresden,Institute of Lightweight Structures and Polymer Technology
(SPE)

A special mixing procedure has been developed for chemical coupling of PTFE micro particles with the polymeric matrix in rubber compounds. Beforehand the non-reactive PTFE is modified to enable the chemically coupling. It is supposed that parts with chemically bonded PTFE particles will show higher abrasion resistance and a better friction behaviour compared to those with physically bonded particles. Thus the production of novel wear resistant elastomers should be possible. 5 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.937090

Item 47
ANTEC 2004. Proceedings of the 62nd SPE Annual conference held Chicago, Il., 16th-20th May 2004.
Brookfield, Ct., SPE, 2004, p.434-7, CD-ROM, 012
STUDY OF PROCESSING BEHAVIOR OF EXTRUDATE PTFE PASTE
Shia Chung Chen; Lei-Ti Huang; Ping-Shun Hsu
Chung Yuan University
(SPE)

Polytetrafluoroethylene (PTFE) is a remarkable material having high melting temperature, high chemical resistance, low frictional and dielectric coefficients, etc. Due to its high melting point, PTFE cannot be processed using the conventional methods such as the injection moulding, extrusion and blow moulding, etc. In this research, PTFE is processed by a number of techniques including paste extrusion, rolling and calendering. It is necessary to preform the PTFE powder-lubricant mixture before extrusion to ensure paste densification. The processing behaviour of extruded PTFE pastes was first studied. The length of extension zone was changed to investigate the variation of extrusion pressure profile. Two-coloured preform paste packed sequentially was used to observe the flow behaviour in extrusion process. It was found that the extrusion pressure increases in the reduction zone and decreases after the paste passed the extension zone. Increasing the packing time in the performing will result in a more steady extrusion pressure. Higher extension length would raise the required pressure for paste extrusion. Furthermore, it was also found that an increase in the lubricant content increases the extent of density uniformity. The paste flow exhibits laminar behaviour of viscous fluid. However, highly non-Newtonian characteristics and slip boundary also occur. 13 refs.

TAIWAN

Accession no.937105

Item 48
Macromolecules
38, No.5, 8th March 2005, p.1542-5

DISPERSION POLYMERIZATION OF VINYLIDENE FLUORIDE IN SUPERCRITICAL CARBON DIOXIDE USING A FLUORINATED GRAFT MALEIC ANHYDRIDE COPOLYMER STABILIZER

Hongyun Tai; Wenxin Wang; Howdle S M
Nottingham,University

Synthesis of an efficient fluorinated polymeric stabiliser for use in the dispersion polymerisation of vinylidene fluoride (VDF) is described, The stabiliser, fluorinated graft poly(methyl vinyl ether-alt-maleic anhydride), was characterised by Fourier transform infrared and nuclear magnetic resonance spectroscopies and gel permeation chromatography, and the effects of the stabiliser on the dispersion polymerisation of VDF in supercritical carbon dioxide, compared to using polydimethylsiloxane or no stabilisers, were examined using scanning electron microscopy. A much finer particle size resulted from use of the new stabiliser. 30 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.937131

Item 49
Macromolecules
38, No.5, 8th March 2005, p.1789-96

PROBING PHASE STRUCTURE AND LOCATION OF REVERSE UNITS IN POLY(VINYLIDENE FLUORIDE) BY SOLID STATE NMR

Hucher C; Beaume F; Eustache R P; Tekely P
ARKEMA; CNRS

Nuclear magnetic resonance spectroscopy studies, particularly fluorine 19 atom excitation from different phases, was used to examine the phase structure of polyvinylidene fluoride. Spatial location of reverse units in amorphous, intermediate and crystalline phases, along with their motional heterogeneity, was observed and quantified. 24 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.937163

Item 50
European Polymer Journal
41, No.5, May 2005 p.1002-12

MICROPATTERNING OF SEMICRYSTALLINE POLY(VINYLIDENE FLUORIDE) (PVDF) SOLUTIONS

Youn Jung Park; Yong Soo Kang; Cheolmin Park
Yonsei,University; Korea,Institute of Science & Technology

Solubility of polyvinylidene fluoride (PVDF) in various polar and non-polar solvents, and the crystal structure of films cast from these solvents were evaluated using X-ray diffraction, polarised optical microscopy, scanning electron microscopy and Fourier transform infrared spectroscopy. Films cast from polar solvents showing gamma-type crystals, from tetrahydrofuran alpha-type crystals, and from methyl ethyl ketone both alpha and gamma-type crystal structure was observed. Micropatterning of PVDF solutions was carried out by a temperature controlled capillary micromoulding method where solvent evaporation rate, which controlled the quality of micropatterning, was controlled by temperature. Dimethyl formamide proved the best solvent for uniformity in shape of the micropatterns, and orientation of crystals depended on whether nucleation was in the centre or from the corners, the latter being dominant. A bamboo structure was observed with the b-axis of the crystals normal to the microchannels. 48 refs.

KOREA

Accession no.937203

Item 51
ANTEC 2004. Proceedings of the 62nd SPE Annual conference held Chicago, Il., 16th-20th May, 2004. Brookfield, Ct., SPE, 2004, p.2158-62, CD-ROM, 012

MORPHOLOGY EVOLUTION IN PTFE AS A FUNCTION OF DEFORMATION AND MELT TIME AND TEMPERATURE: NANO-FIBRILS AND SINGLE- AND MULTI-MOLECULE FOLDED CHAIN SINGLE CRYSTALS

Geil P H; Yang J; Williams R A; Petersen K L; Long T C; Xu P
Illinois,University; Gore W.L.,& Associates Inc.
(SPE)

Evolution of the morphology of dispersed PTFE dispersion particles on glass and mica as a function of melt time and temperature indicates that individual molecules ‘wander’ on the substrate, crystallising (from a chain-folded ‘mesomorphic’ state, it is suggested) in single and multi-molecule chain-folded single crystals when cooled. Shearing of the particles results in nano-fibril production; annealing results in shish-kebab formation through single molecule addition. Nascent dispersion particle structure is also considered. 4 refs.

USA

Accession no.937549

Item 52
Macromolecules
38, No.6, 22nd March 2005, p.2289-95
INFLUENCE OF MORPHOLOGY ON THE TRANSPORT PROPERTIES OF PERFLUOROSULFONATE IONOMERS/ POLYPYRROLE COMPOSITE MEMBRANES
Park H; Kim Y; Hong W H; Choi Y S; Lee H K
Korea,Advanced Institute of Science & Technology; Korea,Institute of Industrial Technology; Samsung Advanced Institute of Technology

Nanosized polypyrrole particles were incorporated into the ionic clusters of Nafion PTFE in chemical in situ polymerisation by means of ion-dipole interaction between the sulphonate groups of Nafion and secondary ammonium groups of polypyrrole. Changes in the morphology of the Nafion matrix were observed using DSC, SEM, small-angle X-ray scattering and wide-angle X-ray diffraction. The influence of changes in morphology on the transport properties of methanol is discussed. 26 refs.

KOREA

Accession no.938384

Item 53
Macromolecules
38, No.6, 22nd March 2005, p.2383-90
STRUCTURAL SURPRISES IN FRICTION-DEPOSITED FILMS OF POLYTETRAFLUOROETHYLENE
Breiby D W; Solling T I; Bunk O; Nyberg R B; Norrman K; Nielson M M
Riso National Laboratory

Thin films of PTFE produced by friction deposition were studied using grazing incidence X-ray diffraction. The structure of the thin films was compared with that of the surface of the PTFE bar used for depositing the films. The possibility of a continuous transition between the low-order single-stem hexagonal and the multistem high-order unit cell is discussed. A modification of the mechanism for the transfer of material from the bar to the substrate is proposed. 33 refs.

DENMARK; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; SCANDINAVIA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.938396

Item 54
Polymer
46, No.9, 2005, p.3056-68
ROLE OF CRYSTALLINE PHASE ON FRACTURE AND MICROSTRUCTURE EVOLUTION OF POLYTETRAFLUOROETHYLENE
Brown E N; Dattelbaum D M
Los Alamos National Laboratory

Details are given of values for the J-integral fracture toughness of PTFE for a range of temperatures and loading rates using the single specimen normalisation technique. Increases in fracture toughness were shown to result from the onset of stable fibril formation bridging the crack plane and increased plastic deformation. Fracture plane morphologies were examined using SEM. 48 refs.

USA

Accession no.938540

Item 55
Plasma Processes and Polymers
2, No.2, Feb.2005, p.127-35
DEPOSITION OF WELL-DEFINED FLUOROPOLYMER NANOSPHERES ON PET SUBSTRATE BY PLASMA POLYMERIZATION OF HEPTADECAFLUORODECYL ACRYLATE AND THEIR POTENTIAL APPLICATION AS A PROTECTIVE LAYER
Feng J C; Huang W; Fu G D; Kang E-T; Neoh K-G
Fudan,University; Singapore,National University

Fluoropolymer films consisting of well-defined nanospheres were formed on the surface of flexible PETP substrates intended for optoelectronic applications by the pulsed plasma polymerisation of 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl acrylate on the PETP substrate. Reactive species and unreacted monomer were removed between successive plasma bursts by cleaning to produce uniform and well-structured nanospheres. The chemical composition of the nanostructured fluoropolymer films was characterised by X-ray photoelectron spectroscopy and film morphology was investigated by field emission scanning electron microscopy and atomic force microscopy. The influence of the fluoropolymer films on the water permeability and optical properties of the PETP substrate before and after exposure to water at 60C for various periods of time was also investigated and the fracture resistance of the plasma polymerised fluoropolymer films determined by peel testing. 50 refs.

CHINA; SINGAPORE

Accession no.938594

Item 56
Journal of Macromolecular Science B
B44, No.2, March-April 2005, p.225-35
CHARACTERISTICS OF IONIC POLYMER-METAL COMPOSITES PREPARED WITH

FLUORINATED ACRYLIC COPOLYMER CONTAINING SULFONATE ANION

Jeong H M; Kim H S; Lee S; Jung S H; Mun M S
Ulsan,University; Korea,Orthopedics & Rehabilitation Engineering Center

As part of a study aimed at developing a new polymer for the preparation of a melt-processable ionic polymer-metal composite(IPMC) that can be used in actuators, the acrylic copolymer of fluoroalkyl methacrylate and 2-acrylamido-2-methyl-1-propanesulphonic acid(SA) was studied. The performance of this copolymer as an electroactive IPMC was observed. The effects of the SA monomeric unit content in the copolymer, the membrane thickness and the type of cation on the actuations, current and displacement resulting from application of voltage between platinum electrodes through the membrane were examined. 12 refs.

KOREA

Accession no.938903

Item 57
Polymer Materials Science and Engineering
21, No.1, Jan.2005, p.145-8
Chinese

STUDY OF MODIFIED POLYACRYLAMIDE WITH THE FLUORINE-CONTAINING ACRYLATE ESTER

Wang Y-F; Kong Y; Yang J-R; Xin W
Dongying,University of Petroleum

A fluorine-containing acrylate was copolymerised with acrylamide and the solution properties of the resulting copolymers investigated. The effects of fluoroacrylate content, temperature, sodium chloride concentration and copolymer concentration in aqueous solution on the apparent viscosity of the copolymer solutions was investigated and the heat resistance and salt tolerance of the copolymer solutions compared with those of polyacrylamide solutions. 7 refs.

CHINA

Accession no.939433

Item 58
Journal of Sol-Gel Science and Technology
32, No.1-3, Oct.-Dec.2004, p.69-72

FLUORINATED COPOLYMER-OXIDE HYBRIDS

Bescher E P; Noori A; MacKenzie J D
California,University at Los Angeles

The preparation of an organic-inorganic, fluorinated copolymer-metal oxide hybrid by refluxing a high hydroxyl content fluoropolymer (fluoroethylene-alkyl vinyl ether alternating copolymer) with tetraethoxysilane is described. The microstructure, density, hydrophobic nature, heat stability and mechanical properties of the hybrid composites are reported and the preparation of composites from neodymium methoxyethoxide instead of tetraethoxysilane is demonstrated. The composites are transparent over the entire composition range when processed with HCL as catalyst and exhibit continuous variations in hardness, hydrophobicity and abrasion resistance. 5 refs.

USA

Accession no.939540

Item 59
Macromolecular Symposia
No.222, 2005, p.81-6

MULTISCALE POROSITY FROM THERMOREVERSIBLE POLY(VINYLIDENE FLUORIDE) GELS IN DIETHYL AZELATE

Dasgupta D; Nandi A K
Indian Association for the Cultivation of Science

The preparation of thermoreversible gels of poly(vinylidene fluoride) in diethyl azelate at different concentrations by polymer-solvent complexation is described. The porosity of dried gels, obtained by extraction of the diester with low-boiling solvent, was investigated using mercury intrusion porosimetry and nitrogen absorption isotherms, and the effect of polymer concentration on pore size distribution is discussed. 6 refs.

INDIA

Accession no.940395

Item 60
Macromolecular Symposia
No.222, 2005, p.265-71

CHARACTERIZATION OF INTERDIFFUSION BETWEEN PVDF AND STEREOREGULAR PMMA BY USING ATR-FTIR SPECTROSCOPY

Lorec G; Baley C; Sire O; Grohens Y
Lorient,Universite de Bretagne

The molecular interdiffusion across an interface between poly(vinylidene fluoride)(PVDF) and poly(methyl methacrylate)(PMMA) samples of different tacticity below the melting-point of PVDF was investigated using ATR-FTIR. The effects of PMMA stereoregularity on the kinetics of diffusion are discussed in terms of differences in chain stiffness. 25 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.940421

Item 61
Journal of Thermal Analysis and Calorimetry
79, No.3, 2005, p.615-22

ANALYSIS OF REVERSIBLE MELTING IN POLYTETRAFLUOROETHYLENE

Androsch R; Wunderlich B; Radusch H-J
Halle,Martin-Luther-Universitat; Tennessee,University at Knoxville

The reversibility of crystallisation and melting of poly(tetrafluoroethylene) in as-polymerised and melt-crystallised forms was investigated as a function of crystallisation conditions and temperature by temperature-modulated DSC. The effects of thermal history and polymer chain conformation on the degree of crystallinity and melting temperature are discussed in comparison with similar studies on polyethylene of different crystal morphology. 61 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.940428

Item 62
Macromolecules
38, No.8, 19th April 2005, p.3263-70

THERMORESPONSIVE BEHAVIOR OF SEMIFLUORINATED POLYMER BRUSHES

Granville A M; Boyes S G; Akgun B; Foster M D; Brittain W J
Akron,University; Southern Mississippi,University

Polymer brushes consisting of a hydrocarbon inner block (poly(methyl acrylate or polystyrene) and a fluoropolymer outer block (polypentafluorostyrene, poly(heptadecafluorodecyl acrylate), poly(pentafluoropropyl acrylate) or poly(trifluoroethyl acrylate)) were treated with a block-selective solvent for the hydrocarbon block and the surfaces then heated to promote fluoropolymer migration to the surface. Surface changes were studied by contact angle measurements and atomic force microscopy. The optimum temperatures and times were dependent upon the glass transition temperature. 23 refs.

USA

Accession no.940489

Item 63
Macromolecules
38, No.7, 5th April 2005, p.3029-32

NOVEL FLUOROALKENE-METHYL ACRYLATE COPOLYMERS BY ATOM TRANSFER RADICAL POLYMERISATION

Borkar S; Sen A
Pennsylvania,State University

Preparation of a random copolymer of methyl acrylate and fluorinated alkenes, using atom transfer radical polymerisation initiated by ethyl bromopropionate, is described. A block copolymer consisting of copolymers of methyl acrylate with ethylene and methyl acrylate with nonafluorohexene was also synthesised. Characterisation was carried out using size exclusion chromatography, nuclear magnetic resonance and X-ray photoelectron spectroscopies, and contact angle measurements on thin, spun cast, films. It was observed that polymerisation rates were higher than with simple alkenes and segregation of fluorinated side chains to the air side in thin films appeared to occur, giving a low surface energy hydrophobic surface. 8 refs.

USA

Accession no.940671

Item 64
Macromolecular Rapid Communications
26, No.5, 4 Mar.2005, p.345-356

SELECTIVE NMR PULSE SEQUENCES FOR THE STUDY OF SOLID HYDROGEN-CONTAINING FLUOROPOLYMERS

Ando S; Harris R.K.; Hazendonk P; Wormald P
Tokyo Institute of Technology; Durham,University; Lethbridge,University; St.Andrews University

The use of fluorine-19 NMR spectroscopy for the analysis of solid hydrogen-containing fluoropolymers is discussed. The existence of proton and fluorine spin centres permits either proton or fluorine-19 relaxation to be selected for particular experiments. The various relaxation characteristics of heterogeneous systems are described briefly, including spin-lattice and spin-spin relaxation and cross-polarisation rate. The selective sequences for use in fluorinated heterogeneous organic solids are described and rationalised on the basis of molecular mobility. The pulse sequences can be used to differentiate between the crystalline and amorphous domains of semicrystalline polymers. The use of selective pulse sequences for analysing poly(vinylidene fluoride) (PVDF) and the PVDF-polytrifluoroethylene (3:1) copolymer is discussed. 64 refs.

CANADA; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.940928

Item 65
Journal of Membrane Science
250, No.1-2, 15th March 2005, p.29-37

CHEMICAL REACTIVITY ASSAY AND SURFACE CHARACTERIZATION OF A POLY(VINYLIDENE FLUORIDE) MICROFILTRATION MEMBRANE ("DURAPORE DVPP")

Momtaz M; Dewez J-L; Marchand-Brynaert J
Louvain,Universite Catholique; Baxter R&D Europe

The surface functionalisation of a commercially available poly(vinylidene fluoride) filtration membrane by covalent grafting of lysine using activating and coupling agents to activate surface hydroxyl groups is described. The modified membrane was characterised by SEM and XPS, and the chemical reactivity of the surface was investigated via radiolabelling.

BELGIUM; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.941314

Item 66
Polymer
46, No.10, 2005, p.3440-51

THERMAL CHEMICAL VAPOR DEPOSITION OF FLUOROCARBON POLYMER THIN FILMS IN A HOT FILAMENT REACTOR

Rastogi A C; Desu S B
Massachusetts,University

Fluorocarbon polymer films with a linear (CF2-CF2)n molecular structure were synthesised by hot filament chemical vapour deposition using hexafluoropropylene oxide precursor. Film growth was studied by infrared absorption and electron spectroscopy. It is proposed that the films grew by attachment of CF2 radicals to single bonded CF2 chains under high radical concentration with a molecular structure similar to that of polytetrafluoroethylene. The morphology and molecular structure were dependent upon substrate temperature. It was necessary to rapidly eliminate trifluoroacetyl fluoride, or to depress its composition reactions within the reactor, to minimise oxygen-related defects and to produce thermally stable PTFE-like fluorocarbon polymer films at a relatively low substrate temperatures. This could be achieved by reducing the filament temperature, but at the expense of reduced film growth rates. 53 refs.

USA

Accession no.941374

Item 67
International Journal of Polymeric Materials
54, No.7, July 2005, p.633-50
CRYSTAL STRUCTURE AND PHYSICAL PROPERTIES OF PVDF FILMS FILLED WITH COPPER CHLORIDE-MANGANESE CHLORIDE MIXED FILLERS
El-Khodary A; Abdelaziz M; Hassan G M
Mansoura,University; Egypt,National Institute for Standards

Details are given of the preparation of PVDF films filled with a mixture of copper chloride and manganese chloride. The existence of two main endothermic peaks and the crystallization exothermic temperature were determined. The presence of semicrystalline structures were examined using X-ray diffraction and verified with FTIR. Electrical resistivity results are discussed on the basis of Kuivalainen modified interpolator hopping model. The temperature and filling level dependence of the hopping distance were studied. 30 refs.

EGYPT

Accession no.941489

Item 68
China Plastics
19, No.2, Feb.2005, p.58-61
Chinese
STUDY ON PROCESSING AND PROPERTIES OF PTFE/GF WAVE-TRANSPARENT COMPOSITE
Hong-Qiang Fang; Guo-Zheng Liang; Wen-Sheng Zhou; Jie-Ying Yang; Jie-Liang Wang
Xian,Northwestern Polytechnical University

A study was made of the moulding of glass fibre cloth reinforced PTFE composites using DSC and the effects of sintering temperature, sintering time, cooling rate, processing pressure and glass cloth content on composite properties, such as tensile strength and dielectric constant, investigated. 7 refs.

CHINA

Accession no.941695

Item 69
Polymer Degradation and Stability
88, No.2, 2005, p.275-85
EXPERIMENTAL STUDY OF LOW EARTH ORBIT ATOMIC OXYGEN AND ULTRAVIOLET RADIATION EFFECTS ON A SPACECRAFT MATERIAL - POLYTETRAFLUOROETHYLENE
Xiao-Hu Zhao; Zhi-Gang Shen; Yu-Shan Xing; Shu-Lin Ma
Beijing,University of Aeronautics & Astronautics

The erosion effects of atomic oxygen on Teflon PTFE, a commonly-used spacecraft material, were studied in a ground-based simulation facility. The samples, before and after the experiments, were compared in appearance, mass, surface morphology, optical properties and surface composition. The effects of temperature, UV radiation and vacuum UV radiation on the atomic oxygen effects were also studied. It was found that PTFE was eroded severely in the ground-based facility, where the erosion yield was higher than that in the flight experiments and identical to those from other ground-based facilities. The erosion yield increased with sample temperature. UV radiation had little effect on the mass loss and erosion yield of the Teflon sample in the atomic oxygen experiment. There could be some synergistic effects of atomic oxygen and vacuum UV radiation, which could be one of the main factors that caused the more severe erosion of Teflon. 21 refs.

CHINA

Accession no.941949

Item 70
Journal of Materials Chemistry
15, No.17, 7th May 2005, p.1689-95
SELF-CLEANING COATINGS
Parkin I P; Palgrave R G
London,University College

The technology of self-cleaning coatings with both commercial and research applications are reviewed in terms of the types of coatings and mechanisms of self-cleaning. Examples of hydrophobic coatings, such as poly(tetrafluoroethylene)-coated carbon nanotubes, and of hydrophilic coatings, such as those based on titanium dioxide which also show photocatalytic properties towards the breakdown of dirt, are cited. 37 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.942365

Item 71
Polymers for Advanced Technologies
16, No.5, May 2005, p.413-9

SURFACE CHARACTERISTICS AND HEMOCOMPATIBILITY OF PAN/PVDF BLEND MEMBRANES

Ting-Yu Liu; Wen-Ching Lin; Li-Ying Huang;
San-Yuan Chen; Ming-Chien Yang
Taiwan,National Chiao Tung University;
Taiwan,National University of Science & Technology

Polyacrylonitrile was blended with PVDF and membranes produced from the resulting blends by phase inversion. The morphology and dynamic mechanical properties of the membranes were investigated by atomic force microscopy, scanning electron microscopy and DMA and the haemocompatibility of the membranes evaluated by means of human plasma protein adsorption, platelet adhesion, thrombus formation and blood coagulation time. The effect of PVDF content on the hydrophilicity and haemocompatibility of the membranes is discussed. 23 refs.

TAIWAN

Accession no.942986

Item 72
Journal of Membrane Science
251, No.1-2, 1st April 2005, p.247-54

SULFONATED POLYSTYRENE/PTFE COMPOSITE MEMBRANES

Jeong-Pil Shin; Bong-Jun Chang; Jeong-Hoon Kim;
Soo-Bok Lee; Dong Hack Suh
Korea,Research Institute of Chemical Technology;
Hanyang,University

Sulphonated PS(SPS)/PTFE composite membranes for direct methanol fuel cells were prepared by adjusting the ratio of styrene/divinylbenzene in reaction mixtures that were impregnated in porous PTFE substrate membranes. The soaked substrates were then thermally polymerised and sulphonated with chlorosulphonic acid. SEM and ATR-FTIR observations confirmed that the porous PTFE substrates were filled successfully with SPS. The water content, ion exchange capacity values, methanol permeability and ion conductivity increased with increasing ratio of styrene/DVB in the sulphonated membranes. The composite membranes showed comparable or higher ion conductivity and lower methanol permeability than Nafion 117 membrane, indicating that the composite membranes could be a suitable alternative for DMFCs.

SOUTH KOREA

Accession no.943087

Item 73
Journal of Membrane Science
255, No.1-2, 15th June 2005, p.125-31

APPLICATION OF THE MODIFIED PVDF ULTRAFILTRATION MEMBRANES IN FURTHER PURIFICATION OF GINKGO BILOBA EXTRACTION

Zhihong Xu; Lei Li; Fawen Wu; Shujuan Tan;
Zhibing Zhang
Nanjing,University

A hydrophilic PVDF-polyvinyl pyrrolidone(PVP) ultrafiltration membrane was prepared by using potassium permanganate as oxidant and potassium hydroxide as strong base to facilitate the HF elimination from PVDF chain, and PVP aqueous solution as a coating medium. The modified membrane was used for further purification of the flavonoids from the Ginkgo biloba extraction(GBE) crude products by ultrafiltration, taking advantage of the hydrogen bond effects between flavonoids and PVP function. Experiments showed that the flux of GBE solution was markedly improved and that the content of flavonoids in the final product could be purified to 34.8 wt % from 21.3 wt % in the GBE crude product, and that the mass transfer of flavonoids decreased with increasing pH value of GBE solution. The flux of GBE solution increased linearly at low pressure and approached a steady state at high pressure because of the concentration polarisation.

CHINA

Accession no.943156

Item 74
Polymer News
30, No.3, March 2005, p.79-84

FLUORINE-CONTAINING POLYMERS AND THE EMERGING NANOTECHNOLOGY

Onah E J
Cornell University

The properties of fluorine-containing polymers which make them suitable for use in the emerging nanotechnology, e.g. for resist technology in photo and radiation lithographies and as insulators in nanoelectronics, are discussed. The synthesis of fluorine-containing polymers, specifically fluoropolyimide, fluoropolyamic acid, fluorimide-amide and fluoropolyacrylates, is described. The preparation of Langmuir-Blodgett monolayers and their ultrathin films is considered. The characterisation of the surface morphology, film thickness, orientation on the substrate and dielectric constant by techniques such as atomic force microscopy, surface plasmon resonance, reflection absorption IR spectroscopy and dielectric spectroscopy is described. The dielectric constant of 1.5 is thought to be the lowest reported to date. 36 refs.

USA

Accession no.943226

Item 75
High Performance and Speciality Elastomers 2005. Proceedings of a conference held Geneva, Switzerland, 20th-21st April 2005.
Shawbury, Rapra Technology Ltd., 2005, Paper 21, pp.18, 29cm, 012

FLUORINATED AND PERFLUORINATED POLYMERS AS PROTECTIVE AND REINFORCING AGENTS FOR STONE ARTEFACTS

Frediani P; Camaiti M; Sacchi B; Toti A
Florence,University; Florence,Istituto Per La Cons.E La Valor.Dei Beni Culturali
(Rapra Technology Ltd.)

A critical evaluation is presented of the performances of different fluorinated materials, particularly perfluoropolyethers, fluoroelastomers and some partially fluorinated acrylic polymers, for use as protective and reinforcing agents for stone artefacts. The synthesis, photostability, hydrophobic properties and water vapour transport properties of these polymers are discussed. The performance of the polymers for conservation of stone materials (biocalcarenites) is described. 36 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.944193

Item 76
Macromolecular Chemistry and Physics
206, No.11, 7th June 2005, p.1098-105

LOW SURFACE ENERGY PERFLUOROALKYL ACRYLATE COPOLYMERS FOR SURFACE MODIFICATION OF PET

Saidi S; Guittard F; Guimon C; Geribaldi S
Nice-Sophia Antipolis,University; Pau,Universite

The synthesis of copolymers of omega-perfluorooctylalkyl acrylate with butyl acrylate by free-radical copolymerisation, and their characterisation by proton and fluorine-19 NMR, GPC, DSC and TGA, is described. The effects of the alkyl spacer chain length and copolymer composition on the surface properties of the copolymers and of films coated on poly(ethylene terephthalate) substrates were studied by contact angle measurements and XPS and the results are discussed. 36 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.944573

Item 77
Macromolecules
38, No.13, 28th June 2005, p.5699-705

MOLECULAR AGGREGATION STRUCTURE AND SURFACE PROPERTIES OF POLY(FLUOROALKYL ACRYLATE) THIN FILMS

Honda K; Morita M; Otsuka H; Takahara A
Kyushu,University

Static and dynamic contact angle measurements, X-ray photoelectron spectroscopy, differential scanning calorimetry and wide angle X-ray diffraction were used to examine the molecular aggregation structure and the surface properties of thin films of a fluoroalkyl acrylate polymer with an acrylate backbone and fluoroalkyl sidechains. Contact angles increased with length of sidechain and where sidechain length exceeded 8 fluoromethylene groups, an ordered and crystallised structure was observed. Water repellence of thin films of this polymer was seen to be due to the ordered fluoroalkyl chains on the outermost surface with less water repellence when fluoromethylene groups in the sidechains are limited in numbers. 35 refs

JAPAN

Accession no.944764

Item 78
Polymer
46, No.11, 2005, p.3776-81

NANOSCALE LOCALIZATION OF POLY(VINYLIDENE FLUORIDE) IN THE LAMELLAE OF THIN FILMS OF SYMMETRIC POLYSTYRENE-POLY(METHYL METHACRYLATE) DIBLOCK COPOLYMERS

Seong Il Yoo; Sang-Hyun Yun; Jeong Min Choi; Byeong-Hyeok Sohn; Wang-Cheol Zin; Jun Chul Jung; Kwang Hee Lee; Seong Mu Jo; Junhan Cho; Cheolmin Park
Pohang,University of Science & Technology; Seoul,National University; Inha,University; Korea,Institute of Science & Technology; Dankook,University; Yonsei,University

Thin film blends of symmetric PS-PMMA diblock copolymers with ferroelectric PVDF were studied. Thin films of the diblock copolymers provided nanometre-sized PMMA lamellae, microscopically parallel to the silicon wafer substrate, in which PVDF chains were dissolved. The amorphous PVDF chains were found to be confined in the PMMA lamellae, and localised in the middle of the PMMA lamellae, in the thin film blends. After crystallisation of the PVDF, however, some of the PVDF migrated to the surface of the film and formed small crystallites. 26 refs.

SOUTH KOREA

Accession no.945188

Item 79
Paint and Coatings Industry
21, No.7, July 2005, p.64/71

EFFECTS OF LATEX PARTICLE MORPHOLOGY ON THE FILM FORMATION AND PROPERTIES OF FLUOROPOLYMER-BASED LATEX PAINTS

Wood K A; Hedhli L; Hanrahan K
Arkema Inc.

Commercial PVDF paints have a hybrid binder structure, being comprised of about 70 wt% PVDF and 30 wt% of a miscible acrylic resin in a semi-crystalline interpenetrating network-type structure. Since the PVDF solvent dispersions contain substantial levels of VOCs and require a high temperature bake, there has been recent interest to develop PVDF-based latex systems that give low-VOC coatings at ambient temperatures, while maintaining the advantageous properties of solvent PVDF paints. This paper considers latex systems containing PVDF resins and acrylics, at ratios similar to commercial solvent PVDF coatings. For these latex systems, differing latex morphologies can be obtained through cold blending or by making structured latex particles. The structured acrylic-modified fluoropolymer (AMF) latexes are prepared by a seeded emulsion polymerisation process. Also discussed are the particular advantages that can be obtained for low-VOC coatings which are based on AMF latexes made with an IPN-type morphology. 18 refs.

USA

Accession no.945556

Item 80

Journal of Membrane Science

258, No.1-2, 1st Aug.2005, p.16-22

PREPARATION OF POROUS PVDF HOLLOW FIBRE MEMBRANE VIA A PHASE INVERSION METHOD USING LITHIUM PERCHLORATE (LICLO4) AS AN ADDITIVE

Yeow M L; Liu Y; Li K

Bath,University; London,Imperial College of Science,Technology & Medicine

The preparation of poly(vinylidene fluoride) hollow fibre membranes by a phase inversion method using N,N-dimethylacetamide as solvent, lithium perchlorate as inorganic salt additive and water as coagulation medium, is described. The membranes were characterised by pore size and pore size distribution by gas permeation, and the effects of temperature and internal coagulant on membrane structure are discussed.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.945721

Item 81

Journal of Applied Polymer Science

97, No.2, 15th July 2005, p.466-74

PREPARATION AND PROPERTIES OF ELECTROSPUN POLYVINYLIDENE FLUORIDE MEMBRANES

Zhao Z; Li J; Yuan X; Li X; Zhang Y; Sheng J

Tianjin,University

PVDF was electrospun into fibrous membranes from its solutions in a mixture of DMF and acetone. The membranes were viewed under an SEM. The effects of acetone amount, polymer concentration, and capillary-collector distance on the morphology of the membranes were studied. Tensile properties and crystallisation of the membranes were also investigated. 29 refs.

CHINA

Accession no.945865

Item 82

Journal of Thermoplastic Composite Materials

18, No.3, May 2005, p241-53

THERMAL CONDUCTIVITY OF PTFE COMPOSITES WITH THREE-DIMENSIONAL RANDOMLY DISTRIBUTED FILLERS

Wen-Zhong Cai; Shan-Tung Tu; Guo-Liang Tao

Nanjing,University of Technology; East China,University of Science & Technology

A finite element mathematical model has been used to study fibre and particle filled polytetrafluoroethylene (PTFE) composites. The aim of the work was to investigate the effect of the thermal conductivity of the fillers on the overall properties of the composites. Both fibre fillers and combinations of fibre and particle fillers were modelled, with different thermal properties being assigned to the fibres, including those of carbon fibre, whilst the particle filler was modelled on graphite. It was found that the model predicted substantial increases in the thermal conductivity of the composite due to the fillers and a saturation point was identified above which there was no further improvement. 22 refs.

CHINA

Accession no.946257

Item 83

Journal of Polymer Science: Polymer Physics Edition

43, No.11, 1st June 2005, p.1310-20

EVOLUTION OF PIEZOELECTRIC POLY(VINYLIDENE FLUORIDE) POLYMERS FOR USE IN SPACE ENVIRONMENTS

Dargaville T R; Celina M; Chaplya P M

Sandia National Laboratories

Attempts were made to predict the performance and long-term stability of the piezoelectric properties of PVDF and its copolymers with trifluoroethylene or hexafluoropropylene under conditions simulating the low-earth-orbit environment. The d33 coefficients (piezoelectric strain coefficient in the thickness direction) were measured at temperatures up to 160C and the electric displacement/electric field(D-E) hysteresis loops were measured from -80 to +110C. The room temperature d33 coefficient of PVDF homopolymer films, annealed at 50, 80 and 125C, decreased rapidly within a few days of thermal exposure and then remained unchanged. In contrast, the trifluoroethylene copolymer exhibited greater thermal stability than the homopolymer, with d33 remaining almost unchanged up to 125C. The hexafluoropropylene copolymer exhibited poor retention of d33 at temperatures above 80C. In situ D-E loop measurements from -80 to +110C showed that the remanent polarisation of the trifluoroethylene copolymer was more stable than that of the PVDF homopolymer. D-E hysteresis loop and d33 results were also compared with the deflection of the PVDF homopolymer and trifluoroethylene copolymer bimorphs tested over a wide range of temperatures. 29 refs.

MEXICO

Accession no.946300

Item 84
ACS Polymeric Materials: Science and Engineering. Fall Meeting 2004. Volume 91. Proceedings of a conference held Philadelphia, Pa., 22nd-26th Aug.2004. Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering, 2004, p.306-7, CD-ROM, 012
CONTROLLED STRAIN INDUCED CRYSTALLIZATION OF PVDF IN A TUBULAR FILM EXTRUSION PROCESS: THE EFFECT OF MOLECULAR WEIGHT AND PROCESS VARIABLES
Xu J; Johnson M; Wilkes G L
Virginia,Polytechnic Institute & State University (ACS,Div.of Polymeric Materials Science & Engng.)

The controlled strain-induced crystallisation of samples of poly(vinylidene fluoride)(PVDF) of different molecular weights in a tubular film extrusion process was investigated using WAXS, AFM and melt rheology. The effects of molecular weight and molecular relaxation characteristics on the strain-induced crystallisation morphology of PVDF films are discussed. 9 refs.

USA

Accession no.946638

Item 85
Plasma Processes and Polymers
2, No.6, July 2005, p.493-500
SELECTED EFFECT OF THE IONS AND THE NEUTRALS IN THE PLASMA TREATMENT OF PTFE SURFACES: AN OES-AFM-CONTACT ANGLE AND XPS STUDY
Vandencasteele N; Fairbrother H; Reniers F
Brussels,Free University; Johns Hopkins University

The treatment of poly(tetrafluoroethylene)(PTFE) surfaces by oxygen and nitrogen neutral and ionic species generated either by RF plasma or in an ion gun was investigated using XPS, AFM and water contact angle measurements. The results are discussed in terms of the effects of modification of the PTFE surface by grafting, chemical etching and by sputtering on surface properties. 38 refs.

BELGIUM; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.946709

Item 86
Journal of Applied Polymer Science
97, No.3, 5th Aug.2005, p.867-71
EFFECTS OF COBALT AND POTASSIUM DOPING ON THERMAL STABILITY AND ELECTRICAL PROPERTIES OF RADIATION GRAFTED ACRYLIC ACID ONTO POLY(TETRAFLUOROETHYLENE ETHYLENE) COPOLYMER FILMS
Ashour A H; El-Sawy N M; Abdel Ghaffar M A; El-Shobaky G A
Egypt,National Centre for Radiation Res.& Technol.; Cairo,National Research Centre

(Tetrafluoroethylene-co-ethylene)-graft-poly(acrylic acid) film, prepared by radiation grafting, was doped by 1.0 wt% cobalt and potassium ions by refluxing with the metal salt solutions. Cobalt doping did not significantly affected the thermal stability, whilst potassium doping reduced the temperature for the onset of degradation by 273 C. Doping increased the electrical conductivity and decreased the activation energy, potassium doping giving the greater conductivity increase. The results are explained in terms of the increased hydrophilicity of the films. 19 refs.

EGYPT

Accession no.946853

Item 87
Journal of Functional Polymers
18, No.1, March 2005, p.122-6
Chinese
EFFECT OF SOLVENTS AND BLENDING ON THE CRYSTALLIZABILITY OF POLY(VINYLIDENE FLUORIDE) MEMBRANES
Li-Shun Wu; Jun-Fen Sun; Si-Jun Zhu; Qing-Rui Wang

The crystal structure and crystallinity of the above membranes prepared by phase inversion were studied by IR spectroscopy and DSC. Blending with a certain amount of incompatible polymer and using solvents with lower solubility parameters resulted in a decrease in the beta crystalline content of the membranes. 16 refs.

CHINA

Accession no.947141

Item 88
Polymer
46, No.18, 2005, p.6976-85
SURFACE GRAFTING POLYMERIZATION AND MODIFICATION ON POLY(TETRAFLUO ROETHYLENE) FILMS BY MEANS OF OZONE TREATMENT
Chen-Yuan Tu; Ying-Ling Liu; Kueir-Rarn Lee; Juin-Yih Lai
Chung Yuan University; Nanya,Institute of Technology

The surfaces of PTFE films were modified by sequential hydrogen plasma/ozone treatments to introduce C-H groups to the surface and form peroxide groups. Surface initiated free-radical polymerisation and atom transfer radical polymerisation were then carried out on the surface of the treated films using, as grafting monomers, acrylamide, acrylic acid, glycidyl methacrylate and 2-(2-bromoisobutyryloxy)ethyl acrylate. The structures of the macromolecules on the PTFE film surfaces were characterised by FTIR-ATR spectroscopy, scanning electron microscopy-energy dispersive X-ray analysis and X-ray photoelectron spectroscopy and the surface properties and morphologies of the modified films discussed. 38 refs.

TAIWAN

Accession no.947945

Item 89

Polymer

46, No.18, 2005, p.7701-6

PREPARATION OF POLY(VINYLIDENE FLUORIDE) (PVDF) ULTRAFILTRATION MEMBRANE MODIFIED BY NANO-SIZED ALUMINA (AL2O3) AND ITS ANTIFOULING RESEARCH

Lu Yan; Yu Shui Li; Chai Bao Xiang
Daqing,Petroleum Institute; Harbin,Institute of Technology

Nano-sized alumina particles were dispersed in a solution of PVDF and membranes prepared therefrom by phase inversion. The cross-sectional structure, porosity and particle size distribution in the membranes were investigated by scanning electron microscopy and TEM and hydrophilicity of the membrane surface determined by water contact angle measurements. The effects of the alumina particles on membrane hydrophilicity, permeation flux, morphology, mechanical properties and antifouling performance were evaluated and membrane antifouling behaviour compared with that of unmodified membranes. 22 refs.

CHINA

Accession no.948043

Item 90

Polymer Science Series A

47, No.8, Aug.2005, p.885-90

PERMEABILITY OF AMORPHOUS AF TEFLONS TO OZONE

Yampol’skii Y P; Polyakov A M; Alent’ev A Y
Topchiev,Institute of Petrochemical Synthesis

Measurements of the permeability of a series of glassy copolymers of bis(trifluoromethyl-4,5-difluoro-1,3-dioxole) and tetrafluoroethylene with a cyclic comonomer content (AF teflons) to ozone are reported. It is shown that the permeability coefficient is not dependent on the amount of ozone in an ozone-oxygen mixture or on the film thickness. The permeability of one Teflon copolymer decreases with increasing temperature although normal dependence is observed for other copolymer films. The difference is due to an abnormally low activation energy of diffusion for this material which has a high free volume. 19 refs.

RUSSIA

Accession no.948585

Item 91

Macromolecules

38, No.16, 9th Aug.2005, p.7150-63

MODELING OF VINYLIDENE FLUORIDE HETEROGENEOUS POLYMERIZATION IN SUPERCRITICAL CARBON DIOXIDE

Mueller P A; Storti G; Morbidelli M; Apostolo M; Martin R
ETHZ; Solvay Solexis SpA; Solvin SA

A kinetic model was developed from experimental results of yield and molecular weight distribution for the heterogeneous polymerisation of vinylidene fluoride in supercritical carbon dioxide. The reaction was analysed as operating in two phases, the continuous supercritical phase and the dispersed polymer phase, but this was a kinetic effect rather than the result of thermodynamic partitioning. The reaction mechanisms promoting this two phase system were discussed, and the model explains why bimodal molecular weight polymers are often found from this system. 49 refs.

BELGIUM; EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SWITZERLAND; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.949148

Item 92

Macromolecular Materials and Engineering

290, No.8, 12th Aug.2005, p.786-91

A STUDY ON THE RELATIONSHIP BETWEEN THE CRYSTAL STRUCTURE AND HARD ELASTICITY OF PVDF FIBERS

Chun-Hui Du; Bao-Ku Zhu; You-Yi Xu
Zhejiang,University

Polyvinylidene fluoride fibres were prepared by melt spinning and their crystal structures and mechanical properties investigated by X-ray diffraction, scanning electron microscopy, tensile testing and elastic recovery determinations along the oriented direction of the fibres under five cycles of loading and unloading at a deformation rate of 6% min/1. The effects of spinning temperature and annealing on the crystallinity and elastic recovery of the fibres were evaluated and the relationship between crystal structure and hard elasticity of annealed fibres, revealed by the morphology and mechanical studies, examined. A structural deformation mechanism for the hard elastic fibres based on crystal rotation, lamellae separation and plastic deformation is suggested. 21 refs.

CHINA

Accession no.949378

Item 93

Macromolecules

38, No.15, 26th July 2005, p.6504-12

MULTIPOROUS POLYMERIC MATERIALS FROM THERMOREVERSIBLE POLY(VINYLIDENE FLUORIDE) GELS

Dasgupta D; Nandi A K
Indian Association for the Cultivation of Science

Thermoreversible PVDF gels in high-boiling point organic diesters (diethyl adipate, diethyl suberate or diethyl azelate) were dried by replacing the diesters with a guest solvent (cyclohexane) followed by leaching with methanol. The porosity of the dried samples was measured using mercury intrusion porosimetry (MIP) for pore sizes greater than 6 nm and by nitrogen adsorption porosimetry for pore sizes between 3 and 6 nm. Micro- meso- and macroporosity were observed in the same sample. Both nano- and macroporosity increased with an increasing number of intermittent carbon atoms in the diesters. The pore volumes and surface areas also increased similarly. The materials showed hysteresis loop in both MIP and nitrogen adsorption porosimetry, indicating ink bottle type or interconnected pore structure in the material. Both nano- and macroporosity decreased with increasing polymer concentration in the gel. DSC thermograms at a heating rate of 40C/min showed two peaks. The lower melting peak may have resulted from crystals at the pore surface and the higher one may have been due to crystals n the bulk material. The higher melting peak increased for samples dried from diesters with an increasing number of intermittent carbon atoms. 41 refs.

INDIA

Accession no.949431

Item 94

ACS Polymeric Materials and Engineering. Fall Meeting 2004. Volume 91. Proceedings of a conference held Philadelphia, Pa., 22nd-26th Aug.2004. Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering. 2004, p.1039-40, CD-ROM, 012

MODIFICATION OF CEMENT MORTARS BY FLUORATED POLYMER LATEX

Shuxiang Zhang; Bing Geng; Anhou Xu; Guohong Chu; Xiang Z Kong
Jinan,University
(ACS,Div.of Polymeric Materials Science & Engng.)

Emulsion polymerisation was used to prepare a copolymer of vinyl acetate (VAc) and chlorotrifluoroethylene (CTFE), a polymer of much reduced cost compared to polyCTFE. Use of the copolymer latex in cement mortars was evaluated in terms of flexural and compressive strength of the resulting concretes and mortars for different curing times and polymer contents. Flexural strength increased whist compressive strength was largely maintained. Flowability of the mortars was compared to others having no polymer content and polyVAc alone. 11 refs.

CHINA

Accession no.949658

Item 95

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2004. Volume 91. Proceedings of a conference held Philadelphia, Pa., 22nd-26th Aug.2004. Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering, 2004, p.471, CD-ROM, 012

MECHANICAL PROPERTIES OF RECYCLED POLYTETRAFLUOROETHYLENE REINFORCED SILICONE RUBBER COMPOSITES

Eun-Soo Park
Young Chang Silicone Co.Ltd.
(ACS,Div.of Polymeric Materials Science & Engng.)

Various recycled PTFE powders were compounded with silicone rubber and the mechanical properties, including TS, EB, tear strength and hardness, of silicone rubber/PTFE composite were evaluated. The effects of surface treatment of recycled PTFE and the addition of fluorosilicone rubber as a compatibiliser were also investigated. SEM observations confirmed that, after addition of fluorosilicone rubber, improvement of the interfacial adhesion between the dispersed phase and the polymer matrix occurred. 5 refs.

KOREA

Accession no.949979

Item 96

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2004. Volume 91. Proceedings of a conference held Philadelphia, Pa., 22nd-26th Aug.2004. Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering, 2004, p.374-5, CD-ROM, 012

EFFECT OF THERMAL ANNEALING ON THE CREEP RESISTANCE OF POLYTETRAFLUORO ETHYLENE(PTFE)

Hongliu Sun; Cooke R S; Wynne K J
Virginia,Commonwealth University
(ACS,Div.of Polymeric Materials Science & Engng.)

PTFE and modified PTFE skived tapes from various sources were annealed in air, nitrogen or supercritical carbon dioxide atmosphere over a broad range of temperatures for various times. Annealing was expected to increase crystallinity and thus to decrease creep by providing more physical crosslinking. The results showed that the crystallinity of the samples annealed in supercritical carbon dioxide increased more than 50%, but there was no obvious increase for samples annealed in air or nitrogen. The creep resistance of the samples heat-treated in air or nitrogen was unexpectedly better than that of the samples treated in supercritical carbon dioxide, increasing 25 to 60% for PTFE and modified PTFE compared with the as-received samples. 6 refs.

USA

Accession no.950304

Item 97

ACS Polymeric Materials: Science and Engineering. Fall Meeting 2004. Volume 91. Proceedings of a conference held Philadelphia, Pa., 22nd-26th Aug.2004. Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering, 2004, p.392-3, CD-ROM, 012

FIRE RETARDANT COATING USING COLD PLASMA POLYMERIZATION OF A FLUORINATED ACRYLATE

Errifai I; Jama C; Le Bras M; Delobel R; Mazzah A; De Jaeger R
ENSCL; USTL
(ACS,Div.of Polymeric Materials Science & Engng.)

An approach was developed for improving the flame retardancy of polyamide-6(PA6) using a cold plasma process involving grafting and polymerising of a fluorinated acrylate onto the PA6 surface. The process resulted in a reduction of 50% in the peak value of the heat release rate in comparison with that of uncoated PA6. This could be due to a reaction of CFx radicals in the gas phase with different fragments of polymer evolved during the thermal degradation, leading to a dilution of the combustible gases. 23 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.950313

Item 98

Journal of Polymer Science: Polymer Physics Edition
43, No.18, 15th Sept. 2005, p.2503-13

EVALUATION OF PIEZOELECTRIC PVDF POLYMERS FOR USE IN SPACE ENVIRONMENTS. II. EFFECTS OF ATOMIC OXYGEN AND VACUUM UV EXPOSURE

Dargaville T R; Celina M; Martin J W; Banks B A
Sandia National Laboratories; US,NASA,Glenn Research Center

The effects were examined of atomic oxygen and vacuum UV radiation, simulating low-Earth-orbit conditions, on commercially available piezoelectric films of poly(vinylidene fluoride) (PVDF) and poly(vinylidene fluoride-trifluoroethylene) P(VDF-TFE). Surface erosion and pattern development were significant for both polymers. The piezoelectric properties of the residual material of both polymers were largely unchanged following exposure, although a slight shift in the Curie transition of the P(VDF-TFE) was observed. A lightly cross-linked network was formed in the copolymer, presumably as a result of the penetrating vacuum ultraviolet (VUV) radiation, whereas the homopolymer remained uncrosslinked. These differences were attributed to varying degrees of crystallinity and potentially greater absorption of VUV radiation in P(VDF-TFE) compared with PVDF. 33 refs.

USA

Accession no.950787

Item 99

Industrial and Engineering Chemistry Research
44, No.20, 28th Sept.2005, p.7646-51

HYFLON ION MEMBRANE FOR FUEL CELLS

Arcella V; Troglia C; Ghielmi A
Solvay Solexis SpA

The development of hydrophilic highly conductive proton exchange membranes based on the copolymer of tetrafluoroethylene and a short side-chain perfluorosulphonylfluoride vinyl ether is described. The membranes were characterised by TGA, water uptake, tensile properties and fuel cell performance and the results are discussed in comparison with commercially available Nafion membranes. 27 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.950926

Item 100

Journal of Polymer Research
12, No.4, Aug.2005, p.305-12

STRUCTURE-PROPERTY RELATIONSHIPS IN RADIATION GRAFTED POLY(TETRAFLUOROETHYLENE)-GRAFT-POLYSTYRENE SULPHONIC ACID MEMBRANES

Nasef M M; Daidi H
Malaysia,Universiti Teknologi

The preparation of poly(tetrafluoroethylene-g-styrene sulphonic acid) graft copolymer membranes by radiation-induced grafting of styrene onto poly(tetrafluoroethylene) films followed by sulphonation is described. The membranes were characterised by ion exchange capacity, XPS, swelling, ionic conductivity, DSC and TGA, and the effects of the degree of grafting on membrane properties are discussed. 28 refs.

MALAYSIA

Accession no.951035

Item 101

Polymer Materials Science and Engineering
21, No.4, July 2005, p.189-92
Chinese

STUDY ON WEAR BEHAVIOR OF PTFE COMPOSITES UNDER VARIOUS LOAD

Sheng-Hua Sun; Xin Feng; Chang-Song Wang; Wei-Ping Chen; Xiao-Hua Lu
Nanjing,University of Technology

The tribological properties of PTFE composites filled with carbon fibres were investigated under various loading conditions and the microstructure and failure of the composites investigated by scanning electron microscopy. The heat of fusion and degree of crystallinity of the composites were determined by DSC and X-ray diffraction and related to the tribological properties. Premature failure of the composites was attributed to creep fracture. 10 refs.

CHINA

Accession no.951238

Item 102
Polymer Degradation and Stability
89, No.3, 2005, p.471-7
A MODEL OF RADIATION-INDUCED DEGRADATION OF THE POLY(VINYLIDENE FLUORIDE) SURFACE DURING XPS MEASUREMENTS
Voinkova I V; Ginchitskii N N; Gribov I V; Klebanov I I; Kuznetsov V L; Moskvina N A; Pesin L A; Evsyukov S E
Chelyabinsk,State Pedagogical University; Russian Academy of Sciences; instrAction GmbH

The carbon core-level spectra in PVDF during prolonged X-ray photoelectron spectroscopy measurements were studied. Surface degradation was observed during prolonged measurements. A simple mathematical model was proposed to describe the process of radiation-induced carbonisation, which agreed very well with experimental results. The limitations of the model were discussed. 21 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; RUSSIA; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.951270

Item 103
Polymer Science Series B
47, No.7-8, July-Aug.2005, p.238-42
DIELECTRIC SPECTROSCOPY OF SULFONATED POLY(TETRAFLUOROETHYLENE) IN THE SWOLLEN STATE
Malyshkina I A; Burmistrov S E; Gavrilova N D
Moscow,State University

The temperature and frequency dependency of the dielectric characteristics of proton conducting sulphonated polytetrafluoroethylene (Nafion) are studied. The dielectric spectra of samples swollen in water are measured in the range 0.1 Hz to 10 MHz at 213 to 278K. Conductivity effects are shown to dominate the dielectric response. Two relaxation processes associated with intracluster and intercluster conduction are revealed. 18 refs.

RUSSIA

Accession no.951591

Item 104
Adsorption
11, No.1, Suppl., 2005, p.787-92
EVALUATION OF POLYTETRAFLUOROETHYLENE SURFACES BY NITROGEN PHYSISORPTION AND THE EFFECTS OF ALKALI ETCHING
Fuller E F
Lorela Enterprises Inc.

The physical adsorption and desorption of nitrogen by poly(tetrafluoroethylene) with and without chemical defluorination by treatment with alkali metals (sodium, potassium, rubidium) was investigated and sorption isotherms determined. The results are discussed in terms of surface area and porosity of the etched materials. 2 refs.

USA

Accession no.951821

Item 105
ACS Polymeric Materials and Engineering: Science and Engineering. Spring Meeting 2005. Volume 92. Proceedings of a conference held San Diego, Ca., 13th-17th March 2005.
Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering. 2005, p.133, CD-ROM, 012
NEW FLUOROPOLYMERS FOR NEXT GENERATION PHOTOLITHOGRAPHIC TECHNIQUES
Wood C D; DeSimone J M
North Carolina,University; North Carolina,State University
(ACS,Div.of Polymeric Materials Science & Engng.)

Synthesis and chemical modification of fluorinated copolymers based on a commercial amorphous fluorinated copolymer, and deprotection by photochemical cleavage to give high contrast imaging on photoresists, are briefly described. Lithography at 193nm and 157nm was shown to be possible, whilst polymers were thermally stable with a high glass transition temperature. 5 refs.

USA

Accession no.951975

Item 106
ACS Polymeric Materials and Engineering: Science and Engineering. Spring Meeting 2005. Volume 92. Proceedings of a conference held San Diego, Ca., 13th-17th March 2005.
Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering. 2005, p.136-9, CD-ROM, 012
THE PRODUCTION OF A NOVEL POLYMER FILM FOR USE IN ADVANCED LITHOGRAPHY
Zimmerman P A; van Peski C; Miller D; Callahan R P; Cashion M
IMEC; Sematech; Texas,University
(ACS,Div.of Polymeric Materials Science & Engng.)

Preparation, characterisation and optical properties of a novel fluoropolymer films, suitable for application in photolithography at 193nm, are described. The theoretical molecular structure for the films that would give optimum properties was developed theoretically and two different films, based on polytetrafluoroethylene, fluorinated ethylene propylene copolymer and perfluorooxyalkane, were prepared to match these structures as closely as possible. Films were characterised using Fourier transform infrared, time-of-flight mass, ultraviolet visible, and X-ray photoelectron spectroscopies, X-ray diffraction, and ratio of incident to transmitted laser radiation. Preparation of totally amorphous polymers from the crystalline starting materials, using high energy electron radiation in an inert atmosphere, was shown to be possible. 12 refs.

USA

Accession no.951977

Item 107

ACS Polymeric Materials and Engineering: Science and Engineering. Spring Meeting 2005. Volume 92. Proceedings of a conference held San Diego, Ca., 13th-17th March 2005.

Washington, D.C., ACS, Division of Polymeric Materials: Science & Engineering. 2005, p.151-2, CD-ROM, 012

JET-BLOWING: A SOLVENT FREE PROCESS FOR FORMING FIBER MATS OF POLYTETRAFLUOROETHYLENE

Bin Gu; Borkar S; Sen A; Jackson B Y; Badding J V
Penn State University
(ACS,Div.of Polymeric Materials Science & Engng.)

Mats of micro and nanofibres of very high molecular weight polytetrafluoroethylene were formed by a new process involving a blowing in a high pressure gas such as hot nitrogen or argon. Plasticisation and extensional stretching occurs in the jet nozzle, and significant molecular alignment was found in the fibres using Raman spectroscopy. Fibres were characterised using scanning electron microscopy, differential scanning calorimetry and X-ray photoelectron spectroscopy. 9 refs.

JAPAN

Accession no.951984

Item 108

Journal of Applied Polymer Science

98, No.3, 5th Nov.2005, p.1317-24

REACTIVE POLYTETRAFLUOROETHYLENE/POLYAMIDE 6 COMPOUNDS. II. STUDY OF THE REACTIVITY WITH RESPECT TO THE FUNCTIONALITY OF THE POLYTETRAFLUOROETHYLENE COMPONENT AND ANALYSIS OF THE NOTCHED IMPACT STRENGTH OF THE POLYTETRAFLUOROETHYLENE/POLYAMIDE 6 COMPOUNDS

Pompe G; Haussler L; Adam G; Eichhorn K-J; Janke A; Hupfer B; Lehmann D
Dresden,Institute of Polymer Research

The formation of block copolymers as a result of an in situ chemical reaction during the reactive extrusion of electron-beam-irradiated PTFE and nylon-6 was detected using DSC and FTIR. The effect of irradiation dose on block copolymer content was investigated. Impact properties were determined. 9 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.952114

Item 109

Journal of Applied Polymer Science

98, No.3, 5th Nov.2005, p.1358-63

POROUS POLYVINYLIDENE FLUORIDE MEMBRANE WITH HIGHLY HYDROPHOBIC SURFACE

Peng M; Li H; Wu L; Zheng Q; Chen Y; Gu W
Zhejiang,University

Details are given of the preparation of very hydrophobic PVDF membranes using two different methods. The morphology of the surface and cross-section of the membranes was investigated using SEM. Relationships between morphology, hydrophobicity and preparation methods were investigated in detail. 22 refs.

CHINA

Accession no.952119

Item 110

Paint and Coatings Industry

21, No.11, Nov.2005, p.70/2

WATER-REPELLENT COATING FOR MOBILE PHONE MICROPHONES

Yamauchi G; Riko Y; Yasuno Y; Shimizu T; Funakoshi N
Nagoya,Institute of Technology; Riko Associates; Matsushita Electric Industrial Co.Ltd.; NTT Advanced Technology

One of the main deteriorating factors of mobile phones is water sticking to the surface of the electret condenser microphone (ECM), a vital part of the phone. A new water-repellent coating material has been developed that can be applied to the ECM of a mobile phone. The coating is composed of low-molecular-weight PTFE particles and anatase-type nanosized titanium dioxide, fluoro-oil and a PVDF binder. The presence of the PTFE particles in the coating material makes it possible to improve the water-repellent properties so that it has a water contact angle of more than 150 degrees. The inclusion of titanium dioxide particles inhibits surface contamination by the photocatalytic reaction of anatase-type titanium dioxide. The fluoro-oil contributes towards the water repellency of this material, which is being used to coat the surface of communication antennas in snowy regions in Japan. 3 refs.

JAPAN

Accession no.952712

Item 111

Journal of Applied Polymer Science

98, No.2, 15th Oct.2005, p.838-42

ADHESION OF MICROWAVE-PLASMA-TREATED FLUOROPOLYMERS TO THERMOSET VINYLESTER

Hedenqvist M S; Merveille A; Odelius K; Albertsson A-C; Bergman G
Stockholm,Royal Institute of Technology

The surfaces of sheet polytetrafluoroethylene (PTFE) and of poly(fluoroethylene-co-fluoropropylene) (FEP) were subjected to microwave plasma treatment using both inert (argon) and reactive plasma gases (hydrogen, oxygen and nitrogen). PTFE/PTFE and FEP/FEP lap joints were bonded using a bisphenol A epoxy-based vinyl ester resin. The shear strength of the joints increased with increasing plasma treatment. The best adhesion was achieved using a hydrogen plasma, which generated the highest degree of defluorination of the surface. Defluorination efficiency decreased in the sequence hydrogen-argon-oxygen-nitrogen. For a given energy dose, surface roughness decreased with increasing plasma power. This was possibly due to partial melting. 30 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; SCANDINAVIA; SWEDEN; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.952992

Item 112
Synthetic Metals
152, No.1-3, 2005, p.49-52
POLYVINYLIDENE FLUORIDE TRANSDUCERS WITH HIGHLY CONDUCTING POLYETHYLEN EDIOXYTHIOPHENE ELECTRODES
Lee C S; Joo J; Han S; Lee J H; Koh S K
Seoul,Korea University; P & I Corp.; Korea,Institute of Science & Technology

Details are given of the fabrication of multifunctional transducers using PVDF film as active layer and ethylene dioxythiophene-styrene sulphonate copolymer as electrode. The PVDF active layers and the electrodes were modified by using the ion-assisted-reaction method for enhancing adhesion. A piezoelectric effect and a pyroelectric effect were observed. 13 refs.

KOREA

Accession no.953064

Item 113
European Polymer Journal
41, No.11, Nov.2005, p.2544-51
POLYMERISATION OF VINYLIDENE FLUORIDE IN SUPERCRITICAL CARBON DIOXIDE. FORMATION OF PVDF MACROPOROUS BEADS
Tai H; Liu J; Howdle S M
Nottingham,University

Details are given of the preparation of PVDF macroporous beads by batch polymerisation in supercritical carbon dioxide using diethyl peroxydicarbonate as initiator. The influence of the rate and type of stirring on the morphology of the polymers was investigated. Results indicated that the shear force was the key factor. Morphologies were examined using SEM. 34 refs.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.953120

Item 114
Journal of Adhesion Science and Technology
17, No.13, 2003, p.1801-13
ADHESION OF COPPER TO POLYTETRAFLUOROETHYLENE SURFACES MODIFIED WITH VACUUM UV RADIATION FROM HELIUM ARC PLASMA
Zheng S; Entenberg A; Takacs G A; Egitto F D; Matienzo L J
Rochester,Institute of Technology; Endicott Interconnect Technologies Inc.; IBM

PTFE film surfaces were exposed to vacuum UV radiation from plasma that rotated inside a graphite tube by the application of an auxiliary magnetic field. Films were covered with optical filters having different cut-off wavelengths to vary the vacuum UV radiation that modified the fluoropolymer surface. Photo-etching was detected as well as surface modification. 68 refs.

USA

Accession no.903257

Item 115
International Journal of Adhesion and Adhesives
23, No.6, 2003, p.515-9
INVESTIGATION OF A NEW REACTANT FOR FLUORINATED POLYMER SURFACE TREATMENTS WITH ATMOSPHERIC PRESSURE GLOW PLASMA TO IMPROVE THE ADHESIVE STRENGTH
Tanaka K; Kogoma M
Sophia,University

Tetrafluoroethylene-perfluoroalkyl vinyl ether copolymers and PTFE films were treated by three kinds of atmospheric pressure glow plasmas. Films were also treated by a wet method using a sodium solution. The adhesive strengths of plasma-treated copolymers were compared with those of untreated films. Trimethoxyborane was selected as a source of boron atoms and the effect of this reactant on the adhesive strength was examined. 16 refs.

JAPAN

Accession no.903228

Item 116
Macromolecular Chemistry and Physics
204, No.17, 12th Nov.2003, p.2064-77
PHASE BEHAVIOUR OF POLYMETHYL METHACRYLATE/POLYVINYLIDENE FLUORIDE BLENDS IN THE PRESENCE OF HIGH-PRESSURE CARBON DIOXIDE
Walker T A; Melnichenko Y B; Wignall G D; Lin J S; Spontak R J
North Carolina,State University; Oak Ridge National Laboratory

Details are given of the effect of high-pressure carbon dioxide on the miscibility of blends of PMMA and PVDF.

Two miscible blends were exposed to high-pressure carbon dioxide at pressures below and above the critical pressure. Characterisation was undertaken using X-ray scattering, TEM and DSC. 80 refs.

USA

Accession no.903207

Item 117
17th International Conference on Fluid Sealing.
Proceedings of a conference held York, UK, 8th-10th April 2003.
Cranfield, BHR Group Ltd., 2003, p.157-66, 25cm, 012
ANALYSIS OF PTFE MATERIAL IN ROTARY SEALS
Li W; Mays S
Polymer Sealing Solutions
(BHR Group Ltd.)

PTFE is a complex material, showing significantly different tensile and compressive behaviour under uni-axial loading. In most finite element analysis (FEA) methods to model the material properties of PTFE, this behaviour is not considered. A new FEA procedure utilising MARC is used to model PTFE rotary seals. This new method can simulate the properties of PTFE material derived from tension and compression data. It is found that the FEA results employing the new method are in good agreement with those from experiment. A PTFE rotary seal is modelled using this new method and results are presented incorporating stress and lip loads of the rotary seal with different temperature effects. FE results with and without the new method are compared and discussed. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.903974

Item 118
Journal of Applied Polymer Science
89, No. 5, 25th July 2003, 1093-1100
DETERMINATION OF THE CRYSTALLINE PHASES OF POLY(VINYLIDENE FLUORIDE) UNDER DIFFERENT PREPARATION CONDITIONS USING DIFFERENTIAL SCANNING CALORIMETRY AND INFRARED SPECTROSCOPY
Benz M; Euler W B
University of Rhode Island

A precise method has been developed to quantitatively measure the degree of alpha-, beta- and gamma-crystallinity in poly(vinylidene fluoride) (PVDF) using IR spectroscopy. The phase composition of solution-deposited PVDF films was found to be strongly influenced by the presence of hydrophilic residues on the silicon substrate, the relative humidity present at film deposition, the spatial position on the substrate, and the thermal treatment of the deposited film. Films produced on pristine surfaces gave predominantly alpha-phase PVDF, but when a layer of polar solvent (acetone or methanol) remained on the surface, the films produced were predominantly gamma phase. Higher humidity promoted a higher fraction of gamma crystallinity in the solution-deposited PVDF films. Solution-cast films had highly variable composition across the substrate, whereas spin-cast films were uniform. High-temperature annealing of PVDF films normally converts the polymer to the gamma phase, but annealing the film while still attached to the silicon substrate inhibited this phase transformation. Low-temperature annealing of freestanding films led to a previously unreported thermal event in the DSC, a premelting process that is a kinetic event, assigned to a crystalline relaxation. Higher-temperature annealing gave a double endotherm, assigned to melting of different-sized crystalline domains. 37 refs.

USA

Accession no.903745

Item 119
164th ACS Rubber Division Meeting - Fall 2003.
Proceedings of a conference held Cleveland, Oh., 14th-17th Oct.2003.
Akron, Oh., ACS Rubber Division, 2003, Paper 9, pp.14, 28cm, 012
A NEW, IMPROVED PROCESSING BASE-RESISTANT FLUOROELASTOMER BASED ON APA TECHNOLOGY, VITON EXTREME TBR-S
Bauerle J G
DuPont Dow Elastomers
(ACS,Rubber Div.)

The development of a new base-resistant fluoroelastomer, designated Viton Extreme TBR-S, which exhibits processing characteristics critical to cost-effective production of finished parts and the required physical properties and chemical resistance for long-term functionality in high pH environments, is reported. The characteristics of this new fluoroelastomer, which is composed of tetrafluoroethylene, propylene and a bisphenol-reactive cure site monomer, are compared with a range of fluoroelastomers, including other Viton grades. 2 refs.

USA

Accession no.903304

Item 120
164th ACS Rubber Division Meeting - Fall 2003.
Proceedings of a conference held Cleveland, Oh., 14th-17th Oct.2003.
Akron, Oh., ACS Rubber Division, 2003, Paper 8. pp.26, 28cm, 012
A NEW BROADLY FLUID RESISTANT FLUOROELASTOMER BASED ON APA TECHNOLOGY. VITON EXTREME ETP-S
Dobel T M; Stevens R D
DuPont Dow Elastomers LLC
(ACS,Rubber Div.)

The development of a new version of Viton Extreme fluoroelastomer, designated Viton Extreme ETP-600S, which exhibits chemical resistance, greatly improved processing characteristics, including better mould flow and mould release, and enhanced compression set resistance, is reported. This new fluoroelastomer, which is based on TFE and perfluoromethyl vinyl ether, is compared with current commercial ETP-900 and its rheological properties, moulding characteristics and physical properties at room temperature and elevated temperature are reviewed. Its unique capabilities are compared with currently available standard fluoroelastomers and some general compounding recommendations for this fluoroelastomer are outlined. 7 refs.

USA

Accession no.903303

Item 121
Journal of Physics D
36, No.23, 7th Dec.2003, p.2980-5
SURFACE MODIFICATION OF POLYTETRAFLUOROETHYLENE FILM USING THE ATMOSPHERIC PRESSURE GLOW DISCHARGE IN AIR
Fang Z; Qiu Y; Luo Y
Xian Jiaotong,University

The surface modification of poly(tetrafluoroethylene) (PTFE) film using atmospheric pressure glow discharge in air and dielectric barrier discharge was investigated using contact angle measurement, x-ray photoelectron spectroscopy and SEM. The results are discussed in terms of changes in surface morphology and composition arising from the creation of oxygen-containing polar groups on the PTFE surface. 18 refs.

CHINA

Accession no.904686

Item 122
Journal of Polymer Research
10, No.4, 2003, p.247-58
EFFECTS OF FILLER CONTENT AND SIZE ON THE PROPERTIES OF PTFE/SIO2 COMPOSITES
Chen Y-C; Lin H-C; Lee Y-D
Taiwan,Industrial Technology Research Institute; Tsinghua,University

The manufacturing process of silica-reinforced PTFE and the effects of the silica content and size on properties of composites are discussed. Data concerning thermal properties, dielectric properties, tensile strength and morphology are presented. Experimental results were compared with theoretical predictions. 53 refs.

CHINA

Accession no.904400

Item 123
Chemistry of Materials
15, No.23, 18th Nov.2003, p.4447-55
PREPARATION OF PROTON-CONDUCTING MEMBRANES BY DIRECT SULFONATION. I. EFFECT OF RADICALS AND RADICAL DECAY ON THE SULFONATION OF POLY(VINYL FLUORIDE) FILMS
Paronen M; Sundholm F; Ostrovskii D; Jacobsson P; Jeschke G; Rauhala E; Tikkanen P
Helsinki,University; Chalmers University of Technology; Max-Planck-Institut fuer Polymerforschung

The effect of irradiation treatment on the structure and sulphonation reactivity of PVF films was studied. The results obtained are presented and discussed with particular reference to EPR spectra, evaluation of the effect or radicals on the ion exchange capacity, FTIR analysis, effect of the type of irradiation and radical decay on the side reactions, effect of the sulphonation reagent concentration and sulphonation time on the side reactions, and semi-quantitative analysis of the -SO3H concentration. The most significant parameters for the homogeneous sulphonation of PVF films were found to be the type of irradiation and radical decay. The combination of sulphonation time and chlorosulphonic acid concentration, on the other hand, could be chosen freely for bulk materials. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FINLAND; GERMANY; SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.904320

Item 124
Polymer International
53, No.2, Feb.2004, p.212-7
ADSORPTION OF VO2+ BY POLY((TETRAFL UOROETHYLENE)-CO-(PERFLUOROVINYL ETHER)) COPOLYMER GRAFTED WITH ACRYLIC ACID USING GAMMA-IRRADIATION
El-Sawy N M
Egypt,National Centre For Radiation Res.& Technol.

The reaction between acrylic acid and poly((tetrafluoroet hylene)-co-(perfluorovinyl ether)) copolymer using direct induced gamma-irradiation to prepare grafted films. The grafted copolymer was complexed with the vanadyl group, VO2+, in aqueous solution. The grafted copolymer-metal complexes were examined by infrared and ultraviolet spectrometry, energy-dispersive spectroscopy (EDS) and X-ray diffraction (XRD). The amount of vanadium in the grafted films was estimated using EDS. The thermal stability of the films was investigated using thermogravimetric and differential scanning calorimetry. The degree of crystallinity of the grafted and complexed films decreased by treatment with VO2+ ions and also by heating at 300 deg C. When heated at a temperature above 300 deg C, the grafted chains degraded until the original polymer was almost completely separated. XRD investigation revealed that the metal oxide may be formed as a separate phase with subsequent decrease in the crystallinity of the copolymer. Scanning electron microscope investigation of the grafted and modified films, at room temperature and 300 deg C, showed changes in the structure and morphology. The tendency of the graft copolymer to adsorb and/or bind to VO2+ from aqueous solution has potential applications in the field of waste treatment of rare metals in the environment. 18 refs.

EGYPT

Accession no.906052

Item 125
Journal of Materials Science
38, No.24, 15th Dec.2003, p.4965-72

ADHESION AND FRICTION BEHAVIOUR BETWEEN FLUORINATED CARBON FIBRES AND POLYVINYLIDENE FLUORIDE

Bismarck A; Schulz E
London,Imperial College of Science,Technology & Medicine; Berlin,Bundesanstalt fur Materialforschung

The potential use of fluorinated polyacrylonitrile-based high strength carbon fibres as reinforcement for PVDF was investigated using the single-fibre pull-out test. The apparent interfacial shear strength as a measure of practical adhesion was determined and the fracture and hidden friction behaviour of the model composites characterised. 48 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.906011

Item 126
Advanced Materials
15, No.23, 3rd Dec.2003, p.2027-32

ELECTROSPUN POLY(VINYLIDENE FLUORIDE) NANOFIBROUS MEMBRANE AND ITS BATTERY APPLICATIONS

Sung Won Choi; Seong Mu Jo; Wha Seop Lee; Yong-Rok Kim
Korea,Institute of Science & Technology; Yonsei,University

A polymer nanofibrous matrix was developed which was suitable for use as polymer electrolytes in high-performance lithium polymer batteries. The PVDF nanofibrous membrane was produced by electrospinning. The porosity, network structure, mechanical strength and electrochemical properties of the membrane were characterised. The electrospun nanofibrous membrane was shown to have high porosity, large surface area, fully interconnected pore structure and adequate mechanical strength. A nanofibrous polymer electrolyte using this membrane exhibited good physical and electrochemical properties. 34 refs.

KOREA

Accession no.905647

Item 127
Polymer
44, No.26, 2003, p8167-76

CRYSTALLIZATION AND ORIENTATION BEHAVIORS OF POLY(VINYLIDENE FLUORIDE) IN THE ORIENTED BLEND WITH NYLON 11

Yongjin Li; Kaito A
AIST

X-ray diffraction, differential scanning calorimetry, scanning electron microscopy, confocal laser scanning microscopy and tensile properties in line with, and perpendicular to, the orientation direction were used to examine oriented films of blends of polyamide-11 (PA11) and polyvinylidene fluoride (PVDF). Oriented films were prepared by uniaxial stretching of the melt followed by annealing the sample at 170 degrees centigrade and quenching in iced water, or allowing crystallisation isothermally at different temperatures. Both alpha and beta forms of PVDF crystals were observed in the polymer blends, with increasing beta-form content when the blend was crystallised at temperatures greater than 120 degrees centigrade. Orientation of alpha-form crystallisation depended on crystallisation conditions with c-axis orientation to the stretching direction at lower temperatures (below 50 degrees centigrade), a-axis orientation parallel to the stretching at higher temperatures (above 100 degrees centigrade) and a tilting of the a-axis from the strain direction at medium temperatures (around 75 degrees centigrade). Beta-form crystals were unaffected by crystallisation temperature, maintaining c-axis orientation. Mechanisms of crystalline structure formation were discussed, and a trans-crystallisation mechanism was preferred. Heat treatment of the samples reduced the tensile strength, but improved the elongation of samples slightly, compared to non-heat treated samples. 29 refs.

JAPAN

Accession no.905468

Item 128
Polymer
44, No.26, 2003, p.7899-906

NANOCOMPOSITES BASED ON LAYERED SILICATE AND MISCIBLE PVDF/PMMA BLENDS: MELT PREPARATION, NANOPHASE MORPHOLOGY AND RHEOLOGICAL BEHAVIOUR

Moussaif N; Groeninckx
Leuven,Catholic University

A series of nanocomposites of polyvinylidene fluoride and montmorillonite clay were prepared by extrusion mixing using polymethyl methacrylate (PMMA) as an interfacial agent. The nanocomposites were characterised by transmission electron microscopy, rheological properties and dynamic mechanical analysis, and the degree of exfoliation of the filler was seen to depend on the amount of PMMA included. Rheological properties and dynamic mechanical properties that depended on clay exfoliation were also strongly influenced by PMMA content. A network structure was observed at 10 percent PMMA content 38 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.905441

Item 129

Journal of Polymer Science: Polymer Physics Edition

42, No.3, 1st Feb.2004, p544-52

PLASTICIZED MICROPOROUS POLY(VINYLIDENE FLUORIDE) SEPARATORS FOR LITHIUM-ION BATTERIES. II. POLY(VINYLIDENE FLUORIDE) DENSE MEMBRANE SWELLING BEHAVIOR IN A LIQUID ELECTROLYTE-CHARACTERIZATION OF THE SWELLING KINETICS

Saunier J; Alloin F; Sanchez J Y; Barriere B

Grenoble,Joseph Fourier University; Totalfina

Membrane swelling kinetics with respect to temperature have been investigated in pure solvents, solvent mixtures and solvent-salt mixtures in the second of two consecutive articles on polyvinylidene fluoride membranes. Interaction parameters were again found to be important. Commercial polymer samples were used and the solvents were ethylene carbonate and dimethyl carbonate. The electrolyte was again lithium phosphorus hexafluoride (LiPF6). Microporous membranes down to a thickness of 1 micrometer were studied; NMR was used to provide experimental data. It was found that equilibrium swelling times could be estimated using the initial Fickian diffusion coefficient although non-Fickian behaviour was observed in the later stages of swelling. 33 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.907088

Item 130

Journal of Polymer Science: Polymer Physics Edition

42, No.3, 1st Feb.2004, p532-43

PLASTICISED MICROPOROUS POLY(VINYLIDENE FLUORIDE) SEPARATORS FOR LITHIUM-ION BATTERIES. I. SWELLING BEHAVIOR OF DENSE MEMBRANES WITH RESPECT TO A LIQUID ELECTROLYTE-CHARACTERIZATION OF THE SWELLING EQUILIBRIUM

Saunier J; Alloin F; Sanchez J Y; Barriere B

Grenoble,Joseph Fourier University; Totalfina

Membrane swelling with respect to temperature, salt concentration and swelling solution concentration has been investigated in the first of two consecutive articles. The aim of the study was to provide membrane data and apply a mathematical model to allow optimisation of rechargeable battery microporous separators. Studies were carried out on commercial samples in pure solvents and solvent mixtures of ethylene carbonate, dimethyl carbonate, diethyl carbonate, methyl butyrate and comparisons were also made with propylene carbonate and ethyl acetate. The electrolyte used was lithium phosphorus hexafluoride (LiPF6). The membranes were characterised by infrared spectroscopy. The Flory-Huggins model was applied to the swelling data and it was concluded that the interaction parameter was important in predicting swelling behaviour. 37 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.907087

Item 131

ANTEC 2003. Proceedings of the 61st SPE Annual Conference held Nashville, Tn., 4th-8th May 2003. Brookfield, Ct., SPE, 2003, Volume 1-Processing Session T1-Single Screw II, p.192-6, CD-ROM, 012

POLYTETRAFLUOROETHYLENE (PTFE) PASTE PREFORMING: THE EFFECTS OF VISCOSITY AND SURFACE TENSION OF LUBRICANTS

Ochoa I; Hatzikiriakos S G

British Columbia,University

(SPE)

Polytetrafluoroethylene, which melts at approximately 342 C, may be processed at approximately 35 C by blending with a lubricant to form a paste. After mixing with the lubricant, the paste is preforming into a cylindrical shape by compression and air removal. Undesirable density variations may occur at this stage due to lubricant migration. A series of pastes was prepared using a group of commercial lubricants with different viscosities and surface tensions, and preforms prepared using a capillary rheometer. Lubricants of low surface tension readily wetted the polymer, leading to preform uniformity. Low viscosity lubricants migrated under pressure, causing non-uniform density and liquid concentration. Lubricants of high viscosity and surface tension exhibited more even radial distributions. 7 refs.

CANADA

Accession no.906524

Item 132

International Fiber Journal

18, No.6, Dec.2003, p.16-8

IMPROVING FABRICS WITH FLUOROPOLYMERS FROM LIVING ROOM SOFAS TO AIRPORT ROOFS

Melville A J

Whitford Corp.

The creation of a range of solvent and waterborne coatings, which are based upon a fluoropolymer (usually PTFE), and are easily applied onto or impregnated into fabrics, is reported. These compounds can be custom tailored to provide properties, which precisely match the requirements of a specific application, and are ideal for a wide range of fabric applications, including belting.

USA

Accession no.906101

Item 133

Oilfield Engineering with Polymers 2003. Proceedings of a conference held in London, 3rd-4th Nov.2003.
Shawbury,Rapra Technology Ltd., 2003, Session 7, Paper 18, p.211-226, 29cm,012

THERMOPROCESSABLE FLUOROPOLYMERS: HIGH PERFORMANCE MATERIALS FOR OILFIELD APPLICATIONS

Grippaldi G; May S
Solvay Solexis
(Rapra Technology Ltd.; Materials Engineering Research Laboratory Ltd.)

The key properties of three types of thermoprocessable fluoropolymer materials supplied by Solvay are described relative to their use for more demanding offshore oil and gas production application requirements. Detailed property comparisons are given in both tabular and graphical formats for ECTFE, PFA and PVDF materials covering mechanical, thermal, chemical and electrical properties. Typical use in umbilicals, flexible pipes and electrical cables are described. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; UK; WESTERN EUROPE

Accession no.907266

Item 134

Oilfield Engineering with Polymers 2003. Proceedings of a conference held in London, 3rd-4th Nov.2003.
Shawbury,Rapra Technology Ltd., 2003, Session 8, Paper 21, p.249-258, 29cm,012

TECNOFLON FLUOROELASTOMERS AND PERFLUOROELASTOMERS: THE RIGHT CHOICE FOR OILFIELD APPLICATIONS

Arrigoni S; Colombo L; Minutillo A; Sanvito G
Solvay Solexis SpA; Oldrati Guarnizioni Industriali SpA
(Rapra Technology Ltd.; Materials Engineering Research Laboratory Ltd.)

Fluoroelastomers are used for the more demanding high temperature oilfield applications where chemical resistance is required. To overcome problems of gas decompression blistering, special fluoroelastomer compounds were developed using blends of carbon black fillers. A range of fluoroelastomer PTFE nanocomposites are being developed to further improve mechanical properties using a co-coagulum process. Detailed results are presented describing tensile, compression and hardness tests on a range of compounds evaluated. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.907269

Item 135

Journal of Applied Polymer Science

91, No.3, 5th Feb.2004, p.1494-7

AN ANALYSIS OF THE CHANGES IN THE STRUCTURE AND TENSILE PROPERTIES OF POLYTETRAFLUOROETHYLENE FILMS UNDER VACUUM ULTRAVIOLET IRRADIATION

Guirong Peng; Hongbin Geng; Zushun Lu; Dezhuang Yang; Shiyu He
Harbin,Institute of Technology

Changes to the structure and tensile properties of polytetrafluoroethylene film after ultraviolet irradiation in a vacuum were investigated using differential scanning calorimetry, electron spin resonance (ESR) spectroscopy and tensile testing. Tensile strength decreased with increasing radiation dose with increased sensitivity at lower dose intensity. Melting temperature and enthalpy, and crystallisation enthalpy increased with dose, but maximum crystallisation temperature decreased. This behaviour was attributed to a reduction in molecular weight and destruction of crystal structure under UV irradiation, with chain end and peroxy radicals found using ESR spectroscopy 15 refs.

CHINA

Accession no.907402

Item 136

Journal of Applied Polymer Science

91, No.3, 5th Feb.2004, p.1962-6

EFFECT OF POLY(VINYLIDENE FLUORIDE) INTERFACE LAYER ON CHARGE STORAGE AND RESIDUAL POTENTIAL IN AMORPHOUS SELENIUM FILMS

Chand S; Sharma G D; Dwivedi S; Chandra R
India,National Physical Laboratory; Delhi,College of Engineering

Effects on charge storage capacity, initial surface potential and residual potential of the introduction of different thickness films of polyvinylidene fluoride as an interface layer in amorphous selenium films were examined. Charge storage capacity and residual potential were significantly reduced, whereas initial surface potential was significantly increased. This resulted in increased sensitivity for selenium films in the field of X-ray radiography. 18 refs.

INDIA

Accession no.907457

Item 137

Polymer

45, No.5, 2004, p.1679-88

STRUCTURAL EVOLUTION OF PVDF DURING STORAGE OR ANNEALING

Neidhoefer M; Beaume F; Ibos L; Bernes, A; Lacabanne C
Atofina; Paris XII,Universite; Toulouse,Universite Paul Sabatier

The effect of annealing of poly(vinylidene difluoride) (PVDF) at temperatures above the glass transition and below the melting temperature was investigated by differential scanning calorimetry, thermostimulated current spectroscopy and solid-state NMR. The study showed a progressive structural evolution takes place during such annealing. Its characteristics suggest a secondary crystallisation mechanism. In addition to forming extra-crystalline rigid material, this phenomenon is believed to generate increasing conformational constraints in the residual amorphous material. Accordingly, a progressive reduction of the molecular mobility was demonstrated by NMR during annealing. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.908141

Item 138
Polymers for Advanced Technologies
15, No.1-2, Jan.-Feb.2004, p.39-42

SYNTHESIS AND PROPERTIES OF FLUOROPOLYACRYLATE COATINGS

Liming Tang; Yi Li; Xiaomin Wu; Xiaofeng Shan; Weicheng Wang
Tsinghua,University

Hydroxyl fluoropolyacrylates of various compositions were prepared by solution copolymerisation of styrene, 2-hydroxypropyl acrylate, butyl acrylate and fluoroacrylate. They were further cured using hexamethylene diisocyanate to give hydrophobic coatings under ambient conditions. The curing reaction was studied by DSC and gel content analysis. The properties, especially the anti-frosting performance, of the cured coatings on copper plate were measured. The results indicated that the anti-frosting property was improved by the presence of the hydrophobic coating. 5 refs.

CHINA

Accession no.908399

Item 139
Journal of Applied Polymer Science
92, No.2, 15th April p.733-42

FILM-FORMING PROCESS FROM GLOBULAR POLYTETRAFLUOROETHYLENE LATEX PARTICLES

Durrschmidt T; Hoffmann H
Bayreuth,University

Film formation from polytetrafluoroethylene (PTF)E latex onto a glass substrate was examined for different annealing temperatures below, and above the melting temperature of the PTFE. The glass was dipped into the aqueous latex dispersion to form a layer of PTFE particles which were then studied before and after heating to the different temperatures by scanning electron microscopy. Only at temperatures above the polymer melting point was a coalesced film formed, and the mechanism of formation was by deformation of particles from the original globular shape into wormlike particles growing in length until coalescence took place. An intermediate stage gave a porous network of short wormlike objects. Confirmation of the mechanism of film formation was given by atomic force microscopy studies. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.908577

Item 140
Surface Coatings International Part B
87, No.B1, Feb.2004, p.51-6

ADVANCES IN FLUOROPOLYMER DISPERSIONS

Poggio T; Kapeliouchko V; Arcella V; Marchese E
Solvay Solexis

The preparation and characterisation of high-performance coatings based on bimodal poly(tetrafluoroethylene) blends of emulsion polymerised latexes with nanoparticle dispersions polymerised in microemulsion are described. Film-forming and particle-packing behaviour of the blends are discussed in terms of the optimum size ratio between small and large particles. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.908872

Item 141
Journal of Applied Polymer Science
91, No.5, 5th March 2004, p.2949-57

STUDY OF THE MECHANICAL AND ELECTRICAL PROPERTIES OF CARBON/POLY(VINYLIDENE FLUORIDE-TETRAFLUOROETHYLENE-PROPYLENE) FILMS CROSSLINKED WITH TRIETHYLENETETRAMINE: POSSIBLE APPLICATION AS BINDER FOR LITHIUM-ION BATTERY ELECTRODES

Zhonghai Chen; Christensen L; Dahn J R
Dalhousie University; 3M Co.

The mechanical properties of poly(vinylidene fluoride-tetrafluoroethylene-propylene) (PVDF-TFE-P) were studied as a function of the degree of crosslinking. Triethylenetetramine (TETA) and bisphenol the latter as incorporated into the polymer by the manufacturer) were used as crosslinkers to improve the mechanical properties of PVDF-TFE-P and carbon black-filled polymer. Crosslinking was carried out by adding magnesium oxide and calcium oxide, followed by heating. Bisphenol crosslinking improved the mechanical properties but further crosslinking using TETA was needed to obtain good extensibility under repeated deformation of carbon black/ PVDF-TFA-P composites. Adding crosslinks had little or no effect on the electrical properties of the composite films. The crosslinked polymer did not become brittle in solvents which are typically used in lithium battery electrolytes, so this binder system may be useful for electrode materials which show large volume changes during charge-discharge cycling. 18 refs.

CANADA; USA

Accession no.909442

Item 142

Journal of Applied Polymer Science

91, No.5, 5th March 2004, p.2958-65

MECHANICAL AND ELECTRICAL PROPERTIES OF POLY(VINYLIDENE FLUORIDE-TETRAFLUOROETHYLENE-PROPYLENE)/SUPER-S CARBON BLACK SWELLED IN LIQUID SOLVENT AS AN ELECTRODE BINDER FOR LITHIUM-ION BATTERIES

Zhonghai Chen; Christiansen L; Dahn J R
Dalhousie University; 3M Co.

The mechanical and electrical properties of poly(vinylidene fluoride-tetrafluoroethylene-propylene) (PVDF-TFE-P) and carbon black-filled PVDF-TFE-P composites were studied when film samples were immersed in a liquid solvent (ethylene carbonate: diethyl carbonate 1:2) commonly used in lithium ion battery electrolytes. Both bisphenol and triethylenetetramine (TETA) introduced a controlled degree of crosslinking into the terpolymer and improved the mechanical properties of both the polymer and the polymer/carbon composites. The TETA-crosslinked composites and better mechanical properties and a higher electrical reversibility than those crosslinked by bisphenol. Adding TETA had little or no effect on the electrical properties on the composite films. The crosslinked polymer did not become brittle in solvents which are typically used in lithium battery electrolytes, so this binder system may be useful for electrode materials which show large volume changes during charge-discharge cycling. 20 refs.

CANADA; USA

Accession no.909443

Item 143

Journal of Applied Polymer Science

91, No.5, 5th March 2004, p.3202-13

IN SITU POLYMERIZATION OF UNFLUORINATED AND FLUORINATED ACRYLIC COPOLYMERS FOR THE CONSERVATION OF STONE

Vicini S; Princi E; Pedemonte E; Lazzari M; Chiantore O
Genoa,University; Turin,University

In-situ polymerisation of butyl methacrylate/ethyl acrylate-based copolymers was carried out in a stone substrate in order to evaluate their effectiveness as consolidants for the stone. Three copolymers, synthesised in-situ and fluorinated by various copolymers were evaluated with reference to surface properties, water permeability and consolidation of the stone substrate. The results obtained were satisfactory and it was concluded that the in-situ polymerisation technique was a promising one. 43 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.909472

Item 144

Polymer International

53, No.4, April 2004, p370-7

PHYSICAL PROPERTIES AND BETA-PHASE INCREMENT OF AGNO3-FILLED POLY(VINYLIDENE FLUORIDE) FILMS

Tawansi A; Oraby A H; Badr S I; Elashmawi I S
Mansoura,University

The increase in crystalline phases in polyvinylidene fluoride (PVDF) has been investigated since the alpha and beta phases show piezoelectric effects. The PVDF films were cast from commercial polymer. The silver nitrate filler increased the presence of alpha and beta phases by 40 and 28 times respectively, for a filler content of 0.5%. The filler was found to form a charge-transfer complex indicated by the diamagnetic susceptibility and the optical absorption spectra. The infrared spectra showed the presence of polarons and bipolarons. Electrical resistivity measurements showed that DC conduction was achieved by an intrachain one-dimensional hopping mechanism. The films were also characterised by uv/vis spectroscopy, electron spin resonance, differential thermal analysis and x-ray diffraction. 43 refs.

EGYPT

Accession no.910305

Item 145

Polymer Preprints. Volume 44. Number 1. March 2003. Papers presented at the ACS meeting held New Orleans, La., 23rd-27th March 2003.
Washington, D.C., ACS,Divison of Polymer Chemistry, 2003, p.1142-3, 28cm., 012

PHASE BEHAVIOR IN SOLUTION PROCESSED PERFLUOROSULFONATE IONOMERS

Phillips A K; Moore R B
Southern Mississippi,University
(ACS,Div.of Polymer Chemistry)

Phase separation between the hydrophobic chain matrix and polar sulphonate groups in perfluorosulphonate ionomers such as Nafion (copolymers of tetrafluoroethylene and a perfluorovinyl ether with a terminal sulphonic acid group) creates a microphase separated morphology with ionic aggregation held together by strong Coulombic attractive forces. Neutralisation of Nafion with sodium and tetrabutylammonium counterions produced macroscopic changes to the material properties which showed a coupling of nanometre scale structure to macroscale behaviour. Solution processing of the blended sodium- and tetrabutylammonium Nafion forms created a mixed ionic aggregate which altered the morphology and properties of the membrane. 11 refs.

USA

Accession no.910346

Item 146

Macromolecules

36, No.26, 30th Dec.2003, p.9986-93

ADSORPTION OF HYDROPHOBICALLY END-CAPPED POLY(ETHYLENE OXIDE) ON POLY(TETRAFLUOROETHYLENE) LATEX PARTICLES: LIGHT SCATTERING STUDY

Myungwoong Kim; Jae-Hyun Sim; Daewon Sohn
Hanyang,University

The adsorption of an associating polymer, hydrophobically end-capped poly(ethylene oxide) urethane resin(HEUR), on PTFE latex was investigated in aqueous solution by static and dynamic light scattering studies. A PTFE latex(stabiliser-free)/HEUR/water system ((I), probe-polymer interaction system) was compared with a PTFE latex(with stabiliser)/PEO/water system ((II), probe-polymer non-interaction system). Static light scattering studies showed that there was no size difference in the II system on increasing the PEO concentration, while there was an increase of particle size in the I system on increasing the HEUR concentration. The stabiliser prevented interaction between PTFE and PEO in the II system, but HEURs were attached to the PTFE particles in the I system. In polarised and depolarised dynamic light scattering studies, a v parameter in ‘stretched exponential’ form of translational diffusion was a sensitive index for showing particle and polymer interaction in the solution, but the parameter of rotational diffusion was not sensitive. Based on the experimental data, three step adsorption mechanisms were proposed. 40 refs.

KOREA

Accession no.910506

Item 147

European Polymer Journal

40, No.4, April 2004, p.667-71

STUDY OF A NEW NOVEL PROCESS FOR PREPARING AND CO-STRETCHING PTFE MEMBRANE AND ITS PROPERTIES

Jizhi Huang; Jianchun Zhang; Xinmin Hao; Yuhai Guo
Dong Hua,University; Beijing,CPLA; Shanghai,New & Special Textile Research Center

The possibility of improving the elastic recovery properties of a PTFE/PU compound membrane through a co-stretching process was investigated. The experimental results obtained showed that the PTFE/PU membrane exhibited very good elastic recovery due to the presence of the PU. When the longitudinal stretching ratio of PTFE was 200%, the transverse stretching ratio was 850% and the thickness of PU was 0.03 mm. When the longitudinal and transverse elastic recoveries of PTFE/PU were 82.1% and 88.6%, respectively, the porosity was 78.0%, mean pore size was 0.382 micrometre and the water vapour permeability was 9330 g/24 h sq m. The use of the membrane for manufacture of SARS protective clothing in China is considered. 6 refs.

CHINA

Accession no.910553

Item 148

European Polymer Journal

40, No.4, April 2004, p.673-8

STUDY OF NEW PROTECTIVE CLOTHING AGAINST SARS USING SEMI-PERMEABLE PTFE/PU MEMBRANE

Xinmin Hao; Jianchun Zhang; Yuhai Guo
Dong Hua,University; Beijing,CPLA; Shanghai,New & Special Textile Research Center

The use of PTFE/PU membrane for chemical protective clothing was investigated. A PETP fabric with permanent antistatic, antibacterial, waterproof and anti-oil properties was prepared by texturing with organic conductive fibre, treating with JAM-Y1 antibacterial agent and then treating with XL-550 waterproofing agent. The PTFE/PU protective material was prepared by laminating with PETP fabric by paste dot coating and then coated with PU solution in a direct process. The PU coating agent, DMF and acetone were used in testing by surface tension and peel strength measurements. The penetration of the PTFE membrane laminated fabric, coated with PU solution, by poliomyelitis virus in liquid and animalcule in air was studied. The results obtained showed that the membrane could separate SARS virus in air and liquid, had a water vapour transmission rate of 11,496 g/24 h sq m and could provide satisfactory wearing comfort. 4 refs.

CHINA

Accession no.910554

Item 149

European Polymer Journal

40, No.4, April 2004, p.735-42

SINGLE-IONIC GEL POLYMER ELECTROLYTE BASED ON POLYVINYLIDENE FLUORIDE AND FLUORIDE-CONTAINING IONOMER

Li-Ying Tian; Xiao-Bin Huang; Xiao-Zhen Tang
Shanghai,Jiao Tong University

A single-ionic conductive gel polyelectrolyte was prepared from PVDF, propylene glycol carbonate(PC) and a fluorine-containing ionomer. Cation-carbonyl interaction behaviour, morphology and ionic conductive properties of the gel polyelectrolyte were studied by IR and NMR spectroscopies, DSC, SEM and complex impedance analysis. The results showed that the fluorine-containing ionomer was miscible with both PVDF and PC and that the carbonyl groups in the ionomer and PC could bond competitively with the cation. Both the content of fluorine-containing ionomer and the content of PC had a significant effect on the morphology and ionic conductivity of the samples. An ionic conductivity of above 0.0001 S/cm at room temperature could be attained and this electrolyte system exhibited a transport number of the sodium ion exceeding 0.99. 19 refs.

CHINA

Accession no.910561

Item 150

Macromolecules

37, No.6, 23rd March 2004, p.2119-27

BIAXIALLY ORIENTED LAMELLAR MORPHOLOGY FORMED BY THE CONFINED CRYSTALLIZATION OF POLY(1,4-BUTYLENE SUCCINATE) IN THE ORIENTED BLEND WITH POLY(VINYLIDENE FLUORIDE)

Yongjin Li; Kaito A; Horiuchi S

Japan,National Institute for Advanced Industrial Science & Technology

Studies of the above were conducted and it was found that the biaxial orientation of PVDF and poly(1,4-butylene succinate)(PBSU) in their blend was a new type of morphology of polymeric systems in which the crystallites of the two polymers were oriented in mutually opposite direction, crystalline domains of the two polymers were dispersed on the scale on tens of nanometers and the molecular chains of the two polymers were miscible in the amorphous phase. The TS of the biaxially oriented sample was higher in the perpendicular direction than that of the as-drawn sample of PBSU/PVDF blend. The biaxial orientation of the blend sample was thought to be responsible for the improvement of tensile properties. 34 refs.

JAPAN

Accession no.910654

Item 151

Polymer

45, No.6, 15 Mar.2004, p.2031-9

MELTING AND CRYSTALLIZATION BEHAVIOR OF POLY(TETRAFLUOROETHYLENE) BY TEMPERATURE MODULATED CALORIMETRY

Pucciariello R; Villani V

Potenza,Basilicata Universita

Temperature-modulated differential scanning calorimetry in quasi-isothermal mode was used to study investigate melting and crystallisation of melt-crystallised and native poly(tetrafluoroethylene) (PTFE) obtained by aqueous dispersion polymerisation. A large reversing heat capacity was observed in the melting and crystallisation regions and related to the very high sliding ability of PTFE chains in the pseudohexagonal phase, which is much larger than that of most semicrystalline polymers. Due to the crystal-crystal transition at 30 degC, which can be described as fusion in the longitudinal direction, melting of PTFE was considered intermediate between the irreversible melting of macromolecules and the completely reversible isotropisation of liquid crystalline polymers. These results confirmed published differences between the melting behaviour of melt-crystallised and native PTFE. 35 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.910856

Item 152

Journal of Polymer Research

11, No.1, 2004, p.1-7

THE EFFECTS OF PHENYLTRIMETHOXYSILANE COUPLING AGENTS ON THE PROPERTIES OF PTFE/SILICA COMPOSITES

Chen Y-C; Lin H-C; Lee Y-D

Taiwan,Industrial Technology Research Institute; National Tsing Hua University

Organic-inorganic composites consisting of PTFE and various amounts of silica treated with a coupling agent were prepared by high-speed dispersion and two-roll milling and the effect of the coupling agent on the properties of the composites investigated. Properties evaluated included thermal properties, such as thermal expansion coefficient, dielectric properties, tensile properties, morphological properties and water absorption. 15 refs.

TAIWAN

Accession no.912125

Item 153

Polymers for Advanced Technologies

14, No.10, Oct.2003, p.711-8

EFFECT OF PROTON IRRADIATION ON STRUCTURE AND OPTICAL PROPERTY OF PTFE FILM

Peng G; Yang D; He S

Harbin,Institute of Technology

Effects of protons on chemical structure and optical properties of PTFE film are in the energy range of 60 to 170 keV to simulate the effects of space proton irradiation environment. Results show that for PTFE film irradiated with protons, the change in C1s spectrum along with those in F1s and the FT-IR spectrum after irradiation, demonstrates that two processes take place simultaneously. One is substitution in which carbon to fluorine bonds can be broken by the protons and some positions of fluorine are occupied by active protons; the other is carbonification, which results in change of surface colour and an increase of carbon percentage on the irradiated surface. For the PTFE film irradiated with 150 keV protons, the spectral absorbance in the wavelengths longer than 300 nm increase unmonotonously with proton fluence, and an abnormally recovery decrease of the AAA with the increase of fluence in the range of 5 x 10 13 cm-2 to 10 15cm-2 is observed. The change of the spectral absorbance could be related to the competition of the carbonification and the substituting effect. The carbonification increases the spectral absorbance, while the substituting increases the amorphousness amount, leading to an increase in the transparency of the film. In addition, the creation of radicals can also contribute to the increase in absorbance. 19 refs.

CHINA

Accession no.912628

Item 154
Chemistry of Materials
16, No.10, 18th May 2004, p.1945-53
INTERACTION OF POLY(VINYLIDENE FLUORIDE) WITH GRAPHITE PARTICLES.
2. EFFECT OF SOLVENT EVAPORATION KINETICS AND CHEMICAL PROPERTIES OF PVDF ON THE SURFACE MORPHOLOGY OF A COMPOSITE FILM AND ITS RELATION TO ELECTROCHEMICAL PERFORMANCE
Yoo M; Frank C W; Mori S; Yamaguchi S
Stanford,University; Mitsubishi Chemical Corp.

The effects of molecular weight and polymer functionality and solvent evaporation kinetics on the surface distribution of poly(vinylidene fluoride)(PVDF) in composite films (as used as anodes in lithium ion batteries) with various types of graphite particles was investigated by fluorine-mapping using energy-dispersive spectroscopy and electron probe x-ray microanalysis. The PVDF distribution was correlated with the electrochemical behaviour of the composite anodes and the results are discussed. 33 refs.

JAPAN; USA

Accession no.913522

Item 155
Journal of Applied Polymer Science
92, No.3, 5th May 2004, p.1782-9
MORPHOLOGICAL STUDY OF POLY(VINYLIDENE FLUORIDE) ASYMMETRIC MEMBRANES: EFFECTS OF THE SOLVENT, ADDITIVE, AND DOPE TEMPERATURE
Yeow M L; Liu Y T; Li K
Bath,University

The preparation of asymmetric poly(vinylidene fluoride) membranes by solution casting from various solvents, including N,N-dimethylacetamide (DMAc), and their characterisation by SEM and water permeability, is described. The effects of various additives, such as glycerol or lithium perchlorate, and of the dope solution temperature on the morphology of membranes cast from DMAc were investigated by SEM and the results are discussed. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.914003

Item 156
Journal of Thermal Analysis and Calorimetry
74, No.2, 2003, p.569-74
THERMAL DECOMPOSITION OF PTFE IN THE PRESENCE OF SILICON, CALCIUM SILICIDE, FERROSILICON AND IRON
Ksiqzczak A; Boniuk H; Cudzilo S
Warsaw,University of Technology; Warsaw,Military Technical Academy

Simultaneous TG/DTA is used to study thermal decomposition of binary compositions containing PTFE with silicon (Si), calcium silicide (CaSi,), ferrosilicon (FeSi) or iron (Fe) powders. In nitrogen and under dynamic heating the thermal decomposition of Si/PTFE and CaSi2/PTFE is an exothermic process. The other two compositions decompose endo-thermically. In each case, the decomposition reactions show first-order kinetics but only iron does not change considerably the kinetics of PTFE depolymerisation. The constants of the decomposition rate at 850 K for silicon containing reducers are about four times higher than those of PTFE and Fe/PTFE. 6 refs.

EASTERN EUROPE; POLAND

Accession no.914141

Item 157
Journal of Membrane Science
238, No.1-2, 15th July 2004, p.21-32
AMORPHOUS TEFLONS AF AS ORGANOPHILIC PERVAPORATION MATERIALS: SEPARATION OF MIXTURES OF CHLOROMETHANES
Polyakov A M; Starannikova L E; Yampolskii Y P
Topchiev Institute of Petrochemical Synthesis

The effects of temperature, feed composition, downstream pressure and copolymer composition on the pervaporation of binary mixtures of dichloromethane, chloroform and carbon tetrachloride through amorphous copolymers of 2,2-bis-trifluoromethyl-4,5-difluoro-1,3-dioxole and tetrafluoroethylene were investigated. The process was characterised by the pervaporation separation index, based on permeability and selectivity of pervaporation.

RUSSIA

Accession no.914551

Item 158
Industrial and Engineering Chemistry Research
43, No.11, 26th May 2004, p.2643-9
THERMORESPONSIVE GATING CHARACTERISTICS OF POLY(N-ISOPROPYLACRYLAMIDE)-GRAFTED POROUS POLY(VINYLIDENE FLUORIDE) MEMBRANES
Li Y; Chu L-Y; Zhu J-H; Wang H-D; Xia S-L; Chen W-M
Sichuan,University

The preparation of thermoresponsive gating membranes with various grafting yields by grafting poly(N-isopropylacrylamide) onto porous poly(vinylidene fluoride) membrane substrates using plasma-induced pore-filling polymerisation, and their characterisation by FTIR, SEM and hydraulic and diffusional permeability studies at a range of temperatures, is described. The effects of different grafting yields on the thermoresponsive gating characteristics of the membranes are discussed. 19 refs.

CHINA

Accession no.914575

Item 159

Journal of Polymer Science: Polymer Physics Edition

42, No.13, 1st July 2004, p.2612-24

DIFFERENTIAL SCANNING CALORIMETRY AND THERMOGRAVIMETRIC ANALYSIS INVESTIGATION OF THE THERMAL PROPERTIES AND DEGRADATION OF SOME RADIATION-GRAFTED FILMS AND MEMBRANES

Brack H-P; Ruegg D; Buhrer H; Slaski M; Alkan S; Scherer G G

Paul-Scherrer-Institut; Zurich University of Applied Sciences at Winterthur

The effects of degree of fluorination, irradiation and grafting with polystyrene (PS) on the crystallinity and thermal degradation of grafted films of three fluoropolymers, poly(vinylidene fluoride), poly(ethylene-alt-tetrafluoroethylene) and poly(tetrafluoroethylene-co-hexafluoropropylene), were investigated using DSC and TGA. The thermal analysis of fuel cell membranes is discussed. 31 refs.

SWITZERLAND; WESTERN EUROPE

Accession no.915630

Item 160

Journal of Membrane Science

240, Nos.1-2, 1st Sept.2004, p.81-9

ALGINATE-COATED MICROPOROUS PTFE MEMBRANES FOR USE IN THE OSMOTIC DISTILLATION OF OILY FEEDS

Xu J B; Lange S; Bartly J P; Johnson R A

Queensland,University of Technology; Osnabruck,University of Applied Sciences

Osmotic distillation (OD) has two main advantages over thermally driven concentration processes attributable to its ambient temperature operation. These are maintenance of the integrity of thermally labile components and minimisation of the loss of volatile flavour/fragrance components. However, a major disadvantage of osmotic distillation is the potential for wet-out of the hydrophobic membrane when fouled by surface-active agents such as citrus oils. Sodium alginate hydrogel coatings are applied to PTFE membranes for protection against wet-out. The coating technique developed for this purpose results in a ten-fold increase in adhesion strength over that achievable by simple casting. This is effected by increased intrusion of the coating solution meniscus into the porous PTFE structure by surface tension adjustment with ethanol, precipitation of sodium alginate by the selective removal of water, and finally alginate crosslinking. Precipitation occurs both on the surface and in the void spaces between the PTFE fibres, thereby providing better anchorage for the coating. The coating decreases the overall OD mass transfer coefficient by less than 5%. OD flux measurements using coated membranes with 0.2, 0.4 and 0.8 wt.% orange oil-water mixtures over a period of 300 min indicate that the coating is successful in protecting the membrane against wet-out. An uncoated membrane is immediately wet out by a 0.2 wt.% orange oil-water OD feed. In a separate trial, a coated membrane retains its integrity after contact with a 1.2 wt.% oil-water mixture for 72 h.

AUSTRALIA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.916933

Item 161

Polymer Engineering and Science

44, No.2, Feb.2004, p.272-82

STRUCTURE AND PROPERTIES OF AN ORIENTED FLUOROSULFONATED/PTFE COPOLYMER

Gilbert M; Haworth B; Myers D J B

Loughborough,University; Regenesys Technologies Ltd.

The thermal characteristics of two Nafion precursors (NX112F and NX115F) were investigated and stretching experiments were performed on these precursors in an attempt to enhance the performance thereof prior to conversion to the ionic form. The precursors were uniaxially and biaxially oriented and their shrinkage behaviour, tensile properties and birefringence determined. A significant increase in tensile strength and a decrease in elongation at break were found to occur when precursor films were subjected to tentering at relatively low temperatures. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.917150

Item 162

Journal of Applied Polymer Science

93, No.1, 5th July 2004, p.209-18

PREPARATION AND CHARACTERIZATION OF PVDF/SILICA HYBRID MEMBRANES CONTAINING SULFONIC ACID GROUPS

Kim D S; Park H B; Lee Y M; Park Y H; Rhim J-W

Hanyang,University; Korea,Suncheon National University; Hannam,University

Organic-inorganic hybrid membranes of PVDF-cohexafluoropropylene (HEP) and composites containing sulphonic acid groups are prepared via in situ polymerisation of tetraethoxysilane (TEOS) and sulpho succinic acid using the sol-gel process. The membranes containing more sulphonic acid groups show higher vapour sorption and behaviour. The bound and free water content of the membrane is proportional to the SSA concentration. However, the hybrid membranes without SSA do not have free water. The ion conductivity of the membranes is proportional to the SSA concentration. Silica content in the hybrid membrane without SSA has a great effect on their mechanical properties. Tensile modulus and yield stress, increased and yield strain and elongation at break decrease with increased silica content. However, in the case of the hybrid membrane containing SSA modulus, yield stress decreases and yield strain and elongation at break increase with increased silica content due to the weak interactions between the hydrophobic polymer chain and the hydrophilic group of SSA.

KOREA

Accession no.917928

Item 163

High Performance Polymers

16, No.2, June 2004, p.319-37

GROUND-BASED DURABILITY PROJECTION OF EPTFE ON ISS BASED ON HUBBLE SPACE TELESCOPE DEGRADATION DATA

De Groh; Banks B A; Dever J A; Hodermarsky J C

US,NASA,Glenn Research Center; Ohio Aerospace Institute

Ground-based environmental durability tests have indicated that exposing materials in accelerated tests to environmental model predicted spacecraft mission exposures of known degradation sources does not simulate the extent of damage that occurs in the space environment. One approach to overcoming the difficulties in simulating the space environment using ground-based testing is to calibrate the facility using data from actual space-exposed materials to determine exposure levels required to replicate degraded properties observed in space. A ground-to-space correlation method is described that uses a multiple step process to determine the durability of expanded PTFE (ePTFE) for International Space Station (ISS) applications based on ground-based X-ray irradiation and heating exposure that simulates bulk embrittlement as occurs in fluorinated ethylene propylene (FEP) thermal insulation covering the Hubble Space Telescope (HST). This method is designed to damage the back surface of equivalent thickness ePTFE to the same amount of scission damage as occurring in HST FEP (based on elongation data) and then correct for differences in ground test ionising radiation versus space radiation effects, temperature variations, space ionising radiation environment variations (spacecraft altitude, inclination and duration), and thickness variations. The analysis indicates that, after a ten-year mission, the ISS ePTFE will have an extremely embrittled front surface, with surface cracks induced under any given strain, and a very ductile back surface. It is also found that a thermal induced strain of 0.1 will develop in the ePTFE, and under this strain condition, microscopic cracks will start developing very early in the mission at the exposed surface and develop to a depth of approximately 300 mu m after ten years. 20 refs.

USA

Accession no.917977

Item 164

Polymer

45, No.14, 2004, p.4669-75

SURFACE MODIFICATION OF HALOGENATED POLYMERS. 6. GRAFT COPOLYMERIZATION OF POLY(TETRAFLUOROETHYLENE) SURFACES BY POLYACRYLIC ACID

Combellas C; Fuchs A; Kanoufi F; Mazouzi D; Nunige D

CNRS-ESPCI

Local electrochemical reduction of polytetrafluoroethylene (PTFE) permits grafting with polyacrylic acid. Two reduction treatments were performed either by direct contact of an electrode or by scanning electrochemical microscopy (SECM); these processes led to disk-shaped reduced zones of ~1 mm and ~100 m diameter, respectively. Deactivation of reduced PTFE zones exposure to air or an oxidant led to unsaturations on the polymeric surface that were prone to graft copolymerisation. The polyacrylic acid graft is a cation exchanger that can complex to fluorescent and reducible cations such as toluidine blue. Desorption of the cation from the polymeric film was characterised by using UV-visible and fluorescence spectroscopy and SECM. SECM was used to study the desorption kinetics, which were interpreted in terms of a model that takes into account the slow diffusion of the cation inside the membrane. The mean thickness of the film, which was initially about 100 nm remained the same after one year of exposure to the air. 32 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.918901

Item 165

Journal of Applied Polymer Science

93, No.3, 5th Aug.2004, p.1012-20

A NEW APPROACH FOR SELECTIVE SURFACE MODIFICATION OF FLUOROPOLYMERS BY REMOTE PLASMAS

Park Y W; Inagaki N

Shizuoka,University

The selective surface modification of poly(ethylene-co-tetrafluoroethylene) and poly(vinylidene fluoride) films by exposure to remote argon, hydrogen and oxygen plasmas was studied. The modified surfaces were characterised by X-ray photoelectron spectroscopy, AFM and contact angle measurements, and the effects of plasma exposure on weight loss and surface chemical composition and functionalisation of the films are discussed. 12 refs.

JAPAN

Accession no.919917

Item 166
Journal of Adhesion
80, No.6, June 2004, p.497-520
WETTABILITY AND SURFACE ENERGETICS OF ROUGH FLUOROPOLYMER SURFACES
Sedev R; Fabretto M; Ralston J
South Australia,University

An investigation was carried out into the wettability of an amorphous, hydrophobic fluoropolymer (Teflon AF1600) coated on glass slides and containing various amounts of silica spheres to make the surface rough. Quasi-static advancing and receding contact angles were determined using the Wilhelmy technique and acoustic vibrations were employed as a means of reducing hysteresis. The experimental results were compared with predictions of the Wenzel equation and wettability represented in terms of a Zisman plot.

AUSTRALIA

Accession no.920636

Item 167
Polymer Engineering and Science
44, No.7, July 2004, p.1368-78
SIMULATION OF PTFE SINTERING: THERMAL STRESSES AND DEFORMATION BEHAVIOR
Andena L; Rink M; Polastri F
Milano,Politecnico; Ausimont CRS

The sintering process of poly(tetrafluoroethylene) cylinders as solid rods and hollow blocks was studied using a finite element model to predict residual thermal stresses by thermal, deformation and stress analysis using experimentally determined material properties obtained by TMA. Temperature and deformation distributions and residual stresses predicted from the model are discussed in comparison with experimental measurements. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.921402

Item 168
Polymer
45, No.15, 2004, p.5295-9
A TWO-DIMENSIONAL INFRARED CORRELATION SPECTROSCOPIC STUDY ON THE STRUCTURE CHANGES OF PVDF DURING THE MELT PROCESS
Yun Peng; Peiyi Wu
Fudan,University

Conformational changes taking place during the melting of polyvinylidene fluoride (PVDF) with increasing temperature were studied using two-dimensional infrared correlation spectroscopy. Changes were observed asynchronously in three kinds of PVDF components, amorphous PVDF, which relaxed its molecular chains, beta-PVDF, which transferred to the amorphous type, and alpha-PVDF which transferred last to the amorphous type. 14 refs.

CHINA

Accession no.921591

Item 169
Polymer
45, No.15, 2004, p.5327-40
A TUBULAR FILM EXTRUSION OF POLY(VINYLIDENE FLUORIDE): STRUCTURE/PROCESS/PROPERTY BEHAVIOR AS A FUNCTION OF MOLECULAR WEIGHT
J Xu; Johnson M; Wilkes G L
Virginia,Polytechnic Institute & State University

Strain induced crystalline morphology, as induced in five samples of polyvinylidene fluoride of different molecular weights but similar polydispersity by a uniaxial tubular film extrusion process, was examined using small and wide angle X-ray scattering, small angle light scattering, birefringence, scanning electron microscopy and atomic force microscopy. By maintaining constant extrusion and cooling conditions, the effects of molecular weight on the film morphology could be isolated, and it was observed that as molecular weight increased, the film structure changed from spherulitic to a high concentration of fibril nuclei and minimal development of folded chain lamellae perpendicular to them. Relaxation times for different samples were determined by use of a Carreau-Yasuda analysis, and from this a relative Deborah number was identified. Morphology of the samples changed considerably depending on whether this Deborah number was much less than, in the range of, or greater than unity. 38 refs.

USA

Accession no.921595

Item 170
Smart Materials and Structures
13, No.4, Aug.2004, p.791-9
USE OF POLYVINYLIDENE FLUORIDE AS SENSORS FOR THE EXPERIMENTAL MODAL ANALYSIS OF STRUCTURES
Rong-Liang Chen; Bor-Tsuen Wang
Taiwan,Industrial Technology Research Institute;
Taiwan,National Ping-Tung University of Science & Technology

The use of PVDF sensors for cantilever beam and simply supported plate modal testing was verified experimentally. The system modal parameters, including natural frequencies, damping ratios and mode shapes, were properly identified. In particular, the extracted mode shapes were physically interpreted as the slope difference between two edges of the PVDF sensors. The frequency response functions of PVDF sensors could also be derived and expressed in conventional modal format. The conventional modal parameter extraction methods could be suitable for application in determination of the modal parameters for the PVDF film structures. The system information was correctly provided and could be adopted for control application. The idea of smart structure testing was experimentally validated. 21 refs.

TAIWAN

Accession no.921969

Item 171

Macromolecules

37, No.15, 27th July 2004, p.5630-7

RELATIONSHIP BETWEEN THE SIZE OF THE LATEX BEADS AND THE SOLID-SOLID PHASE TRANSITIONS IN EMULSION POLYMERIZED POLY(TETRAFLUOROETHYLENE)

Marega C; Marigo A; Causin V; Kapeliouchko V;
Di Nicolo E; Sanguineti A
Padova,Universita; Solvay Solexis

Ten pure samples of PTFE were examined by DSC and wide-angle X-ray scattering(WAXS). The samples were prepared by emulsion or nanoemulsion polymerisation and differed in average molec.wt. and particle size. DSC was used to study the trends of the temperature and enthalpy of solid-solid transitions around room temperature. The samples with smaller particle size and lower molec. wt. departed markedly from the behaviour reported in the literature. The important role of particle size in determining this behaviour was established by experiments of crystallisation from the melt. WAXS was used to study the crystalline phases of PTFE as a function of temperature and to confirm the hypotheses put forward in the DSC analysis. WAXS data showed that the degree of order of the crystallites in the pure powders was controlled by particle size. The confinement of the as-polymerised PTFE crystals in small entities thus had a similar effect on the crystal correlation length and on the solid-melt transitions, while it appeared that the molec.wt. by itself was not able to induce such a behaviour in the melt-crystallised polymers. 40 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.922778

Item 172

Polymer

45, No.19, 2004, p.6569-73

PREPARATION OF PROTON EXCHANGE MEMBRANES BASED ON CROSSLINKED POLYTETRAFLUOROETHYLENE FOR FUEL CELL APPLICATIONS

Yamaki T; Kobayashi K; Asano M; Kubota H; Yoshida M
Japan,Atomic Energy Research Institute;
Gunma,University

Proton-exchange membranes were prepared by the gamma-ray-induced grafting of styrene into crosslinked polytetrafluoroethylene (PTFE) films and subsequent sulphonation. The degree of grafting was controlled in the range 7-75% by the crosslinking density of the PTFE matrix and by the grafting conditions. Films with a grafting yield of 30% or more to produced ion-exchange membranes with a homogeneous distribution of sulphonic acid groups. The resulting membranes showed a high ion-exchange capacity of up to 2.9 meq/g, which exceeded the performance of commercially available perfluorosulphonic acid films. They films appeared to be dimensionally stable in water and are potentially useful in polymer electrolyte fuel cells. 16 refs.

JAPAN

Accession no.923107

Item 173

Journal of Macromolecular Science B

B43, No.4, 2004, p.741-54

THERMOREVERSIBLE GELATION OF POLY(VINYLIDENE FLUORIDE) IN PROPYLENE CARBONATE

Koim B S; Baek S T; Song K W; Park I H; Lee J O;
Nemoto N
Pusan,National University; Kumoh,National University of Technology; Kyushu,University

Thermoreversible gelation of PVDF in propylene carbonate (PC) solutions at relatively low concentrations is studied in terms of the gelation time (or rate) as a function of temperature and polymer concentration. A master curve can be made for the gelation time temperature curves using the temperature shift based on the difference in the gel melting temperature (Tgm) at different PVDF concentrations. The apparent activation energy of gelation is estimated to be proportional to (Tgm - T)-1.8. The gel melting enthalpy determined from the modified Eldrige-Ferry equation is 18.67 kJ/mol. In dried gel films, many spherulites connected by tie molecules are observed by scanning electron microscopy. From wide angle x-ray diffraction measurements, crystallites from PVDF gels are found to consist only of the gamma-type crystal with the TTTGTTTG conformation, irrespective of polymer concentration. As judged from the results obtained, the gelation of PVDF in PC seems to proceed mainly via liquid-liquid phase separation (even if followed by crystallisation in the final stage) within the concentration range covered. 35 refs.

JAPAN; KOREA

Accession no.923165

Item 174

European Polymer Journal

40, No.9, p.2089-95

CRYSTALLIZATION KINETICS OF A FLUORINATED COPOLYMER OF TETRAFLUOROETHYLENE

Pantini R; De Santis F; Speranza V; Besana G B;
Titomanlio G
Salerno,University; Solvay Solexis SpA

The crystallisation kinetics of a commercial fluorinated copolymer of tetrafluoroethylene (MFA) is studied by standard calorimetric tests and fast cooling tests. Tests are carried out by a new apparatus based on detection of light intensity transmitted through a polymer film. A simple kinetic model is adopted for a description of the crystallinity evolution. It takes into account the dependence of the maximum degree of crystallinity on temperature. The comparison between model results and experimental data is satisfactory in the whole range of cooling rates studied. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.924009

Item 175
Journal of Applied Polymer Science
93, No.5, 5th Sept.2004, p.2266-74
FORMATION OF MULTILAYER POLYACRYLIC ACID/POLYVINYLIDENE FLUORIDE COMPOSITE MEMBRANES FOR PERVAPORATION
Lin D-J; Chang C-L; Shaw H-Y; Jeng Y-S; Cheng L-P
Tamkang,University

Dual- and multi-layer composite membranes, consisting of polyacrylic acid and PVDF were synthesised by plasma-induced polymerisation. Membranes were used in a pervaporation process to separate ethanol-water solutions. Results were compared with the performance of a conventional membrane that had only one permselective layer. 29 refs.

CHINA

Accession no.924319

Item 176
Macromolecules
37, No.16, 10th Aug.2004, p.6170-6
LASER LIGHT SCATTERING STUDY ON THE STRUCTURE OF A POLYVINYLIDENE FLUORIDE AGGREGATE IN THE DILUTE CONCENTRATION STATE
Park I H; Yoon J E; Kim Y C; Yun L; Lee S C
Kumoh,National University of Technology

Details are given of the formation of complex aggregates of PVDF in very narrow size distribution in propylene carbonate and butyrolactone. The aggregates were examined using laser light scattering. Static scattering intensities, scattering patterns and hydrodynamic radii were investigated. The intensity patterns of scattered light and large hydrodynamic ratios were explained using core-shell structure and core size distributions. 34 refs.

KOREA

Accession no.924397

Item 177
Polymer
45, No.22, 2004, p.7615-25
THE PROPERTIES OF POLY(TETRAFLUOROETHYLENE) (PTFE) IN COMPRESSION
Rae P J; Dattelbaum D M
Los Alamos National Laboratory

Samples of poly(tetrafluoroethylene) (PTFE, DuPont 7A and 7C) were tested in compression at strain-rates between 0.0001/s and 1/s at -198 to 200 degC. Additionally, a temperature-compression series was measured at -100 and 150 degC at a strain rate of 3200/s by using a Split-Hopkinson pressure bar. To investigate the small-strain response, strain gauges were used to measure the axial and transverse strain, and the Poisson ratio was quantified. The mechanical properties were markedly affected by the strain rate and the temperature. Moduli were determined by several methods and the trend with respect to temperature supports the suggestion that the glass-transition temperature of PTFE is about -100 degC. The physical properties of sintered PTFE were measured and the crystallinities were measured by several techniques. 40 refs.

USA

Accession no.925754

Item 178
Journal of Materials Science
39, No.16-17, 15th Aug.-1st Sept.2004, p.5613-5
PREPARATION OF HYDROPHOBIC THIN FILMS BASED ON PTFE/ACRYLIC RESIN/SIO2 COMPLEX
Gu G; Zhang Z; Dang H; Wu Z
Henan,University

The preparation of hydrophobic thin films based on poly(tetrafluoroethylene) (PTFE)/acrylic resin/silica complex by the emulsion polymerisation of methyl methacrylate, butyl methacrylate and styrene monomers in a silica sol containing 3-trimethoxysilylpropyl methacrylate as crosslinking agent followed by addition of water-dispersible PTFE, and spraying onto substrates, is described. The films were characterised by contact angle measurement, SEM, UV-visible absorption, XPS, adhesion and mechanical properties and the results are discussed. 8 refs.

CHINA

Accession no.925793

Item 179
Journal of Polymer Science: Polymer Physics Edition
42, No.18, 15th Sept.2004, p.3487-95
CONFORMATIONAL CHANGES AND PHASE TRANSFORMATION MECHANISMS IN PVDF SOLUTION-CAST FILMS
Salimi A; Yousefi A A
Iran,Polymer & Petrochemical Institute

Supramolecular structure formations in PVDF-dimethylacetamide and PVDF-cyclohexanone systems were studied by changing the drying temperature. According to intermolecular interactions between PVDF and solvent, a mechanism which was important in stabilising the final PVDF crystalline-state conformation was introduced. Variation in solvent ability to stabilise a certain chain conformation was examined. The effects of uniaxial stretching on the beta phase content and piezoelectric coefficient were also investigated. 42 refs.

IRAN

Accession no.926305

Item 180

Journal of Applied Polymer Science

84, No.5, 2nd May 2002, 1101-5

PRESSURE-VOLUME-TEMPERATURE-VISCOSITY RELATIONS IN FLUORINATED POLYMERS

Utracki L A

Canada,National Research Council

The pressure-volume-temperature (PVT) behaviour of fluorinated polymers is analysed by the Simha-Somcynsky (S-S) equation of state (EoS). In this paper, experimental PVT data in the molten state of two PVDF and three PVDF-HFP resins were fitted to the S-S EoS, which was found to describe well the PVT behaviour of the five fluoropolymers in the full range of pressure, temperature and composition. 11 refs.

CANADA

Accession no.901857

Item 181

Macromolecular Symposia

No.200, 2003, p.101-10

STUDY OF THE INTERACTION POLYMER/ ORGANIC SOLVENTS/SALT IN MICROPOROUS PVDF SEPARATOR FOR LITHIUM BATTERIES

Saunier J; Alloin F; Sanchez J-Y

ST.MARTIN D'HERES,LABORATOIRE D'ELECTROCHIMIE ET DE PHYSICOCHIMIE DE

The interactions between microporous poly(vinylidene fluoride) (PVdF), polar liquid electrolytes such as diethyl carbonate, dimethyl carbonate and ethylene carbonate, and with the salt, lithium hexafluorophosphate, were investigated using ionic conductivity, swelling studies, proton and fluorine-19 NMR, DSC, FTIR, X-ray scattering and DMA. The results are discussed in terms of the use of the use of PVdF as microporous separator in lithium batteries. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.901604

Item 182

Macromolecular Chemistry and Physics

204, No.14, 22nd Sept.2003, p.1765-70

THERMOREVERSIBLE SUPRAMOLECULAR ORGANIZATION IN POLY(VINYLIDENE FLUORIDE)-DODECYL BENZENE SULFONIC ACID BLENDS

Rahman M H; Malik S; Nandi A K

Indian Association for the Cultivation of Science

Polyvinylidene fluoride was blended with the above surfactant and the resulting mixtures characterised by polarised optical microscopy, scanning electron microscopy, DSC and wide angle X-ray diffraction. It was found that the PVDF mixtures phase separated in the melt state and that a reversible mesomorphic order formed in the surfactant-rich phase of the mixtures, which exhibited a fibrillar network morphology. The mesomorphic nature of the mixtures was attributed to the supramolecular organisation of the surfactant molecules within the lamella structure of the blends. 33 refs.

INDIA

Accession no.901430

Item 183

Polymer Engineering and Science

43, No.10, Oct.2003 p1702-14

FRACTURE TOUGHNESS EVALUATION OF POLYTETRAFLUOROETHYLENE

Joyce J A

US,Naval Academy

Fracture tests were carried out on samples of polytetrafluoroethylene, machined from a sheet, at three different temperatures and four different test rates. Tensile tests were also carried out at a range of temperatures. At ambient temperatures, crack propagation at fracture was difficult, but lower temperatures rapidly degraded the fracture resistance of the material. Rapid loading increases the rate of fracture degradation. 12 refs.

USA

Accession no.901142

Item 184

Polymer Bulletin

50, Nos.5-6, July 2003, p.381-7

GENERATION OF TEFLON-LIKE LAYERS ON CELLOPHANE SURFACES UNDER ATMOSPHERIC PRESSURE NON-EQUILIBRIUM SF6-PLASMA ENVIRONMENTS

Cruz-Barba L E; Manolache S; Denes S

Wisconsin-Madison,University

A novel atmospheric pressure SF6-cold-plasma method is suggested for the conversion of cellophane surfaces into perfluorinated layers. This approach takes advantage of the efficiency of SF, (x less than 6) species generated in the discharge for oxygen extraction, dehydro-fluorination and fluorination reaction. It is shown that relative surface atomic concentrations as high as 58% can be created under relatively short treatment times (5 min), and that CF2 groups are the dominant components of the plasma-generated surface layers. Surface morphology analysis by atomic force microscopy and scanning electron microscopy indicate that SF6-discharge environments selectively interact with the amorphous and crystalline zones of cellulose. Contact angle evaluations of plasma-exposed cellophane surfaces show an intense hydrophobic character, with contact angles as high as 120 deg. Potential applications of perfluorinated cellophane layers are suggested. 9 refs.

USA

Accession no.901100

Item 185

Elastomers Times

No.33, 2003, p.1/4

VITON EXTREME FLUOROELASTOMERS

Viton Extreme fluoroelastomers, a family of high performance specialty products based on Advanced Polymer Architecture, are designed to meet the demanding performance requirements currently not met by traditional high performance elastomers. Viton Extreme products combine the excellent thermal resistance of Viton with the unique resistance to chemicals and to environments that have historically exceeded the performance of conventional fluoroelastomers. Viton Extreme TBR-605CS, a TFE/propylene copolymer, is a new, totally base-resistant Viton polymer that is inherently resistant to caustic chemicals and provides superior resistance to hydrocarbon oils and acids.

DUPONT DOW ELASTOMERS SA

SWITZERLAND; WESTERN EUROPE

Accession no.900918

Item 186

Polymer

44, No.23, 2003, p.7143-55

POLYMER GEL ELECTROLYTES PREPARED BY THERMAL CURING OF POLY(VINYLIDENE FLUORIDE)-HEXAFLUOROPROPENE/ POLY(ETHYLENE GLYCOL)/PROPYLENE CARBONATE/LITHIUM PERCHLORATE BLENDS

Changmin Lee; Jin-Hwan Kim; Jin-Young Bae
Sung Kyun Kwan University

The preparation of cured polymer gel networks based on poly(vinylidene fluoride)-hexafluoropropene, using the acetone oxime of polymeric methylene diphenyl diisocyanate as thermal crosslinking agent, polyethylene glycol as coreactant, propylene carbonate (plasticiser) and lithium perchlorate is described. The gels were characterised by FTIR, DSC, electrochemical impedance spectroscopy and linear sweep voltammetry and the results discussed in comparison with those for gels prepared in the absence of poly(vinylidene fluoride)-hexafluoropropene. 32 refs.

SOUTH KOREA

Accession no.900241

Item 187

Journal of Thermal Analysis and Calorimetry

73, No.3, 2003, p.735-43

CRYSTALLIZATION, MELTING AND STRUCTURE OF POLYPROPYLENE/ POLY(VINYLIDENE-FLUORIDE) BLENDS

Varga J; Menyhard A
Budapest,University of Technology & Economics

Blends of isotactic PP and its beta-nucleated form with PVDF were prepared in a twin-screw extruder and their melting behaviour, crystallisation characteristics and phase structure investigated by DSC and polarised light microscopy. It was found that the phase structure of the blends was heterogeneous in the molten state, PVDF had an alpha-nucleating effect on PP, which served as the matrix, and crystallisation of PP occurred in the alpha-form in spite of the presence of a beta-nucleating agent. 17 refs.

EASTERN EUROPE; HUNGARY

Accession no.899909

Item 188

Polymer

44, No.19, 2003, p.5789-96

STRUCTURE ALTERATIONS OF PERFLUORINATED SULFOCATIONIC MEMBRANES UNDER THE ACTION OF ETHYLENE GLYCOL (SAXS AND WAXS STUDIES)

Krivandin A V; Solov’eva A B; Glagolev N N;
Shatalova O V; Kotova S L
Russian Academy of Sciences

Perfluorinated sulphocationic membranes based on tetrafluoroethylene-perfluorovinyl ether copolymers were soaked in ethylene glycol at 110C and then washed with water. Small angle and wide angle X-ray scattering studies showed that this treatment of the membranes caused fast and stable alterations of their nanostructure while their molecular structure remained essentially unchanged. On the basis of the paracrystalline layered model, the structure alterations of the membranes were interpreted as an increase in the thickness of the aqueous layers (ionic channels) in ionic clusters of the membranes. A two-fold growth of the quantum yield of anthracene photooxidation catalysed by tetraphenylporphyrin (TPP) immobilised on the membranes treated with ethylene glycol was explained by a higher TPP accessibility for the substrate because of the broadened ionic channels in the membranes. 43 refs.

RUSSIA

Accession no.899754

Item 189

Journal of Biomaterials Science: Polymer Edition

14, No.9, 2003, p.917-35

CELL ATTACHMENT AND BIOCOMPATIBILITY OF POLYTETRAFLUOROETHYLENE TREATED WITH GLOW-DISCHARGE PLASMA OF MIXED AMMONIA AND OXYGEN

Chen M; Zamora P O; Som P; Pena L A; Osaki S
BioSurface Engineering Technologies Inc.; Brookhaven National Laboratory

The plasma generated from a gas mixture of ammonia plus oxygen was used to impart chemical and biological characteristics to PTFE. Surfaces were examined by ESCA. The surface hydrophilic of plasma-treated PTFE was studied by measuring the contact angle. Cell culture tests included endothelial cell attachment, protein absorption and subcutaneous implantation. 34 refs.

USA

Accession no.899617

Item 190

European Polymer Journal

39, No.10, Oct.2003, p.1995-2003

NEW STRATEGIES FOR THE SYNTHESIS OF PARTIALLY FLUORINATED ACRYLIC POLYMERS AS POSSIBLE MATERIALS FOR THE PROTECTION OF STONE MONUMENTS

Mazzola M; Frediani P; Bracci S; Salvini A
Florence,University; Italy,Istituto per la Conservazione e la Valorizzazione dei Beni Culturali

Polyacrylic esters containing various amounts of fluorine in the alpha-position of the main chain were synthesised by the copolymerisation of ammonium 2-fluoroacrylate with acrylic acid followed by esterification with various compounds and characterised by FTIR spectroscopy, NMR spectroscopy, HPLC and DSC. The effects of polymerisation conditions and degree of esterification on polymer characteristics were studied and the suitability of the polymers for protecting stone monuments briefly considered. 36 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.899233

Item 191

Macromolecules

36, No.15, 29th July 2003, p.5661-5

MECHANISM OF DECAY REACTION OF FREE RADICALS TRAPPED IN POLY(TETRA FLUOROETHYLENE) RELATED WITH THE HETEROGENEITY IN STRUCTURE

Hara S; Yamamoto K; Shimada S; Nishi H
Nagoya,Institute of Technology; Hitachi Cable Ltd.

The reactions of free radicals produced in gamma-irradiated PTFE were studied by ESR spectroscopy. beta-Scission reaction of main chain radicals and fluorine abstraction of chain end radicals were detected directly. The decay reactions of the free radicals were examined in relation to the molecular motion of the matrix polymer. The rates of these reactions were also discussed in relation to the marked heterogeneity in structure. The behaviours of free radicals trapped in crosslinked PTFE were compared with those in non-crosslinked PTFE to clarify the effects of molecular motion and structure on the reactions in the solid state. 33 refs.

JAPAN

Accession no.898316

Item 192

Macromolecular Rapid Communications

24, No.10, 4th July 2003, p.603-8

MECHANISTIC INVESTIGATION INTO THE UNIQUE ORIENTATION TEXTURES OF POLY(VINYLIDNE FLUORIDE) IN BLENDS WITH NYLON 11

Li Y; Kaito A
Japan,National Institute of Advanced Industrial Science and Technology

Self-seeded crystallisation experiments are carried out to detect the mechanism of the unique orientation behaviour of PVDF in oriented PVDF/nylon 11 blends. It is found that primary nuclei have no effects on the final orientation textures adopted by PVDF. The results show that the PVDF crystal orientation in the oriented blends is determined in the early stage of crystal growth, thus a trans crystallisation mechanism is preferred. 27 refs.

JAPAN

Accession no.896972

Item 193

Journal of Applied Polymer Science

90, No.1, 3rd Oct.2003, p.115-21

EFFECTS OF VACUUM ULTRAVIOLET ON THE STRUCTURE AND OPTICAL PROPERTIES OF POLY(TETRAFLUOROETHYLENE) FILMS

Guirong Peng; Dezhuang Yang; Jincheng Liu; Shiyu He
Harbin,Institute of Technology

The effects of vacuum UV(VUV) at wavelengths of 5 to 200 nm on the microscopic structure and optical properties of PTFE films were investigated using X-ray photoelectron spectroscopy. After VUV irradiation, the content of fluorine decreased, while the content of carbon increased in the surface layers of PTFE films. The content of fluorine decreased significantly with an increase in the VUV intensity, but it did not change with the irradiation dose. Under VUV irradiation, the number of CF2 groups decreased, while the number of CCF and CCF2 groups and conjugated bonds increased. This indicated that carbonification took place in the surface layers of PTFE films. Lower intensity VUV irradiation at larger doses induced a more complete change in the surface structure. The spectral transmittance for the PTFE films decreased gradually with an increase in the VUV irradiation dose and more significantly under lower intensity VUV irradiation. 29 refs.

CHINA

Accession no.896385

Item 194

Smart Materials & Structures

12, No.3, June 2003, p.384-92

SPATIAL APERTURE SHADING OF POLYVINYLIDENE FLUORIDE APPLIED TO DISTRIBUTED SYSTEMS FOR UNIFORM DAMPING CONTROL

Isler B; Washington G

Ohio,State University

A model for a vibration control system was derived in which spatially etched PVDF was used to implement uniform damping control on a distributed system. Uniform damping node control(UDNC) theory stated that near optimal vibration control could be achieved when all modes were damped at the same exponential decay rate, when the open-loop and closed-loop natural frequencies of the structure were identical and when the closed-loop modal shapes were identical to the open-loop modal shapes. In order to help achieve this, in a system with N modes participating in a response, sensor/actuator pairs were placed at the nodes of the N + 1 modes. Spatially shaded PVDF actuators were distributed actuators that produced pseudo-discrete forces due to the special weighting applied to the etched electrodes. The system was demonstrated using a spring steel cantilevered beam and spatially etched PVDF actuators that were placed according to nodal control theory. When given the set of gains that were attributed to UDNC, the modes decoupled, reducing spillover. Uniform damping control was thus realised experimentally. 20 refs.

USA

Accession no.896331

Item 195

European Polymer Journal

39, No.8, Aug.2003, p.1713-20

INFLUENCE OF ANNEALING AND CHAIN DEFECTS ON THE MELTING BEHAVIOUR OF POLY(VINYLIDENE FLUORIDE)

Marega C; Marigo A

Padova,Universita

The melting behaviour of PVDF is investigated by differential scanning calorimetry (DSC) and small- and wide-angle X-ray scattering in order to study the influence of the chain defects content and of the temperature of annealing on the crystallisation and melting behaviour. All the DSC scans show a double endotherm and the analysis of the data suggests that the low temperature endotherm is due to the melting of a population of thin lamellae, whose thickness increases during the annealing, but a high content of chain defects prevents the lamellar thickening and the main effect in this case is the crystallisation of thin lamellae from a portion of polymer, which does not crystallise during the quenching from the melt. Furthermore, the two melting endotherms, which are observed, can be partially ascribed to a melting recrystallisation process. Furthermore, stepwise isothermal cooling is performed in a differential scanning calorimeter followed by melting scans of fractionated PVDF samples to point out the possible presence of a series of endothermic peaks. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.895950

Item 196

Macromolecules

36, No.10, 20th May 2003, p.3646-51

CURVATURE-DIRECTED CRYSTALLIZATION OF POLY(VINYLIDENE DIFLUORIDE) IN NANOTUBE WALLS

Steinhart M; Senz S; Wehrspohn R B; Gosele U; Wendorff J H

Philipps-Universitat; Max-Planck-Institut fuer Mikrostrukturphysik

The direction of crystal growth in nanotubes has been investigated using different preparation methods. Anisotropic nanotube walls are important for many electronic and photonic applications. Poly(vinylidene difluoride) (PVDF) was chosen as a model polymer for the study since it is partially crystalline. Nanotubes were produced from either polymer melt or solution by wetting porous templates. The results were studied by x-ray diffraction which showed that crystals grow preferentially along the long axis of the nanotube, and the polymer solutions produced poor crystallinity compared with the polymer melt. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.895918

Item 197

Paint and Coatings Industry

19, No.9, Sept.2003, p.56/64

PERFORMANCE OF DURABLE FLUOROPOLYMER COATINGS

Asakawa A

Asahi Glass Co.Ltd.

Fluoropolymer coatings are known as highly durable coatings that can maintain their initial performance for a long period. In the 1980s, Asahi Glass developed a copolymer of fluoroethylene and vinyl ether as a solvent-soluble fluoropolymer, known as FEVE. FEVE could be used on-site for applications such as heavy-duty architectural and aerospace coatings, as well as for oven-baked coatings. When these fluoropolymer coatings were applied as protective coatings, they were used as a topcoat and protected under-layer basecoats and substrates from UV attack. FEVE coatings as bridge topcoats, on-line coatings and clearcoats are discussed. In recent years, waterborne fluoropolymer coatings have been developed and their sales are increasing mainly in architectural applications. Waterborne FEVE has excellent weatherability and it can be blended with acrylic emulsions, making it possible to design coatings in which weather resistance and cost is between that of fluoro- and acrylic polymers. 4 refs.

JAPAN

Accession no.895770

Item 198
Macromolecules
36, No.12, 17th June 2003, p.4360-7

PTFE-POLYSTYRENE CORE-SHELL NANOSPHERES AND NANOCOMPOSITES

Giani E; Sparnacci K; Laus M; Palamone G; Kapeliouchko V; Arcella V
Piemonte Orientale,University; Solvay Solexis SpA

PTFE latices with submicrometre-sized particles were used as seeds in the emulsifier-free emulsion polymerisation of styrene and PTFE-PS core-shell nanospheres were produced. Stable latices were generally obtained. The sphere size and size distribution could be controlled by changing the ratio between the styrene monomer and the PTFE seed in the reaction mixture. A slightly hemispherical morphology was observed in all cases. Peculiar effects were observed which were related to the high degree of segregation of PTFE cores and their small size, and possibly to the PTFE/PS interface. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.895502

Item 199
Polymer
44, No.15, 2003, p.4293-300

CREEP OF PVDF MONOFILAMENT SUTURES: SERVICE PERFORMANCE PREDICTION FROM SHORT-TERM TESTS

Mano J F; Lopes J L; Silva R A; Brostow W
Minho,Universidade; Porto,Instituto Superior de Engenharia; North Texas,University

Isothermal short-term creep of PVDF monofilament structures is determined at several temperatures between 10 and 90 deg.C under the stress of 10 MPa. Long term service performance is predicted for ten decades of time. The compliance master curve as a function of time fits a hyperbolic sine equation. The temperature shift factor as a function of the temperature is accurately represented by a general equation based on free volume. A simple relationship between the two parameters of the equation is explored. The viscoelasticity of PVDF is also seen in dynamic mechanical analysis performed at the frequency of 1 Hz. The origin of the viscoelastic character well present in the deformability of the PVDF in service is due to the occurrence of the alpha c relaxation that is active at ~50 deg.C (E” peak at 1 Hz). 54 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; USA; WESTERN EUROPE

Accession no.895268

Item 200
Polymer
44, No.15, 2003, p.4197-204

EFFECT OF POLY(VINYLIDENE FLUORIDE) BINDER CRYSTALLINITY AND GRAPHITE STRUCTURE ON THE MECHANICAL STRENGTH OF THE COMPOSITE ANODE IN A LITHIUM ION BATTERY

Yoo M; Frank C W; Mori S; Yamaguchi S
Stanford,University; Mitsubishi Chemical Corp.

The mechanical strength of a series of composites consisting of carbon particles bound together by PVDF, which is closely related to the carbonaceous anode in a lithium ion battery, is evaluated. A balanced beam scrape adhesion tester is used and the influence of carbon particle structure, the chemical properties of PVDF, and the processing parameters temperature and casting solvent on the adhesion of the composite film to a copper substrate are evaluated. The composite prepared with amorphous carbon shows over ten times higher adhesion strength than those fabricated from other graphite materials. This results from chemical binding that is intermediate between semi-ionic and covalent C-F bonds as detected by X-ray photoelectron spectroscopy. To address the effect of the crystalline phase of the binder on the adhesion strength, PVDF crystallinity in the composite films is investigated using differential scanning calorimetry. Samples with higher crystallinity show higher adhesion strength, independent of annealing temperature and casting solvent. The scratch adhesion is also measured for swollen electrodes immersed in 3:7 volume ratio of ethylene carbonate:ethyl methyl carbonate (EC:EMC) at different temperatures. After being swollen, the composite films prepared from PVDF modified with hydroxyl functional groups show higher adhesion strengths than the others due to their low uptake of the electrolyte solvent. 30 refs.

JAPAN; USA

Accession no.895258

Item 201
Iranian Polymer Journal
12, No.3, May-June 2003, p.165-70

SOME ASPECTS OF THE THERMO-KINETIC NON-ISOTHERMAL STUDY ON THE THERMOOXIDATIVE DEGRADATION OF POLYTETRAFLUOROETHYLENE CONTAINING ADDITIVES

Chiriac M; Rosu A; Dumitras M; Odochian L
Bucharest,Res.Inst.for Rubber & Plastics Process.;

Jassy,Cuza Al.I.University

An investigation was carried out into the thermooxidative degradation of PTFE with and without additives using non-isothermal differential thermal analysis. Additives employed included graphite, bronze and glass fibres. The kinetic parameters were predicted using thermo-kinetic equations and compared with the experimentally determined kinetic parameters. The effects of the additives on the heat stability and thermooxidative degradation of the PTFE were examined and evidence found for the existence of a compensation effect. 12 refs.

EASTERN EUROPE; RUMANIA

Accession no.895110

Item 202
Journal of Applied Polymer Science
89, No.12, 19th Sept.2003, p.3396-3403

CRYSTALLIZATION KINETICS AND PVT BEHAVIOR OF POLY(VINYLIDENE FLUORIDE) IN PROCESS CONDITIONS

Pantani R; Speranza V; Besana G; Titomanlio G
Salerno,University; Ausimont SpA

Fluoropolymers have gained considerable industrial success in recent years, and the increasing industrial interest in this class of materials has caused a need for better characterization of the properties of interest for processability, for instance, for injection moulding or extrusion. The pressure-volume-temperature (PVT) relationship of a PVDF is described by combining specific volumes of amorphous and crystalline phases present in the material. The volumes of the two phases are described simply by thermal expansion and compressibility coefficients drawn from standard PVT data below and above the crystallisation range. Within the crystallisation range, the material volume is assumed to change from amorphous to crystalline according to the evolution of an overall crystallinity degree, which is described by the Nakamura non-isothermal formulation of an Avrami crystallisation kinetic model. Model parameters are identified by change comparison with standard calorimetric results, PVT data and final densities of thin samples solidified during quenches conducted with cooling rates of several hundreds of Kelvins/second. The resultant model allows the description of the PVT behavior of PVDF in the pressure- and cooling-rate ranges of interest for processing. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.895065

Item 203
Polymer
44, No.17, 2003, p.5039-45

129XE-NMR STUDY OF FREE VOLUME IN AMORPHOUS PERFLUORINATED POLYMERS: COMPARISON WITH OTHER METHODS

Golemme G; Nagy J B; Fonseca A; Algieri C; Yampolskii Yu
Calabria,University; IRMERC-CNR; Namur,University; Russian Academy of Sciences

The chemical shift of 129Xe, sorbed into microcavities, determined by 129Xe nuclear magnetic resonance spectroscopy, is related to the size of the host cavity. The technique was used to determine free volume sizes in amorphous glassy materials, including random copolymers of tetrafluoroethylene and perfluorodioxoles with different structures. Shifts were measured at pressures up to 1060 Torr, and the dimensions of spherical and cylindrical microcavities determined from the zero pressure chemical shift obtained by extrapolation. The sizes were consistent with those determined by positron annihilation lifetime and inverse gas chromatography methods. 51 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; RUSSIA; WESTERN EUROPE

Accession no.894478

Item 204
Polymer
44, No.17, 2003, p.4853-61

NANOSTRUCTURE OF NAFION MEMBRANE MATERIAL AS A FUNCTION OF MECHANICAL LOAD STUDIED BY SAXS

Barbi V; Funari S S; Gehrke R; Scharnagl N; Stribeck N
Hamburg,University; Deutsches Elektronen-Synchrotron; GKSS Research Center

Strips of Nafion 117 were strained in steps at a rate of 5 mm/min to failure. At each strain level the material was characterised by small angle X-ray scattering (SAXS) studies using synchrotron radiation with a wavelength of 0.15 nm, then allowed to relax and scattering observations made prior to straining to the next level. The two-dimensional SAXS patterns were evaluated using the multi-dimensional chord distribution function. During elongation, ionomer channels opened to form hollow layers (slits) oriented parallel to the strain, with the height increasing from 3 nm at an elongation of 0.5, to 6 nm at an elongation of 1.25. The ultimate structure consisted of groups of not more than three slits in good lateral register. During elongation of the polymer matrix, cylindrical crystallites with a thickness of 2.5 nm and a height of about 7 nm were disrupted and orientated parallel to the strain direction. The structure before failure was characterised by a broad domain high distribution ranging from a height of about 4 nm with an ultimate inclination of 40 degrees, to parallel domains of 20 nm in height. 36 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.894460

Item 205

ACS Polymeric Materials. Science and Engineering. Fall Meeting 2002. Volume 87. Proceedings of a conference held Boston, Ma., 18th-22nd Aug. 2002. Washington, D.C., ACS,Div.of Polymeric Materials Science & Engng., 2002, p.121, CD-ROM, 012

SAXS ANALYSIS OF THE THERMAL RELAXATION BEHAVIOUR OF ORIENTED PERFLUOROSULFONATE IONOMER MEMBRANES

Landis F A; Moore R B; Page K A; Han C C

Southern Mississippi,University; US,National Institute of Standards & Technology

(ACS,Div.of Polymeric Materials Science & Engng.)

Brief details are given of an X-ray scattering analysis of the thermal relaxation behaviour of the oriented morphologies of Nafion PTFE membranes which were neutralised with alkylammonium counterions of varying alkyl chain length. The temperature at which the ion-hopping process allows for thermal relaxation of the oriented morphologies within the membranes to the changes in the Coulombic forces within ionic aggregates as the size and nature of the alkylammonium counterions were varied were correlated.

USA

Accession no.893953

Item 206

Polymer Science Series B

45, No.3-4, March-April 2003, p.75-7

THE DYNAMICS OF LOCAL MOBILITY IN COMPATIBLE POLY(METHYL METHACRYLATE)-POLY(VINYLIDENE FLUORIDE) BLENDS

Privalko V P; Privalko E G; Gorodilov B Ya; Rekhteta N A; Bartolotta A; Carini G; D'Angelo G; Di Marco G; Tripodo G

Ukranian Academy of Sciences; Ukraine,Nikolaev Pedagogical Institute; Messina,Institute of Technical Spectroscopy; Messina,University

The results are reported of a study of the effect of the local environment of chains on the density of the vibrational states of compatible blends of PMMA and PVDF determined via measurements of specific heat capacity from 2 to 60 K. Plots of specific heat capacity/T3 and specific heat capacity/T5/3 vs. T for PMMA, PVDF and 80:20 and 60:40 PMMA/PVDF blends are presented and discussed. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; UKRAINE; WESTERN EUROPE

Accession no.893639

Item 207

Macromolecules

36, No.9, 6th May 2003, p.3380-5

QUANTIFYING PLASTICIZATION AND MELTING BEHAVIOR OF POLY(VINYLIDENE FLUORIDE) IN SUPERCRITICAL CARBON DIOXIDE UTILIZING A LINEAR VARIABLE DIFFERENTIAL TRANSFORMER

Shenoy S L; Fujiwara T; Wynne K J

Virginia,Commonwealth University

The plasticisation and melting behaviour of PVDF in supercritical carbon dioxide were studied by measuring linear dilation as a function of temperature (75-130C) and pressure (138-670 bar) using a linear variable differential transformer. In constant temperature experiments at 75 and 99C, the carbon dioxide density or solvent quality determined the degree of swelling. At lower pressures, the rate of change of dilation with pressure increased rapidly up to 414 bar and then attenuated. At 117 and 130C, the rate of change of dilation with pressure was almost linear. Reasons for the higher swelling of PVDF above 100C were discussed. PVDF swelling was measured as a function of temperature at constant pressure. With increasing pressure, the melting temperature decreased to a minimum of 135C at 483 bar. Above 483 bar, hydrostatic effects predominated over plasticisation and the melting temperature increased. 54 refs.

USA

Accession no.893374

Item 208

Synthetic Metals

138, No.1-2, 2003, p.165-71

PTFE MEMBRANE ELECTRODES WITH INCREASED SENSITIVITY FOR GAS SENSOR APPLICATIONS

Wienecke M; Bunescu M-C; Pietrzak M; Deistung K; Fedtke P

Wismar,University

The surface area of PTFE membrane electrodes was increased by vacuum evaporation coating with metals. The metals acted both as electrode and catalyst. The surface morphology of sintered PTFE membranes was changed as a result of the thermal stress relaxation during the cooling of the metallic film. The "hair morphology" of the surface increased the three-phase boundary layer and enhanced the gas sensor sensitivity. Further improvement of the utilisation efficiency of the metal catalyst was achieved by using a new membrane-electrode assembly consisting of a PTFE membrane and a nanocomposite material of carbon nanotubes and PTFE. Gas sensors with this membrane electrode showed improved sensitivity from the "ppm" to the "ppb" gas concentration level. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.893306

Item 209

Journal of Polymer Science: Polymer Physics Edition

41, No.13, 1st July 2003, p.1578-88

FINE STRUCTURE AND FORMATION MECHANISM OF PARTICULATE PHASE-INVERSION POLY(VINYLIDENE FLUORIDE) MEMBRANES

Dar-Jong Lin; Beltsios K; Cheng-Liang Chang; Liao-Ping Cheng

Tamkang,University; Ioannina,University

A membrane was prepared by coagulation of a solution of PVDF in DMF by the action of 1-octanol, a soft non-solvent. Experimental observations showed that the globule surface was dominated by a grainy nanostructure, the globular interior exhibited a range of fine structures, e.g. twisted sheets and treelike branches, and the globule-globule connections exhibited a sheet-like or rope-like structure. Based on the observed structural details and phase diagram considerations, it was proposed that the membrane structure was the result of a unique combination of a polymer crystallisation and a liquid-liquid phase separation process, with the end result being globular structural features of marked uniformity. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; TAIWAN; WESTERN EUROPE

Accession no.893126

Item 210

Mechanics of Composite Materials

39, No.2, March-April 2003, p.123-8

INFLUENCE OF NANOCERAMICS ON THE PROPERTIES OF POLYTETRAFLUOROETHYLENE

Okhlopkova A A; Sleptsova S A

Russian Academy of Sciences

The influence of nanometer particles of ceramics on the formation and wear of polymer composites based on PTFE was investigated. Tensile strength and elongation at break of the composites were determined. Data concerning properties of the composites and the initial PTFE were compared. 16 refs.

RUSSIA

Accession no.893044

Item 211

Journal of Applied Polymer Science

89, No.6, 8th Aug.2003, p.1579-82

EFFECT OF TEMPERATURE AND PRESSURE TREATMENT ON THE POROSITY OF EXPANDED POLYTETRAFLUOROETHYLENE FILMS

Hall P J; Hitchman M J; Brown S D; Calo J M

Strathclyde,University; Huddersfield,University; Brown University

A series of expanded polytetrafluoroethylene membranes subjected to high temperatures and pressures were examined by small-angle neutron scattering (SANS) to determine the effects on porosity. The SANS data indicated the existence of micropores with a narrow size distribution, and a polydisperse distribution of larger pores. The effect of thermal and pressure treatments on pore structure and surface roughness are discussed. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE

Accession no.891936

Item 212

Journal of Rheology

47, No.3, May-June 2003, p.631-42

SIMULTANEOUS DIELECTRIC AND DYNAMIC MECHANICAL MEASUREMENTS ON PVDF IN THE MOLTEN STATE: STUDY OF THE LINEAR/ NONLINEAR VISCOELASTIC TRANSITION

Gonnet J-M; Guillet J; Sirakov I; Fulchiron R; Seytre G

St.Etienne,Laboratoire de Rheologie des matieres Plastiques; Lyon,Universite Claude Bernard; CNRS

Simultaneous dielectric and dynamic mechanical measurements were performed on PVDF melts using a dynamic rheometer, which permitted the dielectric and mechanical properties of the polymer to be recorded inside and outside the linear viscoelastic domain. The effects of frequency and magnitude of strain during dynamic shear were examined and a study made of the linear/non-linear viscoelastic transition during dynamic shear, which was demonstrated by a decrease in conductivity and by modification of the real permittivity, both of which returned to their original values upon cessation of shear strain. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.891439

Item 213

Polymer Journal (Japan)

35, No.4, 2003, p.345-52

CRYSTALLIZATION STUDIES OF POLYMER BLENDS OF NYLON-11/POLY(VINYLIDENE FLUORIDE)

Gao Q; Scheinbeim J

Rutgers,University

The crystallisation of blends of two semi-crystalline polymers nylon-11 and PVDF is studied. The existence of separate melting and crystallisation temperatures over the whole composition range shows that these two polymers do not co-crystallise. However, blending affects the crystallisation behaviour of each component. Adding nylon-11 decreases the crystallisation temperature (Tc) of PVDF, but increases its crystallisation rate. On the other hand, the Tc of nylon-11 decreases, and its crystallisation rate decreases as well when blended with PVDF. The crystallisation mechanism of both nylon-11 and PVDF changes in the blends compared to that in the pure states. The Ozawa index, or Avrami exponent, of PVDF in the blend decreases from 3 to 1 as the crystallisation temperature decreases from 137 to 131 deg.C, compared with a decrease from 2.5 to 1.3 observed in pure PVDF at the temperature range from 145 to 135 deg.C. The Avrami exponent of nylon-11 in the blend decreases from 2 to 1 as the crystallisation temperature decreases from 159 to 153 deg.C, compared with a decrease from 2.5 to 0.75 observed in pure nylon-11 at the same temperature range. 21 refs.

USA

Accession no.890238

Item 214

Polymer Degradation and Stability

81, No.1, 2003, p.75-9

ELECTRON AND PROTON IRRADIATION OF POLYVINYLIDENE FLUORIDE. CHARACTERIZATION BY ELECTRON PARAMAGNETIC RESONANCE

Adem E; Burillo G; Munoz E; Rickards J; Cota L; Avalos-Borja M

Mexico,Universidad Nacional Autonoma

Films of PVDF were exposed to proton and electron beam irradiation at high doses. Modifications induced in the samples were determined by EPR. The evolution of radical density and its decay in the dark and in normal light conditions was studied. 11 refs.

MEXICO

Accession no.889473

Item 215

Polymer Preprints. Volume 43. Number 2, Fall 2002. Papers presented at the ACS Meeting held Boston, Ma., 18th-22nd Aug. 2002.

Washington, D.C., ACS,Div.of Polymer Chemistry, 2002, p.26-7, 28 cm, 012

POLYMERS AND BLOCK COPOLYMERS OF FLUOROSTYRENES BY ATRP

Hvilsted S; Borkar S; Abilgaard L; Georgieva V; Siesler H W; Jankova K

Denmark,Technical University; Essen,University (ACS,Div.of Polymer Chemistry)

The preparation of novel 2,3,5,6-tetrafluoro-4-methoxystyrene-based homo- and diblock copolymers with 2,3,4,5,6-pentafluorostyrene by atom transfer radical polymerisation is described together with the demethylation of the p-methoxy group in the polymers and its conversion to the corresponding reactive hydroxy sites. Data are provided on the yields and molec.wts. of the homo- and block copolymers and a scheme illustrating the preparation of template polymers and functionalisation is included. 7 refs.

DENMARK; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SCANDINAVIA; WESTERN EUROPE

Accession no.888707

Item 216

ANTEC 2002. Proceedings of the 60th SPE Annual Technical Conference held San Francisco, Ca., 5th-9th May 2002.

Brookfield, Ct., SPE, 2002, Paper 704, Session W33-Polymer Analysis. Student Session, pp.5, CD-ROM, 012

INVESTIGATION OF OPTIMUM CRYSTALLIZATION CONDITIONS OF POLYVINYLIDENE FLUORIDE (PVDF)

Hlopick S G; Baker M W

Pennsylvania,State University

(SPE)

Injection moulded samples of poly(vinylidene fluoride) were cured for one hour at temperatures from room temperature to the melting temperature of 170 C, to determine the curing temperature which gave the maximum crystallinity. Samples which were uncured, cured for two weeks, and annealed above the melting point and quenched in ice water were also tested. The crystallinity was determined from the density, which was measured using Archimedes principle. The as-moulded samples had high crystallinity, attributed to high injection moulding pressures. The subsequent heating resulted in molecular relaxation and a reduction in density. It is proposed that extended curing at high temperatures would result in higher crystallinity, but that this may not be feasible under manufacturing conditions.

USA

Accession no.887790

Item 217

Journal of Materials Science. Materials in Electronics

14, No.3, March 2003, p.135-41

EFFECT OF CUCL2 AND COCL2 MIXED FILLERS ON THE PHYSICAL PROPERTIES OF POLYVINYLIDENE FLUORIDE FILMS

Tawansi A; Oraby A H; Badr S I; Abdelaziz M

Mansoura,University

PVDF films filled with (x)CuCl2(20-x)CoCl2, where x was 0.0, 0.5, 1, 5, 10, 15, 19 and 20 wt %, were prepared by the casting method. The films were characterised by DTA, X-ray diffraction, optical absorption spectroscopy, ESR spectroscopy, IR spectroscopy and d.c. electrical conductivity and magnetic susceptibility measurements. The m.p. did not change on filling and there appeared to be no PVDF structural damage on filling. The filling level(FL) dependence of the electrical resistivity differed from that of the magnetic moment. This indicated that the conduction electrons and/or the hopping sites were of non-magnetic type. The FL range of x 15% or less in PVDF films having relatively strong magnetic moments should allow applications as microwave modulators and sensors. 31 refs.

EGYPT

Accession no.887400

Item 218
Polymer
44, No.9, 2003, p.2773-80
RADIATION INDUCED EMBRITTLEMENT OF PTFE
Fayolle B; Audouin L; Verdu J
Ecole Nationale Superieure d'Arts et Metiers

The degradation of polytetrafluoroethylene (PTFE) by gamma-irradiation at dose rates of 100Gy/hour for total doses up to 5000Gy was investigated using differential scanning calorimetry, tensile testing and Essential Work of Fracture testing. The polymer underwent rapid chain scission, approaching a pseudo-asymptotic ultimate molecular weight of 20kg/mol. The modulus and yield characteristics were relatively unaffected, but the ultimate properties strongly declined. The ultimate elongation and EWF plastic work characteristic both initially increased and then decreased. It was argued that the degradation proceeds via a multi-step mechanism, beginning with destruction of non-extended tie molecules and then proceeding to progressive embrittlement through destruction of the entanglement network. The critical molar mass for embrittlement was shown to be fifty times the molar mass between entanglements in the melt. 32 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.886564

Item 219
Chemistry of Materials
15, No.4, 25th Feb.2003, p.850-61
INTERACTION OF POLY(VINYLIDENE FLUORIDE) WITH GRAPHITE PARTICLES. I. SURFACE MORPHOLOGY OF A COMPOSITE FILM AND ITS RELATION TO PROCESSING OF PARAMETERS
Yoo M; Frank C W; Mori S
Stanford,University; Mitsubishi Chemical Corp.

In lithium ion battery composite anodes derived from graphite particles bound together by a polymeric binder of 5-7 wt.%, it is well-known that the type and content of the binder influence the formation of a solid electrolyte interphase and the electrochemical behaviour. However, the nature of the interaction between the graphite particles and binder has not been extensively studied. The interaction of PVDF with graphite based on the characteristics of the precursor slurry and the surface chemistry and morphology of the final composite anodes is reported. The slurry is characterised by dynamic viscosity measurements and the solid composite by atomic force microscopy, lateral force microscopy, electron probe X-ray microanalysis and X-ray photoelectron spectroscopy. The final film properties correlate with the suspension viscosity, which varies over six orders of magnitude for eight different carbon samples. In the composite film, PVDF preferentially deposits on the edges and grain boundaries of the graphite particles with a maximum of 40% of the surface of graphite being covered by the polymer. An increase in the homogeneity of the PVDF distribution is correlated in the final composite film with an increase in the slurry viscosity and this observation is interpreted in terms of PVDF/graphite interaction. 34 refs.

JAPAN; USA

Accession no.884588

Item 220
Polymer Preprints. Volume 43. Number 2. Fall 2002.
Papers presented at the ACS Meeting held Boston, Ma., 18th-22nd Aug.2002.
Washington, D.C., ACS,Div.of Polymer Chemistry, 2002, p.889, 28cm, 012
POLYMERIZATION OF VINYLIDENE FLUORIDE IN DENSE CARBON DIOXIDE
Wojcinski L M; Saraf M K; Charpentier P; DeSimone J M; Roberts G W
North Carolina,State University; North Carolina,Chapel Hill University
(ACS,Div.of Polymer Chemistry)

Vinylidene fluoride was polymerised via free radical precipitation polymerisation in supercritical carbon dioxide in a continuous stirred tank reactor. The initiator was diethyl peroxydicarbonate. The resulting PVDF was highly porous with a novel bimodal molecular weight distribution which varied with reaction conditions such as monomer concentration, temperature and pressure. No refs.

USA

Accession no.883973

Item 221
Polymer Preprints. Volume 43. Number 2. Fall 2002.
Papers presented at the ACS Meeting held Boston, Ma., 18th-22nd Aug.2002.
Washington, D.C., ACS,Div.of Polymer Chemistry, 2002, p.887, 28cm, 012
PLASTICIZATION AND MELTING BEHAVIOR OF PVDF AND PVDF COPOLYMERS IN SUPERCRITICAL CARBON DIOXIDE
Shenoy S L; Fujiwara T; Wynne K J
Virginia,Commonwealth University
(ACS,Div.of Polymer Chemistry)

PVDF and poly(vinylidene fluoride-co-4.9 mol% hexafluoropropylene) were plasticised by supercritical carbon dioxide. The degree of plasticisation depended strongly on the temperature and the pressure. The hexafluoropropylene groups resulted in a much larger swelling of the copolymer. The melting temperatures of both the homopolymer and the copolymer were lowered by polymer-supercritical carbon dioxide interactions. However, above about 540 bar, there was a modest increase in the melting temperature due to the hydrostatic pressure. Thus, the melting behaviour was a balance between the lowering of the melting temperature due to plasticisation and increasing it due to the hydrostatic pressure. 12 refs.

USA

Accession no.883971

Item 222

Journal of Polymer Science: Polymer Physics Edition

41, No.4, 15th Feb.2003, p.360-7

DEPTH PROFILING OF LATEX BLENDS OF FLUORINATED AND FLUORINE-FREE ACRYLATES WITH LASER-INDUCED SECONDARY MASS SPECTROMETRY

Walz S M; Malner T E; Mueller U; Muelhaupt R

Freiburg,Albert-Ludwigs University; Zeiss C.

Phase separation and self-assembly of perfluoroalkyl segments at the surface of polymer films obtained from latices of semifluorinated acrylate copolymers and the corresponding latex blends of non-fluorinated and semifluorinated polyacrylates were investigated. Using laser-induced secondary mass spectrometry, the fluorine distribution was measured after annealing above the minimum film-forming temperature of the polymers up to a depth of several micrometers. Depth profiles of a semifluorinated acrylate homopolymer and latex blends thereof with fluorine-free alkylacrylates with 25, 50 and 75 mol % semifluorinated acrylate as well as those of a copolymer composed of alkylacrylate and semifluorinated acrylate (50/50 mol %) were investigated. In the case of latex blends containing both semifluorinated polyacrylates and fluorine-free or low-fluorine polymers, self-assembly accounted for enrichment of the perfluoroalkyl segments at the surface. Coatings exhibiting low surface energy and having a markedly reduced total fluorine content were obtained. 36 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.882237

Item 223

Molecular Crystals and Liquid Crystals: Section A

Vol.388, 2002, p.543-9

DOUBLE LAYER CAPACITANCE OF POROUS CARBONS DERIVED FROM DEFLUORINATION OF PTFE

Shiraishi S; Aoyama Y; Kurihara H; Oya A; Yamada Y

Gunma,University; Japan,Advanced Institute of Science & Technology

A highly mesoporous carbon material was prepared by defluorination of PTFE with lithium naphthalenide and its double layer capacitance was measured in 1.0M lithium perchlorate/propylene carbonate. The reaction product of PTFE film with lithium naphthalenide had micro/nano domain structure consisting of one-dimensional carbon chain (carbyne-like structure) and lithium fluoride. Although the carbon chain easily decomposed to amorphous carbon structure by chain crosslinking and lithium fluoride condensation through air exposure, highly mesoporous carbon was obtained by removal of fine lithium fluoride particles with dilute aqueous hydrochloric acid. This mesoporous carbon showed larger capacitance than activated carbon fibre with almost the same BET surface area. The mesoporous carbon also maintained the capacitance even at high current density. These properties could be due to the matrix carbon structure and, especially, the pore structure. 8 refs. (1st International Symposium on Nanocarbons)

JAPAN

Accession no.881112

Item 224

Journal of Applied Polymer Science

87, No.5, 31st Jan.2003, p.752-8

DIELECTRIC BEHAVIOR OF PVDF/POMA BLENDS THAT HAVE A LOW DOPED POMA CONTENT

Gregorio R; Malmonge L F; Leal Ferreira G F;
dos Santos W N; Capparelli Mattoso L H

Sao Carlos,Universidade Federal; UNESP; USP; EMBRAPA

The real and imaginary components of the complex permittivity of blends of PVDF with poly(o-methoxyaniline) (POMA) doped with toluenesulphonic acid (TSA), containing 1, 2.5 and 5 wt% POMA-TSA were determined for frequencies between 100 and 3 000 000 Hz and for temperatures between -120 and 120C. The blends with a low POMA-TSA content had high values of real and imaginary permittivity components in the low frequency region. These values increased with the temperature and amount of POMA-TSA in the blend. The variation of real and imaginary permittivity components with the frequency for the POMA-TSA in the blends could be determined by the modified Maxwell-Garnett equation. A strong decrease in the POMA-TSA conductivity was observed in the blend and this was bigger the lower the POMA-TSA content. The results were discussed. 15 refs.

BRAZIL

Accession no.880702

Item 225

Muanyag es Gumi

39, No.8, 2002, p.251-6

Hungarian

STRUCTURE AND PROPERTIES OF IPP/DVDF BLENDS

Menyhard A; Varga J

Budapesti Muszaki Egyetem

Blends of iPP and PVDF of different composition, and their beta-nucleated versions are prepared. The features of melting crystallisation and structure of the blends are studied by polarised light microscopy and calorimetry. PVDF has a strong alpha-nucleating ability, so the iPP matrix crystallises predominantly in alpha-form in beta-nucleated blends. Mechanical properties of the blends, including impact strength, are also determined. The critical strain energy release rate of the beta-form is about twice as high than that of the alpha-form. 10 refs.

EASTERN EUROPE; HUNGARY

Accession no.880520

Item 226
Journal of Adhesion Science and Technology
16, No.14, 2002, p.1855-68

PLASMA ASSISTED IMMOBILIZATION OF POLY(ETHYLENE OXIDE) ONTO FLUOROCARBON SURFACES

Vasilets V N; Werner C; Hermel G; Pleul D; Nitschke M; Menning A; Janke A; Simon F
Chernogolovka,Institute of Chemical Physics; Dresden,Institute of Polymer Research

Surface modification of fluorocarbon polymers by poly(ethylene oxide)(PEO) is expected to substantially expand their applications in medicine and biotechnology, thus different plasma-assisted procedures for the immobilisation of PEO and poly(ethylene-block-propylene triblock copolymers)(PEO-PPO-PEO) were compared. The fixation of pre-adsorbed PEO-PPO-PEO by argon plasma treatments on the fluorocarbon surface was found to produce less homogeneous coatings, whereas oxygen plasma initiated graft polymerisation of PEO-dimethacrylate and PEO-monocrylate from solutions or melts provided more effective coverage. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; RUSSIA; WESTERN EUROPE

Accession no.880498

Item 227
Journal of Reinforced Plastics and Composites
21, No.18, 2002, p.1619-27

THERMAL CONDUCTIVITIES OF PTFE COMPOSITES WITH RANDOM DISTRIBUTED GRAPHITE PARTICLES

Yin Y; Tu S-T
Nanjing,University of Technology

A two-dimensional finite element model for PTFE composite with random distributed circular graphite particles is developed to study its effective thermal conductivity. Experiments are conducted on thermal conductivities of these composites. Results from experiments and finite element analysis are compared which show that non-uniform distribution lead to low thermal conductivity and that there is a saturated conductivity ratio of the inclusion to the matrix at a certain volume fraction. The saturated ratio rises with the increasing of volume percentage. 9 refs.

CHINA

Accession no.880265

Item 228
Polymer Degradation and Stability
79, No.2, 2003, p.345-51

PHOTOCHEMICAL STABILITY OF PARTIALLY FLUORINATED ACRYLIC PROTECTIVE COATINGS. IV. COPOLYMERS OF 2,2,2-TRIFLUOROETHYL METHACRYLATE AND METHYL ALPHA-TRIFLUOROMETHYL ACRYLATE WITH VINYL ETHERS

Lazzari M; Aglietto M; Castelvetro V; Chiantore O
Torino,Universita; Pisa,University

The photochemical stability of 2,2,2-trifluoroethyl methacrylate/butyl vinyl ether copolymers(TFEMA/BVE) and methyl alpha-trifluoromethyl acrylate/2-ethylhexyl vinyl ether copolymers was studied under artificial solar light irradiation. In both copolymers, and in a reference ethyl methacrylate/BVE copolymer, the photodegradation behaviour was controlled by the reactivity of the corresponding ether component. The degradation occurred mainly in the tertiary positions of the ether units, followed either by formation of gamma-lactones or by chain scissions. The fluorinated methyl of the side chain affected the degradation pathways, i.e. showed a clear inhibition of cyclisation, only in the case of the TFEMA/BE copolymer. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.879816

Item 229
International Polymer Science and Technology
30, No.1, 2003, p.T/44-6

THERMAL AND THERMO-OXIDATIVE DEGRADATION OF POLYVINYL FLUORIDE IN INDIVIDUAL AND MIXED SOLVENTS

Mukhiddinov B F; Sobirov B B; Turabova S S
Uzbekistan,NGGI Institute

This work focuses on the thermal and thermooxidative degradation of polyvinyl fluoride in individual and mixed solvents using an ion-selective fluoride electrode of the ‘Kritur’ type. Before use, the solvents (dimethylformamide (DMF), dimethylsulphoxide (DMSO), acetophenone (ACP), and cyclohexane (CHN)) were purified by vacuum distillation in inert gas. The study shows that it is expedient to use strongly polar compounds containing cyclic or aromatic groups as the solvents, since, by controlling the composition of the solution, it is possible to control the rate of thermal and thermooxidative degradation of the polymer in solution. 2 refs. (Article translated from Plasticheskie Massy, No.3, 2002, p.23-4).

RUSSIA

Accession no.879481

Item 230

Journal of Polymer Research

9, No.3, 2002, p169-74

SPHERULITIC MORPHOLOGY AND CRYSTALLIZATION KINETICS OF POLY(VINYLIDENE FLUORIDE)/POLY(VINYL ACETATE) BLENDS

Hsiu-Jung Chiu

Ta Hwa,Institute of Technology

Differential scanning calorimetry and polarised optical microscopy (POM) were used to study crystallisation kinetics and spherulitic morphology of films prepared by solution casting of blends of polyvinylidene fluoride (PVDF) and polyvinyl acetate (PVAc). A reduction in kinetics of spherulite growth in the PVDF, and overall crystallisation constant of the blend, as PVAc content or crystallisation temperature increased was attributed to decrease in PVDF molecular mobility and dilution as the component with the higher glass transition temperature (PVAc) was added. POM indicated that segregation of the PVAc occurred into the interlamellar and/or interfibrillar regions of the spherulitic morphology of the PVDF. 36 refs.

TAIWAN

Accession no.879406

Item 231

ACS Polymeric Materials: Science and Engineering. Spring Meeting. Volume 84. Proceedings of a conference held San Diego, Ca., 1st - 5th April 2001. Washington D.C.,ACS,Div.of Polymeric Materials Science & Engng., 2001, Paper 586, p.1061-2, 27cm,012

COMPOSITE MEMBRANE FROM AMORPHOUS PERFLUOROPOLYMERS FOR NOVEL APPLICATIONS IN MEMBRANE PROCESSES

Gordano A; Clarizia G; De Santo M P; Arcella V; Drioli E

CNR; Calabria,University; Ausimont SpA (ACS,Div.of Polymeric Materials Science & Engng.)

Contact angle measurements, atomic force microscopy and permeability measurements were used to assess the performance of a composite membrane consisting of a commercial amorphous perfluoropolymer laid on to a polyvinylidene fluoride support. Composite membranes were shown to have strong hydrophobic properties associated with good organophobic properties, with suggested applications in fields of material separation. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.879392

Item 232

Adhasion Kleben und Dichten

46, No.12, 2002, p.24-7

German

DOES PTFE MAKE A SECURE BOND WITHOUT PRE-TREATMENT?

Krueger G; Manert U

3M Deutschland GmbH

The use of fluoropolymers in technical applications, mainly PTFEs, places high demands on bonding techniques. Up until now there was the problem of gluing such components because this was only successful after very expensive pre-treatment methods because of the low surface energy. As a new possibility, the use of a two-component adhesive has been recommended. This should make these measures redundant. This article also looks at the possibilities of PTFE pre-treatment, as well as processing PTFEs and measuring their adhesive power, including the bonding of glass and aluminium and the properties of Scotch Weld DP 8000 PTFE. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.878601

Item 233

Polymer

44, No.2, 2003, p.413-22

EFFECT OF SALT ADDITIVE ON THE FORMATION OF MICROPOROUS POLY(VINYLIDENE FLUORIDE) MEMBRANES BY PHASE INVERSION FROM LITHIUM CHLORATE/WATER/DIMETHYLFORMAMIDE/POLYVINYLIDENE FLUORIDE SYSTEM

Lin D -J; Chang C -L; Huang F -M; Cheng L -P

Tamkang,University

Polyvinylidene fluoride (PVDF) membranes were cast from dopes containing PVDF, dimethyl formamide, water and lithium chlorate salt (LCS). Proportions of the materials were varied and a phase diagram was developed using cloud point measurements. Structures of the PVDF membrane were characterised for different LCS levels from zero to grater than 5 percent using wide angle X-ray diffraction, differential scanning calorimetry, small angle light scattering, fourier transform infrared spectroscopy and scanning electron microscopy. The crystallite structure of the PVDF was seen to change from the alpha form with no LCS present to the beta form at high LCS content. Recrystallisation of the crystallites during the heating process was suggested by observation of twin peaks during calorimetry experiments. Water-flux measurements on membranes decreased as LCS content increased, but tensile strength reduced. 31 refs.

TAIWAN

Accession no.878179

Item 234
Macromolecules
35, No.24, 19th Nov.2002, p.9079-82
RADIOCHEMICAL YIELDS FOR CROSS-LINKS AND BRANCHES IN RADIATION-MODIFIED POLY(TETRAFLUOROETHYLENE)
Fuchs B; Lappan U; Lunkwitz K; Scheler U
Dresden,Institute of Polymer Research

The radiochemical yields (a measure for the efficiency of the radiochemical functionalisation process and its radiation dose dependence) for the high energy electron beam irradiation of PTFE were calculated from the concentration of functional groups such as side groups, branches, and crosslinks from fluorine-19 solid state NMR spectra. The radiochemical yields were compared for the irradiation of PTFE at 365C in a vacuum or at 385C in a vacuum or nitrogen at atmospheric pressure. The radiochemical yields of CF3 side groups and branches decreased with radiation dose but remained nearly constant for crosslinks. These results indicated that when PTFE was irradiated, in addition to main chain scission, CF3 side groups and branches were formed in the first step and then the crosslinks were formed in a second step. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.877357

Item 235
Muanyag es Gumi
38, No.12, Dec.2001, p.448-53
Hungarian
ADHESION TESTING OF PTFE AND ULTRAHIGH MOLECULAR WEIGHT PE SURFACES
Keresztes R; Zsidai L; Kalacska G

The useful effects of PTFE and ultra high molecular weight polyethylene coatings in reducing the adhesion of filter dust to machinery used in glass production are described. 5 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

Accession no.877246

Item 236
Journal of Membrane Science
210, No.1, 1st Dec.2002, p.175-80
FABRICATION OF POLY (ECTFE) MEMBRANES VIA THERMALLY INDUCED PHASE SEPARATION
Ramaswamy S; Greenberg A R; Krantz W B
Colorado,University; Cincinnati,University

The fabrication of poly (ethylene chlorotrifluoroethylene) (ECTFE) membranes via liquid-liquid demixing using the thermally-induced phase separation process and the characterisation of the membranes by scanning electron microscopy, porometry and permeation techniques are described. An experimentally determined binary phase diagram for ETCFE-dibutyl phthalate and representative scanning electron micrographs showing quenched surface and cross-section views of cast membranes are illustrated and ECTFE membrane flux results are presented and discussed. 9 refs.

USA

Accession no.875991

Item 237
Journal of Membrane Science
210, No.2, 15th Dec.2002, p.315-29
CHARACTERIZATION OF PVDF MEMBRANES BY VIBRATIONAL SPECTROSCOPY
Boccaccio T; Bottino A; Capannelli G; Piaggio P
Genova,Universita

The effectiveness of vibrational spectroscopy for characterising membranes was investigated using asymmetric PVDF membranes prepared by phase inversion with different casting solvents. The Fourier transform Raman and Fourier transform infrared spectra were analysed and ATR and photoacoustic spectroscopy spectra were compared with the corresponding spectra obtained from dense films in order to highlight problems relating to porosity and surface roughness in the acquisition of spectra by different techniques. Good characterisation of the membrane surfaces was achieved using FTIR-ATR, FTIR-photoacoustic spectroscopy and Fourier-transform-Raman spectra results. 34 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.875956

Item 238
Journal of Macromolecular Science B
B41, No.4-6, 2002, p.957-76
RELATIONSHIPS BETWEEN MECHANICAL TENSILE BEHAVIOR AND MICRO-MECHANISMS IN POLY(VINYLIDENE FLUORIDE) AT HIGH TEMPERATURES: INFLUENCE OF THE MOLECULAR WEIGHT DISTRIBUTION
Andre-Castagnet S; Tence-Girault S
ENSMA; ESPCI; CNRS

The micromechanisms of deformation of PVDF were studied and related to the macroscopic mechanical tensile behaviour at temperatures higher than 100C and after necking and to colour changes. Cavitation, crystalline phase transitions and the orientation process were investigated by small- and wide-angle X-ray experiments. Two PVDFs with different MWDs were examined. The microstructure differences were shown mainly to affect cavitation. 16 refs. (European Conference on Macromolecular Physics: Morphology and Properties of Crystalline Polymers, Eger, Hungary, Sept.2001)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.875550

Item 239
Journal of Applied Polymer Science
86, No.10, 5th Dec.2002, p.2550-6
PREPARATION AND CHARACTERIZATION OF THE COPOLYMERS OBTAINED BY GRAFTING OF MONOACRYLOXYETHYL PHOSPHATE ONTO POLY(TETRAFLUOROETHYLENE-CO-HEXAFLUOROPROPYLENE) FILMS
Grondahl L; Cardona F; Chiem K; Wentrup-Byrne E
Queensland,University of Technology

Two fully fluorinated polymers, PTFE membranes and PTFE-co-hexafluoropropylene) (FEP) films are modified by graft copolymerisation with monoacryloxyethyl phosphate (MAEP) in an aqueous solution at ambient temperature using gamma irradiation. The modified membranes are characterised by XPS, FTIR and phosphate analysis. A correlation between peak heights in the FTIR PAS spectra and the overall grafting yield is found. Neither the surface coverage (as obtained from XPS multiplex scans) nor the overall grafting yield (as obtained from phosphate analysis) show simple correlations on the monomer concentrations (20-40%) or the irradiation doses (25-150 kGy) within the ranges investigated. Similar surface coverage is achieved on the PTFE membranes and on the FEP films. In contrast, the overall grafting yields are significantly higher for the PTFE membranes than for the FEP films. The high porosity of the PTFE membranes is the most likely explanation for these differences in grafting. 25 refs.

AUSTRALIA

Accession no.875181

Item 240
ANTEC 2002. Proceedings of the 60th SPE Annual Technical Conference held San Francisco, Ca., 5th-9th May 2002.
Brookfield, Ct., SPE, 2002, Paper 342, Session T22-Joining of Plastics and Composites. IR and Laser Session, pp.5, CD-ROM, 012
SIMULTANEOUS BUTT/LAP JOINTS FOR PVDF PIPES
Savitski A
Edison Welding Institute
(SPE)

Poly(vinylidene fluoride) (PVDF) pipe, with a combination of butt and lap joints, was joined by through-transmission infrared welding. A butt joint was formed between two sections of pipe and a PVDF sleeve positioned over the joint. An absorbing film of PVDF containing carbon black was positioned between the sleeve and the pipe, and infrared radiation applied to the joint whilst the pipe was rotated. Weld quality was assessed visually and by microscopy. 2 refs.

USA

Accession no.874823

Item 241
Polymer
43, No.25, 2002, p.6863-80
ON THE CRYSTALLIZATION MECHANISM OF POLY(ETHYLENE TEREPHTHALATE) IN ITS BLENDS WITH POLY(VINYLIDENE FLUORIDE)
Rahman M H; Nandi A K
Indian Association for the Cultivation of Science

The overall crystallisation of PETP in its blends with PVDF were studied by DSC. At a fixed temperature, the crystallisation rate of PETP decreased with increasing volume fraction of PVDF in the blend. However, at a fixed undercooling, there was initially an almost invariant rate with increasing volume fraction of PVDF in the blend but it increased at higher PVDF concentrations. Avrami analysis indicated that the nucleation process changed from three-dimensional to two-dimensional heterogeneous nucleation. A regime-I to regime-II transition of PETP occurred during its isothermal crystallisation in the pure state and in the blends. A jump in the crystallisation rate at the regime-I to regime-II transition occurred for the blends in which the volume fraction of PVDF was 0.55 and 0.35. This was attributed to the different diffusion processes occurring in the two regimes. Analysis of the lateral surface free energy obtained from the nucleation constant indicated that there might be some chain extension of PETP due to blending. 42 refs.

INDIA

Accession no.874655

Item 242
Macromolecules
35, No.23, 5th Nov.2002, p.8694-707
RADICAL HOMOPOLYMERIZATION OF VINYLIDENE FLUORIDE INITIATED BY BUTYL PEROXYPIVALATE. INVESTIGATION OF THE MICROSTRUCTURE BY FLUORINE-19 AND PROTON NMR SPECTROSCOPIES AND MECHANISMS
Guiot J; Ameduri B; Boutevin B
CNRS

Details are given of the radical solution polymerisation of vinylidene fluoride initiated by different peroxides. Various reaction temperatures and times and solvents were chosen to monitor the polymerisation in terms of initiating radical generated from these initiators and transferring agents. Characterisation was undertaken using fluorine-19 and proton NMR. 44 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.873622

Item 243
Journal of Biomedical Materials Research (Applied Biomaterials)
63, No.6, 2002, p.686-91
S/E-PTFE EPISCLERAL BUCKLING IMPLANTS. AN EXPERIMENTAL AND HISTOPATHOLOGIC STUDY
Mortemousque B; Leger F; Velou S; Graffan R; Colin J; Korobelnik J F
Bordeaux,University

An experimental and histopathological study was performed to investigate tissue changes induced by the implantation of a silicone band coated with expanded PTFE. Encapsulation combined with numerous giant cells were found to be surrounding the implants and deposits from the mineral salts of calcium were also found. The porous structure allowed a peripheral colonisation by fibrovascular tissue. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.873547

Item 244
Plastics Technology
48, No.11, Nov.2002, p.47/9
PVDF LATEX FOAM COMPOSITES PROVIDE HIGH FLAME RESISTANCE
Sherman L M

Atofina Chemicals in the USA has developed a new patent-pending process to create highly flame-resistant foams of polyvinylidene fluoride (PVDF) fluoropolymer, without using blowing agents or melt processing. This article describes the technology, which combines a liquid latex of the company's "Kynar" PVDF copolymer with glass mat or other reinforcements, to produce open-celled foams that are essentially non-flammable. The article also presents the results of fire tests carried out on the new material.

ATOFINA CHEMICALS
USA

Accession no.873054

Item 245
Journal of Polymer Science: Polymer Chemistry Edition
40, No.21, 1st Nov.2002, p.3771-95
FLUOROPOLYETHERS END-CAPPED BY POLAR FUNCTIONAL GROUPS. III. KINETICS OF THE REACTIONS OF HYDROXY-TERMINATED FLUOROPOLYETHERS AND MODEL FLUORINATED ALCOHOLS WITH CYCLOHEXYL ISOCYANATE CATALYZED ORGANOTIN COMPOUNDS
Mashlyakovskiy L; Khomko E; Volynkina N; Tonelli C
St.Petersburg,Institute of Technology; Ausimont

The kinetics of the dibutultin dilaurate (DBTDL)-catalysed urethane formation reactions of cyclohexyl isocyanate (CHI) with model monofunctional fluorinated alcohols and fluoropolyether diols of varius molecular weights in different solvents were studied. Depending on the initial reagent concentration and solvent, the reactions could be described by zero-order, first-order, second-order or more complex equations. The reaction mechanism, including the formation of intermediate ternary or binary complexes of reagents with the tin catalyst, could vary with the concentration and solvent and even during the reaction. A rate expression analogous to those used for enzymatic reactions was used for the results. Under the conditions studied, the rate of the uncatalysed reaction between fluorinated alcohols and CHI was negligible. No allophanate formation, side reactions, or catalysis by urethane occurred in the absence of DBTDL, or a synergetic effect in the presence of the catalyst. 39 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; RUSSIA; WESTERN EUROPE

Accession no.872933

Item 246
Journal of Polymer Science: Polymer Physics Edition
40, No.22, 15th Nov. 2002, p.2516-22
EXPERIMENTAL CHARACTERIZATION OF THE VOLUME STRAIN OF POLY(VINYLIDENE FLUORIDE) IN THE REGION OF HOMOGENEOUS PLASTIC DEFORMATION
Quatravaux T; Elkoun S; G'Sell C; Cangemi L; Meimon Y
Ecole des Mines de Nancy; Institut Francais du Petrole

Changes in the volume strain of PVDF subjected to uniaxial tensile testing at different temperatures and strain rates were investigated using a variant of the VideoTraction system. The effects of temperature on the mechanical behaviour of PVDF under stretching tests and of deformation, temperature, strain rate and unloading on volume strain of PVDF were examined and Bucknall's model was adapted for application to materials undergoing large volume strains. It was found that PVDF exhibited an increase in volume strain with true axial strain caused by material damage, which was dependent upon temperature and strain rate and related to the whitening phenomenon. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.872741

Item 247
Materie Plastiche ed Elastomeri
66, No.10, Oct.2001, p.742/50
Italian
PTFE: BETWEEN RESEARCH AND SERENDIPITY
Maltese P

The history of PTFE and fluorine chemistry in general is reviewed, and developments which led to the use of PTFE in chemically resistant applications in the Second World

War are examined.

DU PONT DE NEMOURS E.I.,& CO.INC.
USA

Accession no.872615

Item 248
designed Monomers and Polymers
5, No.2-3, 2002, p.317-324
NEW PTFE-POLYAMIDE COMPOUNDS
Lehmann D; Hupfer B; Lappan U; Pompe G; Haussler L; Jehnichen D; Janke A; Geibler U; Reinhardt R; Lunkwitz K; Franke R; Kunze K
Dresden,Institut fuer Polymerforschung; IMA; Dresden,Technische Universitat

New PTFE-polyamide compounds produced by reactive extrusion show very good material and tribological properties, combined with an excellent wear resistance. The basis of these properties is the formation of chemical bonds between PTFE and PA by transamidation in a melt modification reaction. The effective processing and the material properties of PA are combined with the excellent anti-friction properties of PTFE in this innovative material. Test specimen of PA and PA-PTFE obtained by two-component injection moulding process show very high interfacial adhesion. The processability of this material on polymer processing equipment and the use of available materials favours the commercialisation of these new PTFE polyamide compounds. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.871973

Item 249
Plastics, Rubber and Composites
31, No.8, 2002, p.359-63
MATERIAL AND FINITE ELEMENT ANALYSIS OF POLY(TETRAFLUOROETHYLENE) ROTARY SEALS
Li W; Mays S; Lam D
Polymer Sealing Solutions Ltd.

The stress-strain characteristics of PTFE under uniaxial tension and compression are measured at various temperatures. A new finite element analysis procedure using MARC is presented, which can simulate the different properties of PTFE from tension and compression data. This method is based on using the maximum principle stress value at the integration point of each element to define whether the element is under tension of compression at each increment, then using subroutines to specify the material properties. A positive value indicates a state of tension and a negative value indicates compression. It is found that the finite element analysis results are in good agreement with those from experiment. Finally, a PTFE rotary seal is modelled using this new method, and results are obtained incorporating stress and lip loads of the rotary seal, with different temperature effects. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.871937

Item 250
Journal of Applied Polymer Science
86, No.13, 20th Dec. 2002, p.3454-9
ANTIWEAR AND LUBRICATION PROPERTIES OF POLYURETHANE/ POLYTETRAFLUOROETHYLENE-BONDED COATING
Tian J; Huang Y L
Lanzhou,Institute of Chemical Physics; Chinese Academy of Sciences

The tribological properties of lubricating coatings composed of a PU binder and PTFE particles irradiated with Cobalt-60 gamma-rays to improve their dispersivity in the PU were investigated using a ring-on-block tester at a speed of 1.25 to 2.5 m/s and a load of 314 to 785N. The effects of PTFE concentration, curing conditions, coating thickness and sliding conditions on the wear life of the coatings were examined and the dependence of wear life on the curing process assessed. 23 refs.

CHINA

Accession no.871483

Item 251
Journal of Applied Polymer Science
86, No.13, 20th Dec. 2002, p.3377-88
INITIATION AND DEVELOPMENT OF THE HEAT-AFFECTED ZONE IN THE VIBRATION WELDING OF POLYVINYLIDENE FLUORIDE AND ITS COPOLYMERS
Valladares D; Cakmak M
Akron,University

Structure development in the heat-affected zone of PVDF and a copolymer of vinylidene fluoride and hexafluoropropylene during vibration welding was investigated using time slicing. The thermal behaviour of the polymers was examined by DSC and the state of the crystalline regions, including molecular orientation along the heat-affected zone, was assessed by wide-angle X-ray microbeam analysis. Fracture surfaces were analysed by scanning electron microscopy and low high magnification pictures of the weld interfaces were obtained by means of optical microscopy. The role of melt elasticity in structure development is briefly considered. 21 refs.

USA

Accession no.871474

Item 252
Polymer
43, No.23, 2002, p.6255-62
SEPARATION OF CHIRAL MOLECULES USING POLYPEPTIDE-MODIFIED POLY(VINYLIDENE FLUORIDE) MEMBRANES
Lee N H; Frank C W
Stanford,University

A chiral separation system was developed by the modification of PVDF ultrafiltration membranes with polyglutamate derivatives. Poly(gamma-benzyl-L-glutamate)s were vapour deposited on the membranes and the resulting poly(amino acid)s were modified via debenzylation or ester exchange reaction to produce poly(L-glutamic acid) (PLGA) and polyglutamates with triethylene glycol monomethyl ether side chains. The enantioselectivities for chiral amino acids (tryptophan, phenylalanine and tyrosine) and chiral drugs (propranolol, atenolol and ibuprofen) ranged from 1.04 to 1.47. The selectivity of PLGA increased as its helical content increased. Chemically grafted polymers showed increased enantioselectivity compared with physisorbed polymers within the membrane, possibly resulting from an increase in molecular weight and density of the polymer chains which may enhance the interaction between the chiral compounds and the surface-bound polypeptides. 40 refs.
USA

Accession no.870959

Item 253
Synthetic Metals
130, No.3, 20th Oct.2002, p.235-7
EFFICIENT LIGHT EMITTING DIODES WITH TEFLON BUFFER LAYER
Qiu Y; Gao Y; Wang L; Zhang D
Tsinghua,University

PTFE was used as a buffer layer to improve the performance of organic light-emitting diodes. The PTFE film was found to enhance the hole tunneling injection and effectively impede indium diffusion from a indium-tin oxide electrode. Results were compared with devices without the PTFE layer. 9 refs.
CHINA

Accession no.870931

Item 254
Macromolecules
35, No.20, 24th Sept.2002, p.7652-61
ATRP OF AMPHIPHILIC GRAFT COPOLYMERS BASED ON PVDF AND THEIR USE AS MEMBRANE ADDITIVES
Hester J F; Banerjee P; Won Y-Y; Akthakul A; Acar M H; Mayes A M
Massachusetts Institute of Technology

Amphiphilic graft copolymers of polyvinylidene fluoride (PVDF) with polymethacrylic acid or polyoxyethylene methacrylate (POEM) sidechains were prepared by atom transfer radical polymerisation. Addition of small amounts of the graft copolymer during a standard immersion precipitation process for fabrication of a membrane results in migration to the surface of a high percentage of the copolymer (5 percent by mass addition of POEM copolymer to pure PVDF result in 42 percent by mass near the membrane surface). Wettability of the membrane, and fouling resistance, were increased substantially compared to membranes of PVDF alone. Characterisation of copolymers utilised gel permeation chromatography, nuclear magnetic resonance spectroscopy, differential scanning calorimetry and transmission electron microscopy. Membranes were characterised using X-ray photoelectron spectroscopy, scanning electron microscopy, contact angle and protein adsorption measurements. 44 refs.
USA

Accession no.870816

Item 255
ANTEC 2002. Proceedings of the 60th SPE Annual Technical Conference held San Francisco, Ca., 5th-9th May 2002.
Brookfield, Ct., SPE, 2002, Paper 238, Session M45-Flexible Packaging. Joint with Extrusion. Film Extrusion and Properties, pp.5, CD-ROM, 012
TUBULAR MELT EXTRUSION OF POLY(VINYLIDENE FLUORIDE): STRUCTURE/PROCESS/PROPERTY BEHAVIOR AS A FUNCTION OF MOLECULAR WEIGHT (MW)
Xu J; Johnson Matthew; Wilkes G L
Virginia,Polytechnic Institute & State University
(SPE)

To determine the influence of molecular weight on film morphology, film of approximately 25 micrometre thickness was produced from five poly(vinylidene fluoride)s of different weight average molecular weights (Mw) and narrow molecular weight distributions. The film was produced using a blow-up ratio of unity and a range of melt extrusion temperatures, screw speeds, quench heights and line speeds. Wide angle x-ray scattering showed that the crystal orientation increased with increasing Mw. The characteristic relaxation time, determined by a Carreau-Yasuda fit of melt rheology data, correlated with the observed morphologies. The lowest Mw polymer exhibited a spherulitic-like texture, whilst under the same processing conditions the highest Mw material had a highly concentrated fibril morphology. A desirable stacked lamellar structure was obtained by blending two polymers. 9 refs.
USA

Accession no.870786

Item 256
Journal of Thermal Analysis and Calorimetry
69, No.3, 2002, p.939-46
THE MECHANISM OF ALPHA-GAMMA

TRANSITION OF POLY(VINYLIDENE FLUORIDE) IN THE MISCIBLE BLENDS. THE SIMULTANEOUS DSC-FTIR METHOD

Zhang G Z; Kitamura T; Yoshida H; Kawai T
Tokyo,Metropolitan University

The crystallisation and melting behaviour of blends of PVDF with atactic PMMA, syndiotactic PMMA and polyethyl methacrylate were investigated under isothermal conditions of both alpha-form and gamma-form competitive crystallisation using the simultaneous DSC/FTIR procedure. The mechanism of alpha-gamma transition of PVDF in the miscible blends was established from the relationship between the decrease of the alpha-form and increase of the gamma-form. It was found that the critical crystallisation temperature at which the transition from the alpha-form to the gamma-form in the solid state shifted to a higher temperature in the order of the interaction parameter. 14 refs.

JAPAN

Accession no.870398

Item 257
European Polymer Journal
38, No.11, Nov.2002, p.2153-60

ELECTROLESS DEPOSITION OF NICKEL ON FLUOROPOLYMERS MODIFIED BY SURFACE GRAFT COPOLYMERIZATION

Yang G H; Lim C; Tan Y P; Yan Zhang; Kang E T; Neoh K G
Singapore,National University

Polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) films were argon plasma pretreated and were then graft copolymerised, using ultraviolet light induced copolymerisation, with 4-vinylpyridine (4VP), 2-vinylpyridine (2VP) or 1-vinylimidazole(1VID). Activation of the functionalised film surface with palladium chloride allowed electroless deposition of nickel, and adhesive strength was measured using the T-peel test. X-ray photoelectron spectroscopy was used to examine the graft polymerised film surface before nickel coating and after adhesion testing. It was shown that highest adhesion of nickel was to the PVDF film, and that in all cases rupture during the peel test occurred in the polymer film. Peel strength depended on type of comonomer and graft concentration, and the high adhesion strength was attributed to the interaction of nitrogen groups in the grafted copolymers with palladium and nickel. 31 refs.

SINGAPORE

Accession no.870324

Item 258
Polymer Preprints. Volume 41, Number 1. Proceedings of a conference held San Francisco, Ca., March 2000.
Washington D.C., ACS,Div.of Polymer Chemistry, 2000, p.14-5, 28cm, 012

SYNTHESIS OF LINEAR POLY(TETRAFLUOROETHYLENE-CO-VINYL ACETATE) IN SUPERCRITICAL CARBON DIOXIDE

Lausenberg R D; Shoichet M S
Toronto,University
(ACS,Div.of Polymer Chemistry)

Linear copolymers of tetrafluoro ethylene and vinyl acetate were prepared in supercritical carbon dioxide solution with different initiator and tetrafluoroethylene concentrations. The linearity of the polymers was proven by attempted hydrolysis of the vinyl acetate to vinyl alcohol, where only a slight change in molar mass was observed. Causes of this mass change were discussed. Polymers were characterised using gel permeation chromatography, fourier transform infrared and nuclear magnetic resonance analysis, and elemental analysis. 13 refs.

CANADA

Accession no.868858

Item 259
Journal of Applied Polymer Science
86, No.7, 14th Nov.2002, p.1667-72

EFFECT OF RARE EARTH ELEMENTS' SURFACE TREATMENT ON TENSILE PROPERTIES AND MICROSTRUCTURE OF GLASS FIBER-REINFORCED POLYTETRAFLUOROETHYLENE COMPOSITES

Yu-Jun Xue; Xian-Hua Cheng
Shanghai,Jiao Tong University

The surface treatment of glass fibre using rare earth element-doped surface modifiers was studied. Modifiers used were N-beta-aminoethyl-gamma-aminopropyltrimethoxysilane, a mixture of silane and rare earth elements, and rare earth elements. The effects of different surface treatment conditions, rare earth element surface modifiers and glass fibre content on the tensile properties of glass fibre/PTFE composites were evaluated. The fracture surface morphologies of glass fibre/PTFE composites were also investigated. The optimum amount of rare earth elements for glass fibre surface treatment and its influence on the tensile properties of glass fibre/PTFE composites were identified. 24 refs.

CHINA

Accession no.868552

Item 260
ANTEC 2002. Proceedings of the 60th SPE Annual Technical Conference held San Francisco, Ca., 5th-9th May 2002.
Brookfield, Ct., SPE, 2002, Paper 166, Session M33-Polymer Analysis. Polymer Analysis Trends, pp.5, CD-ROM, 012

VISCOELASTIC PROPERTIES OF NYLON 12 AND PVDF

McFerran N L A; Armstrong C G; McNally T; McNally

G M; Murphy W R
Belfast,Queen's University
(SPE)

The time and temperature dependent properties of polyamide-12 and poly(vinylidene fluoride) were determined using linear viscoelastic theory based on the Boltzmann superposition principle. The isothermal dynamic mechanical properties were measured over the temperature range 30-140 C and the frequency range 0.3-30 Hz. Tensile stress relaxation measurements were made over the temperature range 25-140 C. The dynamic mechanical thermal analysis and stress relaxation results were compared by converting the temperature dependence at constant frequency to time dependence at constant temperature. There was good agreement between the experimentally determined stress relaxation modulus and that calculated from the dynamic modulus. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.868432

Item 261
Polymer
43, No.20, 2002, p.5511-20
GENERATION OF MICROCELLULAR FOAMS OF PVDF AND ITS BLENDS USING SUPERCRITICAL CARBON DIOXIDE IN A CONTINUOUS PROCESS
Siripurapu S; Gay Y J; Royer J R; DeSimone J M; Spontak R J; Khan S A
North Carolina,State University

Supercritical carbon dioxide was used as a blowing agent to generate microcellular foams of PVDF and its blends with PS or PMMA in a continuous process. Foams of neat PVDF and immiscible blends with PS showed poor cell characteristics but miscible blends of PVDF with PMMA produced foams with greatly improved morphologies. The PVDF/PMMA melt viscosity, decreased markedly with increasing PMMA content and supercritical carbon dioxide concentration. The cell density of microcellular PVDF/PMMA foams increased with increasing PMMA fraction and decreasing foaming temperature. 32 refs.

USA

Accession no.868068

Item 262
Surface Coatings International Part B
85, No.B3, Sept. 2002, p.209-14
SOLVENT-SOLUBLE FLUOROPOLYMERS FOR COATINGS - CHEMICAL STRUCTURE AND WEATHERABILITY
Unoki M; Kimura I; Yamauchi M
Asahi Glass Co.Ltd.

Chlorotrifluoroethylene and tetrafluoroethylene were evaluated as components for fluoroolefin-alkyl vinyl ether alternating copolymers for use in coatings. The weatherability of unpigmented films and pigmented coatings made from these copolymers was investigated and the degraded surfaces analysed by scanning electron microscopy. It was found that, in the case of pigmented coatings, pigment dispersibility was more important than the chemical structure of the copolymer for producing weather-resistant coatings. 4 refs.

JAPAN

Accession no.867883

Item 263
Coventry, 2001, pp.128, 29 cm, 30/7/02
PVDF/PVDF-HP PLASTIC PIPING SYSTEMS
Fischer G.,Ltd.

This catalogue from George Fischer gives information relating to its range of PVDF and high purity PVDF pipes and pipe fittings, and valves. Prices, dimensions and catalogue numbers are given for products in the Sygef range, together with general property information, including chemical resistance.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.867302

Item 264
Biomaterials
23, No.11, June 2002, p.2411-28
EFFECTS OF PLASMA TREATED PET AND PTFE ON EXPRESSION OF ADHESION MOLECULES BY HUMAN ENDOTHELIAL CELLS IN VITRO
Pu F R; Williams R L; Markkula T K; Hunt J A
Liverpool,University

The expression of adhesion molecules on the surface of human endothelial cells in response to the systematic variation in materials properties by ammonia plasma modification of PETP and PTFE was evaluated. Differences between first and second passage human umbilical vein endothelial cells were compared. Results were supported by immunohistochemical studies. The effect of plasma treated polymer surfaces on cell adhesion and proliferation was also studied. 53 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.866752

Item 265
Journal of Physics D
35, No.15, 7th Aug.2002, p.1859-63
PULSED LASER DEPOSITION OF COMPACT HIGH ADHESION POLYTETRAFLUOROETHYLENE THIN FILMS
Smausz T; Hopp B; Kresz N
Szeged,University

PTFE thin films are prepared from pressed powder pellets via pulsed laser deposition by using ArF (193 nm) excimer laser. The applied laser fluences are in the 1.6-10 J cm -2 range, the substrate temperature is varied between 27 and 250 deg.C and post-annealing of the films was carried out in air at temperatures, between 320 and 500 deg. C. Films deposited at 250 deg.C substrate temperature are found to be stoichiometric while those prepared at lower temperatures are fluorine deficient. Morphological analyses prove that the film thickness does not significantly depend on the substrate temperature and post-annealing at 500 deg.C results in a thickness reduction of approximately 50%. It is demonstrated that the films prepared at 8.2 J cm-2 fluence and annealed at 500 deg.C followed by cooling at 1 deg.C min-1 rate are compact, pinhole-free layers. The adherence of films to the substrates is determined by tensile strength measurements. Tensile strength values up to 2.4 MPa are obtained. These properties are of great significance when PTFE films are fabricated for the purpose of protecting coatings. 16 refs.

EASTERN EUROPE; HUNGARY

Accession no.866730

Item 266

ANTEC 2002. Proceedings of the 60th SPE Annual Technical Conference held San Francisco, Ca., 5th-9th May 2002.

Brookfield, Ct., SPE, 2002, Paper 89, Session M22-Applied Rheology. Extensional, pp.6, CD-ROM, 012

ANALYSIS OF EXTENSIONAL VISCOSITY TECHNIQUES FOR THE CHARACTERIZATION OF FLUOROPOLYMERS

Pattamaprom C; Mekhilef N

Atofina Chemicals Inc.

(SPE)

The extensional flow of poly(vinylidene fluoride) and polyethylene with different molecular weights, molecular weight distributions and degrees of long chain branching was investigated using a Rheotrans tester, in which an extruded polymer strand is pulled with increasing speed with continuous recording of the force, speed and pull-down ratio. The extensional viscosity was determined using procedures proposed by Laun and Schuch, and also by Wagner. The results are compared with those obtained by other methods, including Cogswell's entrance pressure drop in a converging flow. 5 refs.

USA

Accession no.866275

Item 267

Analytical Chemistry

74, No.17, 1st Sept.2002, p.4566-9

FABRICATION OF MICROCHANNEL STRUCTURES IN FLUORINATED ETHYLENE PROPYLENE

Sahlin E; Beisler A T; Woltman S J; Weber S G

Pittsburgh,University

A technique was developed for fabrication of channel structures with diameters down to 13 micrometres in FEP (tetrafluoroethylene-hexafluoropropylene copolymer). The technique was based on the unusual property of a dual-layer fluoropolymer tubing consisting of an outer layer of PTFE and an inner layer of FEP. When heated to above 350C, the outer PTFE layer shrank, while the inner FEP layer melted, resulting in filling of all empty space inside the tubing with FEP. The channel structures were formed using tungsten wires as templates that were pulled out after completion of the shrinking and melting process. A single example is described, although several analytical devices have been reproducibly prepared and shown to function. A microreactor coupled to an electrochemical flow cell detected the biuret complex of the natively electroinactive peptide des-Tyr-eu-enkephalin. 31 refs.

USA

Accession no.865872

Item 268

Journal of Applied Polymer Science

85, No.13, 23rd Sept. 2002, p.2692-8

PHYSICOCHEMICAL INVESTIGATION OF RADIATION-GRAFTED POLY(ACRYLIC ACID)-GRAFT-POLY(TETRAFLUOROETHYLENE-ETHYLENE) COPOLYMER MEMBRANES AND THEIR USE IN METAL RECOVERY FROM AQUEOUS SOLUTION

El-Sawy N M; Al Sagheer F A

Cairo,National Center for Radiation Res.& Technol.; Kuwait,University

Membranes were obtained by radiation grafting of acrylic acid onto a copolymer of tetrafluoroethylene and ethylene, reacted with potassium, silver and mercury ions in aqueous solution and characterised by various techniques. These techniques included FTIR spectroscopy, UV vis spectroscopy, SEM, TGA and ionic conductivity of grafted and metal-ion treated grafted membranes. Ion exchange capacity was determined by back titration and atomic absorption spectroscopy and the selectivity of the grafted membranes towards the metal ions by energy-dispersive spectroscopy. The ion selectivity, ionic conductivity, ion exchange capacity, morphology, heat stability and hydrophilicity of the membranes are discussed. 20 refs.

EGYPT; KUWAIT

Accession no.865273

Item 269

Journal of Reinforced Plastics and Composites

21, No.13, 2002, p.1221-40

FRICTION AND WEAR PERFORMANCE EVALUATION OF CARBON FIBRE REINFORCED PTFE COMPOSITE

Bijwe J; Neje S; Indumathi N J; Fahim M

Indian Institute of Technology

Recently commercialised PTFE composite reinforced with 25% chopped carbon fibres is selected for this study since details of the evaluated for friction and tribological behaviour were not available. The composite is evaluated for friction and wear performance in stringent operating conditions in adhesive as well as abrasive wear modes. The coefficient of friction (mu) and specific wear rate (Ko) of the composite in the adhesive wear mode are measured under high speeds, loads, extended sliding duration and elevated temperatures. At moderate loads, it is observed that although it exhibits a high mu and low Ko, it shows lower mu and appreciably good wear performance at higher loads and moderate speeds. At higher speeds its performance, however, deteriorates. It is also revealed that the composite shows poor performance when tested at elevated temperatures beyond 150 deg. C. A comparison with tribo-performance of neat PTFE indicates that CF reinforcement results in enhancement in wear behaviour very significantly. The friction coefficient, however, increases substantially. Moreover, abrasive wear performance also shows little deterioration due to carbon fibre reinforcement. Worn surface analysis by scanning electron microscopy is done to study wear mechanisms. 25 refs.

INDIA

Accession no.864814

Item 270
International Polymer Science and Technology
29, No.8, 2002, p.T/49-52
POLYTETRAFLUOROETHYLENE IN MEDICINE
Mikhailov I V; Sidorchuk S V; Lavrusenko S R

The use of PTFE in medical devices is discussed with particular reference to research and development carried out in Russia. The suitability of PTFE for synthetic tissue, bone and organs is examined, and details are given of particular projects, including artificial lungs and heart valves. (Article translated from Plasticheskie Massy, No.8, 2001, pp.38-41)

RUSSIA

Accession no.864352

Item 271
Journal of Polymer Science: Polymer Physics Edition
40, No.16, 15th Aug.2002, p.1754-9
CHARACTERIZATION OF VOLUME STRAIN OF POLY(VINYLIDENE FLUORIDE) UNDER CREEP TEST
Elkoun S; G’sell C; Cangemi L; Meimon Y
Ecole des Mines de Nancy; Institut Francais du Petrole

PVDF (Kynar 1000HD) was subjected to creep testing at constant true stress. The use of an original model to control and adjust, in real time, the stress allowed the assessment of volume changes occurring during the test. The adaptation of Bucknall’s model allowed the component related to microstructural modifications to be extracted from the whole volume strain. Mechanisms inducing volume strain were temp.-dependent. Above -40C and below 80C, i.e. between the two Tgs of PVDF, a linear increase of volume strain was observed as a result of polymer damage via the crazing phenomenon. In addition, this region was characterised by the presence of two distinct domains that could be attributed to either nucleation and propagation of voids or to an increase of the number of potential sites for nucleation resulting from microstructural modifications taking place during the test. Above the secondary Tg, on the other hand, a regular decrease of volume strain was observed. It was assigned to a material densification as a result of molecular orientation of the amorphous chain segment. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.863602

Item 272
Polymer International
51, No.7, July 2002, p.577-84
PHOTOINITIATED ALTERNATING COPOLYMERIZATION OF VINYL ETHERS WITH CHLOROTRIFLUOROETHYLENE
Gaboyard M; Hervaud Y; Boutevin B
Montpellier,Ecole Nationale Superieure de Chimie

The photoinitiated alternating copolymerisation of chlorotrifluoroethylene (CTFE) with ethyl vinyl ether, 2-chloroethyl vinyl ether, cyclohexyl vinyl ether (CHVE) and 4-hydroxybutyl vinyl ether (HBVE) was studied. Under the experimental conditions used, the equilibrium constant of the charge-transfer complex was relatively low for CHVE/CTFE and HBVE/CFE systems. The copolymerisation appeared to involve the free monomers rather than propagation via the donor-acceptor complex. The alternating structure arose from the difference in polarity between the two monomer types. 25 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.862954

Item 273
Polymer Preprints. Volume 42. Number 1. Spring 2001. Papers presented at the ACS Meeting held San Diego, Ca., 1st-5th April 2001.
Washington, D.C., ACS,Div.of Polymer Chemistry, 2001, p.9-10, 28cm. 012
TRIPLE RESONANCE MULTIDIMENSIONAL SOLUTION NMR OF FLUOROPOLYMERS. PROBLEMS, SOLUTIONS AND RESULTS
Rinaldi P L; Assemat O; Li L
Akron,University
(ACS,Div.of Polymer Chemistry)

Some of the complications of doing proton/carbon 13/fluorine 19 triple resonance, multidimensional NMR on fluoropolymers are described. Experimental methods are illustrated for circumventing problems with uniform excitation, multiple quantum interference, and decoupling over wide spectral windows. Results from the characterisation of hexafluoropropylene-difluoroethylene copolymers are used to illustrate the application of these techniques. 3 refs.

USA

Accession no.862394

Item 274

Macromolecular Symposia

Vol.182, 2002, p.119-29

CONTINUOUS PRECIPITATION POLYMERIZATION OF VINYLIDENE FLUORIDE IN SUPERCRITICAL CARBON DIOXIDE: MOLECULAR WEIGHT DISTRIBUTION

Saraf M K; Wojcinski L M; Kennedy K A; Gerard S; Charpentier P A; DeSimone J M; Roberts G W
North Carolina,State University

An investigation was carried out into the surfactant-free precipitation polymerisation of vinylidene fluoride in supercritical carbon dioxide using, as polymerisation initiator, diethyl peroxydicarbonate. Polymerisation was carried out in a continuous stirred autoclave at temperatures from 65 to 85C and at pressures between 210 and 305 bar. Molecular weight distributions of the polymers were determined by GPC and the effects of inlet monomer concentration, total polymerisation pressure and polymerisation temperature on MWD evaluated. A model, which includes chain transfer to polymer, was developed to predict the increase in polydispersity observed with increasing monomer concentration and the reasons for the formation of polymers with bimodal MWD at many of the operating conditions investigated are briefly considered. (3rd IUPAC-Sponsored International Symposium on Free-Radical Polymerization: Kinetics and Mechanism, Il Ciocco (Lucca), Tuscany, Italy, 3rd-9th June, 2001)

USA

Accession no.860998

Item 275

Polymer Preprints. Volume 43, Number 1. Spring 2002. Papers presented at the ACS meeting held Orlando, Fl., 7th-11th April 2002.
Washington D.C., ACS, Div. of Polymer Chemistry, 2002, p.644, 28 cm, 012

RADICAL TELOMERIZATION OF VINYLIDENE FLUORIDE IN THE PRESENCE OF DIBROMODIFLUOROMETHANE AS TELOGEN

Belfield K D; Abdel-Sadek G G; Huang J; Ting R Y
Central Florida,University
(ACS,Div.of Polymer Chemistry)

The telomerisation of vinylidene fluoride using, as a telogen, dibromodifluoromethane, and either tri-n-butyl boron/oxygen or di-tert-butyl peroxide, as polymerisation initiators, and the characterisation of the resulting telomers by multi-nuclear NMR spectroscopy and elemental analysis are briefly described. The molecular structure, molec.wt. and composition of the bromine-terminated telomers are briefly discussed. 6 refs.

USA

Accession no.860642

Item 276

Journal of Polymer Science: Polymer Physics Edition

40, No.14, 15th July 2002, p.147-89

COCRYSTALLISATION IN BLENDS OF RANDOM TETRAFLUOROETHYLENE FLUORINATED COPOLYMERS: THE EFFECT OF THE CHAIN STRUCTURE AND CRYSTALLISATION CONDITIONS

Pucciariello R; Villani V; De Ballesteros O R
Potenza,Basilicata University; Napoli,Universita Federico II

The possibility of the cocrystallisation of random fluorinated tetrafluoroethylene copolymers is investigated with differential scanning calorimetry and wide-angle X-ray scattering. In particular, mixtures composed of poly(tetrafluoroethylene)-co-(hexafluoropropylene) containing 8 or 1 mol.% comonomer or poly(tetrafluoroethylene)-co-perfluoromethylvinylether (2-10 mol.% comonomer) are examined. The extent of cocrystallisation is determined by the difference in the comonomer content, being higher when the difference is lower, and it is favoured when quenching from the melt state is adopted. Nevertheless, a key to determining the extent of cocrystallisation is the behaviour of co-units with respect to inclusion or exclusion from the crystal lattice: when the components are different with respect to this behaviour, they are not likely to be miscible in the crystal state even if the difference in the comonomer content is low. Moreover, the similarity in the crystallisation rates between the components plays an important role: the cocrystallisation decreases as the difference in the crystallisation rate increases until, when the difference becomes high enough, the blend becomes immiscible. 48 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.860497

Item 277

Macromolecules

35, No.14, 2nd July 2002, p.5670-80

SELF-CONSISTENT-FIELD ANALYSIS OF THE SURFACE STRUCTURE AND SURFACE TENSION OF PARTIALLY FLUORINATED COPOLYMERS: INFLUENCE OF POLYMER ARCHITECTURE

van de Grampel R D; Ming W; Laven J; van der Linde R; Leermakers F A M
Eindhoven,University of Technology; Wageningen,University

A molecular-level self-consistent-field theory was used to analyse physical and thermodynamic properties of partially fluorinated PMMA chains in the vicinity of the polymer-vapour interface. The molecules were described on a united atom level in which the methyl ester and perfluoroalkyl esters were linked onto a C-C backbone, whereas the vapour was modelled as free volume. Replacing -OCH3 groups by -OCH2C6F13 groups was used to vary the chain composition/architecture. In agreement with experimental data, the degree of fluorination influenced the surface tension in a non-linear manner, a small fraction of fluorinated groups leading to a relatively large drop of the surface tension. The surface characteristics were also dependent on various polydispersity effects. The effects of chain length, blockiness and degree of incorporation of the fluorinated monomer were systematically analysed. It was found that both the surface tension and surface structure were very sensitive to the degree of blockiness, leading in special cases to microphase separation of the bulk. For these microphase-separated systems, a completely ordered bulk with lamellae parallel to the surface was observed. 40 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE

Accession no.860095

Item 278
Biomaterials
23, No.16, Aug.2002, p.3487-93

PVDF AS A NEW POLYMER FOR THE CONSTRUCTION OF SURGICAL MESHES

Klinge U; Klosterhalfen B; Ottinger A P; Junge K; Schumpelick V
Aachen,Technical University

Details are given of the development of mesh prostheses made of PVDF for abdominal hernia repair. The PVDF meshes were compared to a PP mesh in regard to functional consequences and morphological tissue responses. After implantation the tensile strength of the suture zone and the mesh were determined. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.859497

Item 279
Journal of Membrane Science
204, No.1-2, 2002, p.295-301

FUEL CELL PERFORMANCE OF PROTON IRRADIATED AND SUBSEQUENTLY SULFONATED POLYVINYL FLUORIDE MEMBRANES

Vie P; Paronen M; Stromgard M; Rauhala E; Sundholm F
Trondheim,University; Helsinki,University

Proton irradiated and sulphonated PVF membranes were tested with respect to fuel cell performance and swelling in water. Comparisons were made with the performance of Nafion fluoropolymer membranes tested under similar conditions. 26 refs.

EUROPEAN UNION; NORWAY; SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.859461

Item 280
Polymer Engineering and Science
42, No.6, June 2002, p.1247-59

PROPERTIES OF POLYTETRAFLUOROETHYLENE (PTFE) PASTE EXTRUDATES

Ariawan A B; Ebnesajjad S; Hatzikiriakos S G
British Columbia,University; DuPont Fluoroproducts

The effects of die design, polymer molecular structure and isoparaffinic lubricant concentration on the mechanical properties of PTFE paste extrudates were investigated using various techniques, including tensile testing, DSC and Raman spectroscopy. The mechanical property data were related to the quantity and quality of fibrils formed during extrusion and the effects of die reduction ratio, die entrance angle, length-to-diameter ratio of die, molecular structure and lubricant concentration on tensile strength of the extrudates considered under separate headings. 18 refs.

CANADA; USA

Accession no.859237

Item 281
Journal of Applied Polymer Science
85, No.7, 15th Aug.2002, p.1362-9

MISCIBILITY AND MORPHOLOGY OF POLY(VINYLIDENE FLUORIDE)/ POLY((VINYLIDENE FLUORIDE)-RAN-TRIFLUOROETHYLENE) BLENDS

Gregorio R; Chaud M R; Dos Santos W N
Sao Carlos,Universidade Federal

An investigation is presented of the effect of the different crystalline phases of each blend component on miscibility when blending PVDF and its copolymer poly((vinylidene fluoride)-ran-trifluoroethylene) (P(VDF-TrFe)) containing 72 mol.% of VDF. It is found that, when both components crystallise in their ferroelectric phase, the PVDF shows a strong effect on the crystallinity and phase-transition temperature of the copolymer, indicating partial miscibility in the crystalline state. On the other hand, immiscibility is observed when both components, after melting, are crystallised in their paraelectric phase. In this case, however, a decrease in crystallisation temperatures suggests a strong interaction between monomers in the liquid state. Blend morphologies indicate that, in spite of the lack of miscibility in the crystalline state, there is at least miscibility between PVDF and P(VDF-TrFE) in the liquid state, and that a very intimate mixture of the two phases on the lamellar level can be maintained upon crystallisation. 15 refs.

BRAZIL

Accession no.858742

Item 282

Polymer Science Series B

44, Nos.3-4, March-April 2002, p.94-8

EFFECT OF MODIFICATION OF CARBON FIBERS ON THE STRUCTURE AND THERMOPHYSICAL PROPERTIES OF FILLED POLY(TETRAFLUOROETHYLENE)

Shelestova V A; Yurkevich O R; Grakovich P N
Belarus Academy of Sciences

Carbon fibre-reinforced polytetrafluoroethylene (PTFE) composites were produced in which a thin layer of PTFE was formed on the fibre surface by plasma deposition prior to preparing the composite, so as to enhance interaction between fibre and matrix. The temperature dependence of heat capacity, thermal conductivity and mechanical loss tangent were determined for unfilled PTFE and for composites containing 20 wt% fibre (with and without the surface modification). The use of a modified filler increased the density of the boundary layers, and enhanced the mechanical properties of the composite. 10 refs.

BELARUS; BELORUSSIA

Accession no.858694

Item 283

Polymer Science Series B

44, Nos.3-4, March-April 2002, p.91-3

SIMULATION OF THE ASSOCIATIVE STRUCTURES OF FLUOROALKYL METHACRYLATES

Il'in A A; Solov'ev M E; Mogilevich M M; Semeikin I N; Korolev G V
Yaroslavl',State Technical University; Russian Academy of Sciences

Associative structures of fluoroalkyl methacrylates which may occur during polymerisation were simulated. The simplest associative structure (dimer) structure was determined by calculating the spatial position of molecules with the minimum potential energy. It was shown that the dimers were formed predominantly by interaction between the fluoroalkyl fragments of molecules, and that the participation of methacrylic groups was thermodynamically disadvantageous. The contribution of atomic groups and the sites of the intermolecular interactions were determined. The structure of the associates was consistent with that of a comb-like polymer with layers of antiparallel-packed side groups. It is proposed that the specific features of a monomer polymerisation medium may be transferred to the polymer structure. 6 refs.

RUSSIA

Accession no.858693

Item 284

Polymer

43, No.14, 2002, p.3879-90

PREPARATION AND CHARACTERIZATION OF POLYVINYLIDENE FLUORIDE HOLLOW FIBER MEMBRANES FOR ULTRAFILTRATION

Khayet M; Feng C Y; Khulbe K C; Matsuura T
Madrid,Universidad Complutense; Ottawa,University

PVDF hollow fibre membranes with different pore sizes were prepared by solvent spinning. The polymer solutions were prepared from 23 wt% of PVDF in DMAC using different concentrations of ethylene glycol (4, 6 and 8 wt%) as a non-solvent additive. The pore sizes were increased as the ethylene glycol concentration in the spinning solution increased and when ethanol was added to the internal coagulant solution, the external coagulant solution, or to both. Atomic force microscopy (AFM) studies showed that the pore size of the inner surface was larger than that of the outer surface. Mean pore sizes determined by AFM were larger than those determined by gas permeation or solute transport experiments. The effective porosity determined by gas permeation and solute transport tests decreased with the addition of ethanol to either the bore liquid, or the coagulation bath, or both. Nodules and nodule aggregates were observed at the inner and outer surfaces of the PVDF hollow fibre membranes. SEM studies showed that finger-like structures were formed when water was used as the coagulant and that a sponge-like structure was formed when a water/ethanol (50% v/v) was used as internal or external coagulant. 24 refs.

CANADA; EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.857630

Item 285

Journal of Applied Polymer Science

84, No.13, 24th June 2002, p.2366-71

MELT-SPINNING PROCESS OF A TETRAFLUOROETHYLENE-HEXAFLUOROPROPYLENE COPOLYMER

Uno T; Miyata S; Shirai H
Tokyo,University of Agriculture & Technology; Shinshu,University

The melt spinning process of tetrafluoroethylene-hexafluoropropylene copolymer (FEP) using an extruder was studied. A novel spinneret with a large diameter spinning nozzle and a high temperature vessel was used to solve the problem of filament breakage caused by the high melting viscosity of FEP. The drawing of as-spun FEP fibre was effective to increase the modulus and the tensile strength. The drawing process was necessary to strengthen the fibre. FEP fibres up to six denier were continuously produced through long-run production. 9 refs.

JAPAN

Accession no.857044

Item 286
Composites Science and Technology
62, Nos.7-8, 2002, p.1001-9

DYNAMIC MECHANICAL PROPERTIES OF PTFE BASED SHORT CARBON FIBRE REINFORCED COMPOSITES: EXPERIMENT AND ARTIFICIAL NEURAL NETWORK PREDICTION

Zhang Z; Klein P; Friedrich K
Kaiserslautern,University

Dynamic mechanical properties (storage modulus and damping) of short fibre reinforced composites are investigated in a temperature range from -150 to 150 deg.C. A series of PTFE-based composites blended with different contents of polyetheretherketone (PEEK) and reinforced with various amounts of short carbon fibres (CF) is considered. Dynamic mechanical thermal analysis (DMTA) is employed using a three-point-bending configuration. The influence of different characteristics of PTFE and PEEK at various temperatures is also considered. Based on measured results, an artificial neural network (ANN) approach is introduced for further prediction purposes. Analysis shows that the number of training dataset plays a key role to the ANN predictive quality. In addition, the more complex the nonlinear relation between input and output, the larger the number of training dataset required. The simulation result shows that ANN is a potential mathematical tool in the structure property analysis of polymer composites. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.856487

Item 287
Journal of Membrane Science
202, No.1-2, 2002, p.119-35

DESIGN AND PERFORMANCE OF FOUL-RESISTANT POLY(VINYLIDENE FLUORIDE) MEMBRANES PREPARED IN A SINGLE-STEP BY SURFACE SEGREGATION

Hester J F; Mayes A M
Massachusetts Institute of Technology

Immersion-precipitated membranes with enhanced fouling resistance were prepared from blends of PVDF and a free-radically synthesised amphiphilic comb polymer having a methacrylate backbone and PEO side chains. X-ray photoelectron spectroscopy analysis indicated marked surface segregation of the comb polymer during membrane coagulation, providing an integrated near-surface coverage of up to 50 vol % comb for a membrane containing 10 wt %. The surface coverage increased with comb molec.wt., providing hydrophilic surfaces with good stability and providing evidence for a proposed mechanism for surface localisation. Separation surface porosities for comb-modified membranes were up to an order of magnitude higher than PVDF controls. With the combined benefits of fouling resistance and increased porosity, a membrane containing 10 wt % comb was over 20 times as permeable as a PVDF-only membrane with equivalent separation characteristics after 3 h of filtration of a foulant protein solution. 69 refs.

USA

Accession no.854755

Item 288
Journal of Coatings Technology
74, No.928, May 2002, p.57-66

STRUCTURE CONTROL, COATING PROPERTIES, AND DURABILITY OF FLUORINATED ACRYLIC-BASED POLYMERS

Castelvetro V; Aglietto M; Ciardelli F; Chiantore O; Lazzari M; Toniolo L
Pisa,University; Torino,Universita; CNR,Centro Gino Bozza

Conventional, side-chain fluorinated, fully acrylic random copolymers were synthesised from fluorinated acrylates along with more unusual hybrid copolymers with vinyl ethers. The photodegradation of these fluorinated copolymers was investigated by accelerated photoageing under strictly controlled conditions using a fluorescent xenon lamp to mimic solar irradiation. The coating and protective properties of these copolymers applied to microporous and macroporous stone substrates having different chemical composition and morphology were also evaluated. 22 refs. (78th Annual Meeting of the FSCT, Chicago, Ill., 16th-20th Oct. 2000)

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.854532

Item 289
Polymer Preprints, Volume 42, No.2, Fall 2001,
Conference proceedings.
Chicago, Il., Fall 2001, p.554-5

CONTINUOUS AND BATCH POLYMERISATIONS OF VINYLIDENE FLUORIDE IN DENSE CARBON DIOXIDE

Wojeiski L M; Saraf M K; Roberts G W; DeSimone J M
North Carolina,State University; North Carolina,Chapel Hill University
(ACS,Div.of Polymer Chemistry)

As an environmentally benign solvent, supercritical carbon dioxide (scCO2) has shown potential as a viable medium for a number of chemical processes, including the polymerisation of fluorinated olefins. A green process has been developed, which allows for the continuous polymerisation of fluorinated monomers via free radical precipitation polymerisation in scCO2 in a continuous stirred tank reactor (CSTR). It was hoped that by carrying out these polymerisations in a CSTR, the environmental benefits of CO2-based polymerisations could be coupled with the process advantages of using a continuous system. Although it has been possible to achieve desirable conversions of monomer, molecular weight of the polymers produces in this system has been lower than desired. A small-scale polymerisation system is implemented which allows for rapid screening of polymerisation conditions and initiators, in this case, for the free radical precipitation polymerisation of vinylidene fluoride. The fluorinated initiators examined are active at lower temperatures relative to non-fluorinated initiators, which opens up the possibility of preparing high molecular weight polymer under reasonably mild reaction conditions. These lower reaction temperatures lead to an increase in the Tm of the polymer to one comparable with commercially available PVDF. NMR analysis of these polymers shows a reduced tendency to reverse added monomer units, and shows a lower concentration of end-groups, indicating that these materials have higher Mn's relative to those prepared at high temperatures. 3 refs.

USA

Accession no.853927

Item 290
Macromolecules
35, No.10, 7th May 2002, p.4050-5
EVIDENCE OF ELONGATED POLYMERIC AGGREGATES IN NAFION
Rubatat L; Rollet A L; Gebel G; Diat O
CNRS

Small-angle X-ray and neutron scattering techniques were used to probe the structure of swollen Nafion PTFE membranes. A new structural model of Nafion in the hydrated state is suggested based on analysing the scattering data as a function of the polymer volume fraction and using a contrast variation method for the neutron experiments. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.853650

Item 291
Journal of Intelligent Material Systems and Structures
12, No.6, June 2001, p.423-33
INTEGRATION OF SMART MATERIALS INTO DYNAMICS AND CONTROL OF INFLATABLE SPACE STRUCTURES
Park G; Kim M-H; Inman D J
Virginia,Polytechnic Institute

An experimental investigation of vibration testing and control of an inflated thin-film torus is presented. The use of PVDF smart materials as integrated sensors/actuators to find modal parameters and to reduce vibration is discussed. 13 refs.

USA

Accession no.851742

Item 292
Analytical Chemistry
74, No.7, 1st April 2002, p.1597-603
OPTIMAL ENVIRONMENT FOR GLUCOSE OXIDASE IN PERFLUOROSULFONATED IONOMER MEMBRANES. IMPROVEMENT OF FIRST-GENERATION BIOSENSORS
Karayakin A A; Kotelnikova E A; Lukachova L V; Karyakina E E; Wang J
Moscow,State University; New Mexico,State University

An optimal environment for glucose oxidase in Nafion PTFE membranes was achieved using an advanced immobilisation protocol based on a nonaqueous immobilisation route. Exposure of glucose oxidase to water-organic mixtures with a high content of the organic solvent resulted in stabilisation of the enzyme by a membrane-forming polyelectrolyte. A glucose biosensor was prepared by casting the membranes over Prussian blue-modified glassy carbon disk electrodes. 39 refs.

RUSSIA; USA

Accession no.851251

Item 293
European Polymer Journal
38, No.1, Jan.2002, p.179-86
DEHYDRATION OF WATER-ALCOHOL MIXTURES BY PERVAPORATION AND VAPOUR PERMEATION THROUGH SURFACE RESINTERING EXPANDED POLY(TETRAFLUO ROETHYLENE) MEMBRANES
Huang J; Yi-Chieh Wang; Chi-Lan Li; Kueir-Rarn Lee; Shu-Chin Fan; Tian-Tsair Wu; Juin-Yih Lai
Chung Yuan University; Nanya Junior College of Technology

Membranes were prepared by the surface sintering of expanded PTFE membranes, and characterised by X-ray diffraction, atomic force and scanning electron microscopies, and contact angle measurements. The crystallinity and surface roughness decreased with increasing sintering temperature. The separation of aqueous alcohol mixtures by pervaporation and vapour permeation was enhanced by the surface sintering treatment, with vapour permeation giving a superior separation factor to that obtained by pervaporation. 10 refs.

TAIWAN

Accession no.850836

Item 294
European Polymer Journal
38, No.1, Jan.2002, p.49-55
THERMAL AND IONIC CONDUCTIVITY STUDIES OF PLASTICIZED PMMA/PVDF BLEND POLYMER ELECTROLYTES
Rajendran S; Mahendran O; Mahalingham T
Alagappa,University; Madurai College

Films of blends of poly(methyl methacrylate) and poly(vinylidene fluoride), containing various lithium perchlorate concentrations, were prepared by solvent casting. Complexation was studied using X-ray diffraction and Fourier transform infrared spectroscopy. The influence of salt concentration, temperature and dimethyl phthalate plasticiser content on the ionic conductivity and the thermal stability of the films was investigated. The highest conductivity was achieved using a salt concentration of 8 wt%. 29 refs.

INDIA

Accession no.850822

Item 295
Chemistry of Materials
14, No.3, March 2002, p.1306-13
TAILORING TRANSPARENCY OF IMAGEABLE FLUOROPOLYMERS AT 157NM BY INCORPORATION OF HEXAFLUOROISOPROPYL ALCOHOL TO PHOTORESIST BACKBONES
Bae Y C; Douki K; Tianyue Yu; Junyan Dai; Schmaljohann D; Koerner H; Ober C K; Conley W
Cornell University; International SEMATECH

Hexafluoroisopropyl alcohol-functionalised acrylic and styrenic monomers, such as 2-(4-(2-hydroxyhexafluoro isopropyl)cyclohexane)hexafluoroisopropyl acrylate(I), 2-(4-(2,2,2-trifluoro-1-methoxy-methoxy-1-trifluorom ethylethyl)cyclohexane)hexa fluoroisopropyl acrylate and 2-(4-(2,2,2-trifluoro-1-ethoxymethoxy-1-trifluor omethylethyl))styrene(II), were synthesised and their (co)polymers were studied as photoresist platforms for 157 nm lithography. It was found that these (co)polymers were unusually transparent at 157 nm and absorbances of poly(I) and poly(I-co-II) were determined to be 1.93 and 2.38/micrometre, respectively. Results indicated that both electron-withdrawing effects and bulkiness of CF3 groups played important roles in tailoring the absorbance of chromophores. Lithographic studies were carried out with poly(I)-based resists using 157 and 248 nm steppers and it was demonstrated that, after selective modification, it was possible to use conventional resist backbones, such as acrylic or styrenic polymers, in the design of single-layer resists for 157 nm lithography. 25 refs.

USA

Accession no.850770

Item 296
Advanced Materials
14, No.6, 18th March 2002, p.436-9
ORIENTED CRYSTALLINE FILMS OF TRIS(8-HYDROXYQUINOLINE) ALUMINIUM(III): GROWTH OF THE ALPHA POLYMORPH ONTO AN ULTRA-ORIENTED POLY(TETRAFLUOROE THYLENE) SUBSTRATE
Moulin J-F; Brinkmann M; Thierry A; Wittmann J-C
Institut Charles Sadron

Crystalline films of tris(8-hydroxyquinoline) aluminium(III) (TQA) were grown on PTFE substrates and the evolution of film morphology investigated by TEM. Electron diffraction was employed to identify the crystal structure of TQA and the preferential orientation of the microcrystallites on the PTFE substrate. The effect of the molecular structure of the PTFE on the oriented growth mechanism was examined and the nucleating ability of the PTFE substrate evaluated. The possibility of modifying the growth habit of TQA onto PTFE using electron beam irradiation was also assessed. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.849935

Item 297
Macromolecules
35, No.7, 26th March 2002, p.2682-8
ROLE OF SOLUTION PHASE WATER ON THE DEPOSITION OF THIN FILMS OF POLYVINYLIDENE FLUORIDE
Benz M; Euler W B; Gregory O J
Rhode Island,University

Thin films of PVDF were deposited from a variety of solution conditions and examined by IR spectroscopy and SEM. Methods to rapidly assess the film thickness and the phase composition of PVDF were developed. The effect of the composition of the solvent on the formation of the ferroelectric beta phase was examined. The influence of the kinetics of the evaporation process on the nature of the PVDF films was determined. 34 refs.

USA

Accession no.849124

Item 298
Macromolecules
35, No.3, 29th Jan.2002, p.714-21
CONFIRMATION OF CRYSTAL STRUCTURE OF POLY(VINYLIDENE FLUORIDE) THROUGH THE DETAILED STRUCTURE ANALYSIS OF VINYLIDENE FLUORIDE OLIGOMERS SEPARATED BY SUPERCRITICAL FLUID CHROMATOGRAPHY
Tashiro K; Hanesaka M
Osaka,University

The separation of vinylidene fluoride oligomers with uniform molecular weights was carried out using supercritical fluid chromatography. Oligomers with 6, 7 and 8 vinylidene fluoride units were grown into single crystals and X-ray structure analyses were carried out on these. The molecular conformation and the packing structure in the subcell were found to be essentially the same as those of PVDF form II. The oligomers showed the same types of crystal modification, depending on the preparation conditions, as the parent polymer. The end groups appeared to play an important role in the structure formation of the oligomers. 34 refs.

JAPAN

Accession no.848177

Item 299

Macromolecular Symposia

179, 2002, p.347-58

PTFE NANOEMULSIONS AS ULTRALOW-K DIELECTRIC MATERIALS

Machetta P; Lazzarino M; Kapeliouchko V; Poggio T; Canil G; Sanguineti A; Arcella V

TASC-INFM; Ausimont SpA

Nanoemulsions of PTFE, of high, medium and low molecular weight, were prepared using a reactor charged with perfluoropolyether microemulsion and pressurised at 80 C by tetrafluoroethylene monomer. The initiator was ammonium persulphate. Thin films were prepared from the emulsions by spin coating followed by heat treatment to 150 C. The film morphology was strongly dependent upon molecular weight. Films as thin as 160 nm with dielectric strengths above 4 MV/cm were obtained. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.848077

Item 300

Chemistry of Materials

14, No.2, Feb.2002, p.804-11

ANALYSIS OF THE SURFACE CHEMICAL COMPOSITION AND MORPHOLOGICAL STRUCTURE OF VAPOR-SENSING GOLD-FLUOROPOLYMER NANOCOMPOSITES

Cioffi N; Losito I; Torsi L; Farella I; Valentini A; Sabbatini L; Zambonin P G; Bleve-Zacheo T

Bari,Universita degli Studi; CNR; Bari,University

A systematic spectroscopic and morphological characterisation was conducted of gold-Teflon nanocomposites, deposited by ion beam co-sputtering. These composites exhibited vapour-sensing properties based on swelling phenomena. Analysis by X-ray photoelectron spectroscopy allowed the conclusion that gold co-deposition induced a progressive defluorination of the polymeric chains, leading to a significant increase of the polymer chain branching and of the concentration of unsaturated fluorinated carbons. The presence of a fluoride peak in the F 1s spectrum proved the formation of polar gold fluorides. TEM revealed the presence of in-plane homogeneously distributed nanosized gold domains, while angle-resolved X-ray photoelectron spectroscopy indicated a non-homogeneous in-depth distribution of the gold particles, with the outer surface being less rich in nanoparticles. Results derived from the analytical characterisation allowed a deeper understanding of the swelling phenomena involved in the sensing process. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.847650

Item 301

Journal of Polymer Science: Polymer Physics Edition

40, No.6, 15th March 2002, p.602-4

COMMENTARY ON ‘CARBON DIOXIDE-POLY(VINYLIDENE FLUORIDE) INTERACTIONS AT HIGH PRESSURE’

Kennedy K A; Desimone J M; Roberts G W

North Carolina,State University; North Carolina,University

Comments are made about the paper by Briscoe et al. on the swelling and sorption behaviour of PVDF in supercritical carbon dioxide (ibid, Vol.36, 1998, p.2435-47). In that paper, the mass uptake of carbon dioxide into PVDF was measured at 42 and 80C for a range of carbon dioxide pressures up to 30 MPa and the data were compared with predictions from the Sanchez-Lacombe equation of state. An unsuccessful attempt was made to duplicate the calculations made in that study and it was concluded that errors were made in the original analysis. These errors may have led to misleading conclusions regarding the applicability of the Sanchez-Lacombe equation of state to the carbon dioxide/PVDF system. 6 refs.

USA

Accession no.847596

Item 302

Journal of Adhesion Science and Technology

16, No.1, 2002, p.47-57

INTERFACIAL ADHESION BETWEEN POLYURETHANE BINDER AND POLY(TETRAFLUOROETHYLENE) POWDER IN BONDED SOLID LUBRICANT FILMS

Tian J; Huang Y L

Lanzhou,Institute of Chemical Physics

PTFE powder was irradiated with cobalt-60 gamma-rays in order to improve its dispersing ability in PU as a binder. The bonded solid lubricant films of the irradiated PTFE were prepared on an AISI 1045 steel block by spraying and curing at ambient temp., with PU as the binder. The tribological properties of bonded solid lubricant films with the PTFE pigment volume fraction were examined on a ring-on-block friction and wear tester. The interfacial adhesion between the PU binder and PTFE powder was investigated using FTIR spectroscopy, SEM, immersion heat and X-ray photoelectron spectroscopy. It was found that gamma-ray irradiation increased the activity of the PTFE powder surface and improved the interfacial adhesion between the PTFE powder and the PU binder, which helped to improve the wear resistance of the corresponding bonded solid lubricant films. 22 refs.

CHINA

Accession no.847475

Item 303
ACS Polymeric Materials Science and Engineering Fall Meeting.Volume 85.
Chicago, IL, 26th-30th August 2001, p.581-2, 012

MODIFICATION OF MORPHOLOGY-PROPERTY RELATIONSHIPS IN NAFION/PVDF BLEND MEMBRANES

Taylor E P; Landis F A; Moore R B
Southern Mississippi,University
(ACS,Div.of Polymeric Materials Science & Engng.)

The influence of the ionomer counterion and content on the crystallisation kinetics, water vapour permeability and morphology of membranes of Nafion ionomer/poly(vinylidene fluoride) blends was investigated. Membranes were prepared by solution casting and characterised by small angle X-ray scattering, water vapour permeation measurements, and determination of the bulk crystallisation kinetics. Blends containing the strongly electrostatically crosslinked Na+ Nafion formed highly phase-separated systems, whilst more homogeneity was observed in blends containing the tetrabutylammonium+ form, where the electrostatic crosslinking was much weaker. 7 refs.

USA

Accession no.847138

Item 304
Journal of Applied Polymer Science
83, No.11, 14th March 2002, p.2277-87

ADHESIVE AND ANTICORROSIVE PROPERTIES OF POLY(VINYLIDENE FLUORIDE) POWDERS BLENDED WITH PHOSPHONATED COPOLYMERS ON GALVANIZED STEEL PLATES

Bressy-Brondino C; Boutevin B; Hervaud Y; Gaboyard M
Toulon et du Var,Universite; CNRS-UMR

Preparation and characterisation of methacrylic monomers carrying dialkyl phosphonate groups or phosphonic acid groups is described. Characterisation was carried out using nuclear magnetic resonance spectroscopy. Copolymerisation of these different comonomers (CM) with methyl methacrylate (MMA) was carried out using radical copolymerisation under nitrogen at ratios of either 20/80 or 10/90 CM/MMA. The resulting copolymers were characterised using nuclear magnetic resonance spectroscopy, elemental analysis and conductometric titration. The copolymers were then solution blended with polyvinylidene fluoride at different proportions and coated onto galvanized steel plates which were heated to evaporate solvents, giving a coating thickness of approximately 23 micron. Adhesive and anticorrosive properties of the coatings were assessed using cross-cut testing, conical mandrel bend testing, boiling water testing and salt spray testing. Good adhesion was achieved, resulting in limiting of corrosion of the steel plates, and it was reported that the adhesive properties (hence the anticorrosive properties) were influenced by the number of phosphonic acid groups introduced. 32 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.846646

Item 305
Journal of Applied Polymer Science
83, No.2, 10th Jan.2002, p.340-8

SURFACE MODIFICATION OF POLY(TETRAFLUOROETHYLENE) WITH PULSED HYDROGEN PLASMA

Inagaki N; Tasaka S; Narushima K; Teranishi K
Shizuoka,University

Surface modification of polymers by pulsed plasma has been studied to minimise degradation reactions occurring at the same time as the surface modification reactions. Polytetrafluoroethylene film was modified using pulsed hydrogen plasma. The surface modification was then evaluated from the contact angle on the modified surfaces and chemical composition of the modified surfaces as functions of the interval between turning-on and turning-off of hydrogen plasma and RF power. The contact angle measurement showed that hydrogen plasma treatment, regardless of pulsed or continuous plasma, led to degradation reactions as well as defluorination and oxidation on PTFE surfaces. XPS measurement showed that the pulsed hydrogen plasma did not cause frequent bond scission of PTFE polymer chains, while the continuous hydrogen plasma did cause frequent bond scission. A combination of the on-time/off-time of 30/270 microseconds in the pulsed hydrogen plasma was efficacious in modifying PTFE surfaces. The surface modification of PTFE by pulsed hydrogen plasma is superior to that by continuous plasma. 10 refs.

JAPAN

Accession no.846619

Item 306
Journal of Applied Polymer Science
83, No.6, 7th Feb.2002, p.1258-67

SURFACE MODIFICATION OF TETRAFLUOROETHYLENE-HEXAFLUOROPROPYLENE(FEP) COPOLYMER BY REMOTE HYDROGEN, NITROGEN, OXYGEN AND ARGON PLASMAS

Park Y W; Tasaka S; Inagaki N
Shizuoka,University

FEP copolymer sheets were modified by remote hydrogen, nitrogen, oxygen and argon plasmas and the effects of the modification on adhesion between FEP sheets and copper metal were investigated. The four plasmas were able to modify the hydrophilicity of the FEP surfaces. Defluorination and oxidation reactions on the FEP surfaces occurred with exposure to the plasma. The hydrophilic modification by hydrogen plasma was best, followed by modification by oxygen argon and nitrogen plasmas. The surface modification of FEP by all four remote plasmas was effective in improving adhesion with copper metal. The peel strength of the FEP/copper adhesive joints decreased in the order hydrogen, argon, nitrogen, oxygen plasmas. Mild surface modification was important for the adhesion improvement of FEP with copper metal. 10 refs.

JAPAN

Accession no.846070

Item 307

Chemistry of Materials

13, No.12, Dec.2001, p.4399-401

POLY(TETRAFLUOROETHYLENE) IMPREGNATION FOR ION-EXCHANGE REACTIONS WITH LAYERED CE(IV) FLUORIDES

Sykora R E; Albrecht-Schmitt T E

Auburn,University

The preparation, using Ni(II)-impregnated PTFE autoclave liners, of ion-exchangeable Ce(IV) fluorides by a technique in which the ion exchange products can be prepared in the form of single crystals, was investigated. Studies were conducted to determine whether the layers in these compounds remained intact throughout the ion exchange process and if ion selectivity could be achieved in these systems. 29 refs.

USA

Accession no.846043

Item 308

Journal of Polymer Science: Polymer Physics Edition

40, No.1, 1st Jan.2002, p.19-30

MORPHOLOGY, CRYSTALLINE STRUCTURE, AND PROPERTIES OF POLY(VINYLIDENE FLUORIDE)/SILICA HYBRID COMPOSITES

Jae-Wan Kim; Won-Jei Cho; Chang-Sik Ha

Pusan,National University

PVDF/silica hybrid composite films were prepared by sol-gel reactions from mixtures of polymer and tetraethoxysilane in DMAc. Their morphology, crystalline structure and thermal, mechanical and electrical properties were examined. SEM and optical microscopy were used for morphology measurements. X-ray diffraction and IR analyses showed that the crystalline structure of PVDF was not changed much by the addition of silica, indicating that there was no interaction between PVDF and silica. With increasing silica content, the m.p. rarely changed, the degree of crystallinity and the dielectric constant decreased and the decomposition temp. slightly increased. A PVDF/silica hybrid composite film with 5 wt % silica exhibited balanced mechanical properties without a severe change in the crystalline structure of PVDF, whereas for the composites with higher silica contents (above 10 wt %) the mechanical properties were reduced and the spherulite texture of PVDF was significantly disrupted by the presence of silica particles. 22 refs.

KOREA

Accession no.845896

Item 309

Journal of Biomaterials Science: Polymer Edition

12, No.11, 2001, p.1177-89

BIOCOMPATIBILITY ASSESSMENT OF POLYTETRAFLUOROETHYLENE/ WOLLASTONITE COMPOSITES USING ENDOTHELIAL CELLS AND MACROPHAGES

Risbud M V; Hambir S; Jog J; Bhonde R

Pune,National Chemical Laboratory

Details are given of the preparation of wollastonite-filled PTFE and its biocompatibility with endothelial cells. Morphology for cell growth was examined using SEM. Tensile strength and percentage elongation were determined from stress-strain curves. 28 refs.

INDIA

Accession no.845812

Item 310

Journal of Materials Science Letters

20, No.21, 1st Nov. 2001, p.1941-2

MUSCLE CELL ADHESION ON POLYTETRAFLUOROETHYLENE MODIFIED BY UV IRRADIATION

Svorcik V; Walachova K; Heitz J; Gumpenberger T; Bacakova L

Prague,Institute of Chemical Technology; Linz,University; Czech Republic,Academy of Sciences

The adhesion of smooth muscle cells was studied on PTFE irradiated by UV light from an excimer lamp in ammonia atmosphere. Changes in biocompatibility were correlated with changes in physicochemical properties induced by the irradiation. Potential applications in blood vessel prostheses are mentioned. 8 refs.

AUSTRIA; CZECH REPUBLIC; EUROPEAN UNION; WESTERN EUROPE

Accession no.844610

Item 311

Journal of Intelligent Material Systems and Structures

12, No.1, Jan.2001, p.11-20

LIMITATIONS OF USING MEMBRANE THEORY FOR MODELLING PVDF PATCHES ON INFLATABLE STRUCTURE

Williams R B; Austin E M; Inman D J

Virginia,Polytechnic Institute & State University

An underlying goal in structural modelling is to use the simplest mathematics possible that captures the physics of a problem accurately. Inflatable structures are normally fabricated from thin films, so they are often modelled as membranes, i.e. structural elements that cannot resist bending moments. Researchers have recently been looking at active control of inflated structures, so this raises the question of whether membrane theory can account for the effects of surface-mounted piezopolymer patches used as either sensors or actuators. These effects on the dynamic behaviour of a flat, rectangular coupon section are discussed, and the patch's ability to sense and actuate transverse deflections of the thin film substrate are assessed using traditional membrane theory. The Rayleigh-Ritz method is employed to approximate the natural frequencies and mode shapes of this layered system. While including the additional mass of the patch, traditional membrane theory is unable to account for the added stiffness of the patch layer. When the piezoelectric behaviour of the patch is considered, membrane theory fails to model the PVDF as a useful sensor. Also, excitation of transverse vibrations is not possible using membrane theory, which does not allow application of bending moments. However, PVDF actuation is modelled as an applied in-plane force, which allowed the patch the ability to suppress out-of-plane disturbances by altering the tension in the base layer as a function of applied voltage. The limitations associated with using traditional membrane theory to analyse the dynamic behaviour of thin-layered systems are discussed, and the interaction between an active PVDF patch and the torus substrate is modelled. 12 refs.

USA

Accession no.843893

Item 312
Journal of Materials Science. Materials in Electronics
12, No.10, Oct.2001, p.601-3
LOW-TEMPERATURE PYROELECTRIC STUDY OF PVDF THICK FILMS
Birlikseven C; Altinas E; Durusoy H Z
TUBITAK; Ankara,Hacettepe University

Pyroelectric coefficient measurements are made at various temperatures for poled and unpoled samples of PVDF films. Samples are produced using the spin coating technique onto glass substrates. Experiments are made using the quasistatic technique. PVDF samples are poled at various electric field strengths and the relation between poling field strength and the pyroelectric coefficient is investigated. The effect of the poling temperature is also studied. The maximum pyroelectric coefficient is obtained for a poling temperature of 340 K and for a poling field strength of 14 MV m-1. Dielectric permittivity and dielectric loss measurements are also performed in the 125-375 K temperature range. 6 refs.

TURKEY

Accession no.843391

Item 313
Journal of Applied Polymer Science
83, No.5, 31st Jan.2002, p.990-6
CRYSTALLIZATION BEHAVIOR OF POLYTETRAFLUOROETHYLENE
Xiao Qun; Da Rong Chen; Jie Cai Han; Shan Yi Du
Beijing,University; Harbin,Institute of Technology

The isothermal and non-isothermal crystallisation kinetics of PTFE were followed by differential scanning calorimetry. The isothermal crystallisation was analysed by the Avrami method, which showed that PTFE crystallises unidimensionally from pre-existing nuclei, probably impurities, and the crystallisation activation energy, the equilibrium melting point, and nucleation rate parameter Kg were calculated. The results of non-isothermal crystallisation were in accordance with those for isothermal crystallisation, but in this case the Kissinger method was used to study the PTFE activation energy. The effects of glass fibre filler on the crystallisation of a PTFE matrix were studied. 16 refs.

CHINA

Accession no.842744

Item 314
Journal of Applied Polymer Science
81, No.7, 15th Aug.2001, p.1643-53
PREPARATION OF PVDF HOLLOW-FIBER MEMBRANES VIA IMMERSION PRECIPITATION
Jianfeng Kong; Li K
Singapore,National University; Bath,University

Highly porous PVDF microporous membranes were fabricated via immersion precipitation. The membranes were prepared using lithium chloride and organic acids as non-solvents via a phase inversion technique. DMAC or N-methyl-2-pyrrolidone was used as the solvent. Polyvinyl pyrrolidone, lithium chloride and organic acids (acetic acid or propionic acid) were used as non-solvent additives. The effects of internal and external coagulation media on the membrane properties were studied. The use of acetic acid as the non-solvent in the PVDF-DMAC-lithium chloride system gave a higher effective surface porosity than the propionic acid-lithium chloride-PVDF-DMAC or propionic acid-lithium chloride-PVDF-N-methyl-2-pyrrolidone systems. There was an optimum cut-off point for the amount of acid to be added to obtain maximum porosity. Also, using ethanol as the internal coagulant during the spinning process could eliminate the inner skin, resulting in a higher membrane permeability. 34 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SINGAPORE; UK; WESTERN EUROPE

Accession no.842700

Item 315
Journal of Applied Polymer Science
81, No.7, 15th Aug.2001, p.1595-604
APPLICATION OF DMAEMA-GRAFTED EXPANDED PTFE FILMS TO POSITIVELY CHARGED ULTRAFILTRATION MEMBRANES AND THEIR ELECTROSTATIC SIEVE SEPARATION PROPERTIES

Yamada K; Gondo T; Hirata M
Nihon,University

The ultrafiltration properties of 2-(dimethylamino)ethyl methacrylate (DMAEMA)-grafted expanded PTFE films, prepared by the combined use of plasma treatment and photografting, were studied using dextran (Dxt) and quaternised dextran (qDxt) in water and in buffer solutions (pH 4-19). Two types of expanded PTFE films were used, one which had an average pore size of 0.5 and the other of 3.0 micrometres (0.5-ePTFE and 3.0-ePTFE respectively). The water permeability was proportional to the operating pressure below 2.0 kgf/cc. The apparent rejection of Dxt in water increased with increasing molecular weight of Dxt for both grafted ePTFE films and the cut-off value for grafted 0.5-ePTFE films decreased with an increase in the grafted amount. The apparent rejection of Dxt and qDxt increased with decreasing pH and the apparent rejection of qDxt was higher than that of Dxt between pH 4-8. For grafted 0.5-ePTFE films, 40KDxt was selectively separated from a binary 40KDxt/250KDxt mixture system in water and from a 40KDxt/40KqDxt mixture system at pH 6 by using the difference in their apparent rejection, and the separation factor increased with an increase in the grafted amount. The results suggested that grafted ePTFE films could be used as positively charged ultrafiltration membranes. 34 refs.

JAPAN

Accession no.842696

Item 316
Journal of Applied Polymer Science
83, No.7, 14th Feb. 2002, p.1596-9
MOLECULAR ORIENTATION IN THE SURFACE LAYER OF POLYTETRAFLUOROETHYLENE
Aleinik A I; Saydov G V
St.Petersburg,State University

A study was made of the molecular orientation and deformation of PTFE using ATR spectroscopy. The parameters of the degree of order for the entire volume and surface layer of uniaxially oriented PTFE films was determined and the dependence of lSL(L), where lSL is the effective thickness of the surface layer and L is the degree of orientation of the films, examined. 9 refs.

RUSSIA

Accession no.841853

Item 317
Polymer Degradation and Stability
75, No.1, 2002, p.85-92
INVESTIGATION OF ELECTRON IRRADIATION INDUCED-CHANGES IN POLY(VINYLIDENE FLUORIDE) FILMS
Nasef M M; Saidi H; Dahlan K Z M
Petronas,Universiti Teknology; Malaysia,Universiti Teknologi; Malaysian Institute for Nuclear Technology Research

The radiation-induced changes occurring in polyvinylidene fluoride (PVDF) films exposed to electron irradiation were studied in relation to the applied doses. A universal electron beam accelerator was used to irradiate samples in air at room temperature with doses of 100-1200 kGy. The properties of the PVDF films were studied by FTIR, differential scanning calorimetry, and a universal mechanical tester, using non-irradiated PVDF film as a reference. It was found that electron irradiation induced changes in the physical, chemical, thermal, structural, and mechanical properties of the PVDF films, depending on the radiation dose. These were ascribed to a mixture of oxidative degradation, crystal disruption and crosslinking. 20 refs.

MALAYSIA

Accession no.841516

Item 318
ACS Polymeric Materials Science and Engineering Fall Meeting.Volume 85.
Chicago, IL, 26th-30th August 2001, p.406-7.012
EFFECTS OF HEXAFLUOROPROPYLENE COMONOMER ON CHAIN SCISSION OF FLUOROPOLYMERS
Holt D B; Farmer B L; English A D
US,Naval Research Laboratory; US,Air Force Research Laboratory; DuPont Central Research & Development (ACS,Div.of Polymeric Materials Science & Engng.)

Semi-empirical molecular orbital calculations on model compounds representing copolymers of tetrafluoroethylene and hexafluoropropylene were made to establish the free radical mechanism responsible for the thermal degradation, to determine the energy barriers for initial scission events and monomer release, and to determine relative degradation rates. Six isomers of the copolymers were considered. 6 refs.

USA

Accession no.840864

Item 319
Journal of Materials Science Letters
20, No.18, 15th Sept.2001, p.1729-31
TENSILE PROPERTIES OF GLASS FIBRE REINFORCED PTFE USING A RARE-EARTH SURFACE MODIFIER
Xue Y; Cheng X
Shanghai,Jiao Tong University

PTFE is a useful bearing material as it registers a low friction coefficient, high thermal stability and chemical resistance. Although PTFE has been widely used in practice, its low mechanical properties, high thermal expansion and excessive viscoelastic deformation under load have greatly limited its application. Glass fibre has widely been used to improve the properties of polymer composite materials. Fibre-reinforced polymer composites consist of two major components: an inorganic phase, such as glass fibres, and an organic polymer matrix, such as a PTFE resin. The interfacial adhesion between fibre and matrix is known as an important factor that determines the mechanical properties of polymer composites. It is well known that the application of a silane coupling agent to a glass fibre surface will improve the fibre-matrix adhesion in composites. The presence of a small amount of coupling agent in the composite can greatly enhance its properties. The mechanical properties of glass fibre reinforced PTFE are well researched, but the correlative surface treatment of glass fibre has apparently not been covered. There has also been little research into the processing and characteristics of modifying glass fibre using a rare earth surface modifier. The optimum amount of rare earth for modifying the glass fibre is determined, and its influence on the tensile properties of glass fibre-reinforced PTFE examined. 9 refs.

CHINA

Accession no.839848

Item 320

ACS POLYMERIC MATERIALS SCIENCE AND ENGINEERING. SPRING MEETING 2001. VOLUME 84. Proceedings of a conference in San Diego, Ca..
Washington, D.C., 2001, p.137. 012

THE POLYMERIZATION OF FLUORINATED MONOMERS AND THE DETERMINATION OF PHASE EQUILIBRIA IN CARBON DIOXIDE

DeSimone J M; Wojcinski L M; Kennedy K A; Zannoni L; Saraf M; Charpentier P; Roberts G W
North Carolina,University; North Carolina,State University

Studies were carried out on the polymerisation of fluorinated monomers. The phase equilibria in carbon dioxide was also determined. A continuous polymerisation system was developed for the precipitation polymerisation of fluorinated monomers in carbon dioxide, where the polymer yielded is isolated as dry free-flowing powder. Studies with vinylidene fluoride reveal that at higher monomer concentrations the polymer molecular weight becomes bimodal and the polymer displays a tendency to become more highly branched. A system was also developed for the determination of partition coefficients of monomer as initiator. 2 refs.

USA

Accession no.839630

Item 321

Polymer Engineering and Science
41, No.12, Dec. 2001, p.2137-47

POLYTETRAFLUOROETHYLENE DECOMPOSITION IN AIR AND NITROGEN

Conesa J A; Font R
Alicante,University

The kinetics of thermal decomposition of PTFE were investigated in an inert nitrogen atmosphere and in an oxidative atmosphere using dynamic TGA and differential thermal gravimetry. A kinetic scheme capable of correlating simultaneously eight runs carried out at different heating rates and different atmospheres was employed to analyse weight loss data. Decomposition products were analysed by means of mass spectrometry and the quotient between combustion and pyrolysis intensities of the most important volatile decomposition products presented. 41 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.839378

Item 322

ACS Polymeric Materials Science and Engineering Fall Meeting.Volume 85.
Chicago, IL, 26th-30th August 2001, p.330-1, 012

INFLUENCE OF ADDITIVES AND PREPARATION CONDITIONS ON PVDF MEMBRANE MORPHOLOGY

Lu Y; Zhao J; Chen H L; Gao C J
Zhejiang,University; Hangzhou,Development Centre of Water Treatment Technology
(ACS,Div.of Polymeric Materials Science & Engng.)

Poly(vinylidene difluoride) (PVDF) membranes were prepared by the phase-inversion method using different additives and preparation conditions, and characterised by measurement of porosity, mean pore size, and nitrogen permeability. Solutions of PVDF in dimethyl acetamide containing 5 wt% additive were used for casting. Porosity and nitrogen permeability decreased in the additive sequence: polyvinyl pyrrolidone (PVP)-polyethylene glycol-lithium chloride. When using PVP as the additive, the mean pore size increased and the effective porosity decreased with increasing casting solution temperature. 9 refs.

CHINA

Accession no.839136

Item 323

Industrial and Engineering Chemistry Research
40, No.24, 28th Nov. 2001, p.5710-8

PREPARATION AND CHARACTERIZATION OF POLYVINYLIDENE FLUORIDE MEMBRANES FOR MEMBRANE DISTILLATION

Khayet M; Matsuura T
Ottawa,University

Details are given of the preparation of PVDF flat-sheet membranes for membrane distillation. Pure water was used as a pore-forming additive in the casting solution. Dimethylacetamide was used as the solvent. Membranes were characterised in terms of nonwettability, pore size and porosity. The influence of feed temperature, stirring rate or downstream pressure on the membrane distillation flux were studied. The effect of water in the casting solution on the geometrical properties of the membrane is discussed. 32 refs.

CANADA

Accession no.838759

Item 324
Macromolecules
34, No.24, 20th Nov. 2001, p.8416-8
HIGH-RESOLUTION SOLID-STATE CARBON 13 NMR OF FLUOROPOLYMERS
Liu S-F; Schmidt-Rohr K
Iowa State University

Details are given of the high-resolution carbon 13 cross polarisation/magic angle spinning spectra of PTFE and polychlorotrifluoroethylene. The use of the high-speed magic-angle spinning to overcome line-broadening problems is discussed. 18 refs.

USA

Accession no.836965

Item 325
Polymer Preprints. Volume 41. Number 2. Conference proceedings.
Washington, D.C., 20th-24th Aug.2000, p.1558-9
SYNTHESIS AND ELECTRIC PROPERTIES OF VDF/TRFE/HFP TERPOLYMERS
Petchsuk A; Chung T C
Pennsylvania,State University
(ACS,Div.of Polymer Chemistry)

The molecular structure-electric property relationships of VDF/TrFE/HFP terpolymers, containing vinylidene difluoride (VDF), trifluoroethylene (TrFE) and hexafluoropropene (HFP) units, are examined. Several terpolymers are synthesised and evaluated with the corresponding VDF/TrFE copolymers. In general, a small amount of bulky HFP units in the polymer chain prevents the long sequence crystallisation and results in smaller ferroelectric (polar) domains, which show the improved electric properties. The resulting terpolymer possesses interesting combined properties with good processibility, low Curie transition temperature and high dielectric constant, narrow polarisation hysteresis loop, and high strain response at relatively low electric field. 8 refs.

USA

Accession no.836600

Item 326
Smart Materials and Structures
10, No.5, Oct.2001, p.946-62
DETECTION OF DISBONDING IN A REPAIR PATCH BY MEANS OF AN ARRAY OF LEAD ZIRCONATE TITANATE AND POLYVINYLIDENE FLUORIDE SENSORS AND ACTUATORS
Koh Y L; Chiu W K; Marshall I H; Rajic N; Galea S C
Monash,University; Australia,Defence Science & Technology Org.

A numerical study was conducted in which an array of surface-mounted lead zirconate titanate and PVDF sensors was used for the detection of disbond under a composite (e.g. boron/epoxy resin) repair patch. The two techniques used for detecting these disbonds were an impedance method and the transfer function method. It was found that an array of smart materials could locate and determine the extent of damage. The results also showed that the location and size of the sensor used were dependent on the location and size of the disbond to be detected or monitored. 9 refs.

AUSTRALIA

Accession no.836393

Item 327
Industrial and Engineering Chemistry Research
40, No.22, 31st Oct. 2001, p.4785-8
MECHANOCHEMICAL SYNTHESIS OF LANTHANUM OXYFLUORIDE BY GRINDING LANTHANUM OXIDE WITH POLYVINYLIDENE FLUORIDE
Lee J; Zhang Q; Saito F
Sendai,Tohoku University

A mixture of lanthanum oxide and PVDF was ground in air by to investigate the mechanochemical reaction between the two materials. This reaction as a method of disposing of PVDF waste as well as its reuse as a fluoride source in the synthesis of lanthanum oxyfluoride is discussed. 21 refs.

JAPAN

Accession no.835577

Item 328
Fullerene Science and Technology
9, No.4, 2001, p.487-95
MISCIBILITY OF POLYVINYLIDENE FLUORIDE WITH C60-CONTAINING POLYETHYL METHACRYLATE, POLYMETHYL ACRYLATE OR POLYETHYL ACRYLATE
Zheng J; Goh S H; Lee S Y
Singapore,National University

C60 is incorporated onto polyethyl methacrylate, polymethyl acrylate and polyethyl acrylate. The miscibility of PVDF with the C60-containing polymers is examined. PVDF is miscible with all six C60-containing polymer samples as shown by the optical clarity of the melt and the existence of a single glass transition temperature in each blend. The polymer-polymer interaction parameters of various blend systems are evaluated by the melting point depression method. 29 refs.

SINGAPORE

Accession no.835070

Item 329
Journal of Materials Science
36, No.19, 1st Oct.2001, p.4731-8

RUTHERFORD BACKSCATTERING SPECTROMETRY AND COMPUTER SIMULATION FOR THE IN-DEPTH ANALYSIS OF CHEMICALLY MODIFIED POLYVINYLIDENE FLUORIDE

Ross G J; Barradas N P; Hill M P; Jeynes C; morrissey P; Watts J F
Surrey,University; Sacavem,Instituto Tecnologico e Nuclear; Innogy Ltd.

The alkaline treatment of PVdF, in the presence of phase transfer catalysts (PTCs), is investigated. Rutherford backscattering spectrometry (RBS) is used to determine the depth of modification achieved and to provide compositional depth profiles of modified PVdF samples. The complex chemical nature of the modified substrate, and the overlap of the elemental scattering edges within the depths involved, create RBS spectra which are difficult to interpret. DataFurnace software is applied to the data, leading to excellent results. Defluorination and oxygenation of PVdF occurs on treatment with NaOH and PTC. Through the use of samples prepared with the aim of establishing the kinetics of the modification, a mechanism concerning elimination of fluorine followed by oxygenation, is shown to occur. RBS analysis indicates that the kinetics of defluorination reaction follows the Case 1 (Fickian) diffusion law, and that the depth of treatment is of the order of 1.4 mu m. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; UK; WESTERN EUROPE

Accession no.835067

Item 330
Macromolecules
34, No.21, 9th Oct. 2001, p.7489-85

ADSORPTION OF A CATIONIC POLYACRYLAMIDE INTO THE SURFACE OF A NAFION IONOMER MEMBRANE

Kim Y-H; Oblas D; Angelopoulos A P; Fossey S A; Matienzo L J
Massachusetts,University; IBM

Time-dependent adsorption of a high molecular weight cationic polyacrylamide from sulphuric acid solution onto a Nafion membrane was characterised using X-ray photoelectron spectroscopy, UV vis spectroscopy and dynamic contact angle measurements. Fluorine and nitrogen atomic surface concentration determined from X-ray photoelectron spectroscopy were correlated to the adsorbed polymer surface coverage from water contact angle analysis. 12 refs.

USA

Accession no.832903

Item 331
High Performance Polymers
13, No.3, Sept. 2001, p.S401-20

THERMAL CONTRIBUTIONS TO THE DEGRADATION OF TEFLON FEP ON THE HUBBLE SPACE TELESCOPE

de Groh K K; Dever J A; Sutter J K; Gaier J R; Gummow J D; Scheiman D A; He C
US,NASA,Glenn Research Center; Ohio Aerospace Institute; Dynacs Engineering Co.Inc.; Swales Aerospace

The results are reported of study of the tensile properties, density, crystallinity and thermal properties of 5 and 2 mil FEP insulation retrieved from the Hubble Space Telescope during three servicing missions. The effect of heating on the degradation of the insulation is evaluated and the differences in the degree of degradation from each of the servicing missions are assessed. Data for as-received and heated FEP insulation are presented and discussed. 10 refs.

USA

Accession no.832766

Item 332
High Performance Polymers
13, No.3, Saept. 2001, p.S373-90

MECHANICAL PROPERTIES OF TEFLON FEP RETRIEVED FROM THE HUBBLE SPACE TELESCOPE

Dever J A; de Groh K K; Messer R K; McClendon M W; Viens M; Wang L L; Gummow J D
US,NASA,Glenn Research Center; Cleveland,State University; US,NASA,Goddard Space Flight Center; Ohio Aerospace Institute

The results are reported of an investigation of the tensile properties, flexural properties and crack morphology, as determined by SEM, of Teflon FEP materials, which were exposed on the Hubble Space Telescope for 9.7 years between launch and the third servicing mission and for 2.8 years between the second servicing mission and third servicing mission. The effects of post-retrieval heating and air on mechanical properties are discussed and compared with the effects of vacuum storage on mechanical properties. 9 refs.

USA

Accession no.832764

Item 333
Polymer
42, No.21, 2001, p.8799-806

IMPACT OF NUCLEATING AGENTS OF PVDF ON THE CRYSTALLIZATION OF PVDF/PMMA BLENDS

Schneider S; Drujon X; Wittmann J C; Lotz B
Strasbourg,Institut Charles Sadron; Elf-Atochem

The effects of nucleating agents (particularly PTFE) were studied on the crystallisation behaviour of PVDF/PMMA blends. The kinetics of PVDF crystallisation and the ultimate crystallinity of the blend samples were significantly enhanced by the addition of a nucleating agent. The results were discussed. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.831887

Item 334
Polymer
42, No.24, 2001, p.9849-53

DIELECTRIC PROPERTIES OF BLENDS OF SILICONE RUBBER AND TETRAFLUOROETHYLENE/PROPYLENE/VINYLIDENE FLUORIDE TERPOLYMER

Ghosh A; Naskar A K; Khastgir D; De S K
Indian Institute of Technology

Blends of a fluororubber, based on a terpolymer of tetrafluoroethylene/propylene/vinylidene fluoride, with silicone rubber were prepared in a miniature batch mixer and cured in sheet form. Dielectric properties of the cured blend were measured using a dielectric analyser, and the morphology of the blends was examined by etching out the fluororubber phase and examining the remainder by scanning electron microscopy. It was shown that the blends of the two rubbers are immiscible, with dielectric loss factor increasing with increasing concentration of the fluororubber phase. Dielectric constant was found to increase with reduction in domain size of the fluororubber in a blend with high silicone rubber content, and the energy barrier for free rotation of the vinylidene fluoride segment increased, resulting in high activation energies for dipolar relaxation. Activation energy for relaxation of the vinylidene fluoride segment was noted to increase with increasing silicone rubber content. 7 refs.

INDIA

Accession no.831811

Item 335
Journal of Membrane Science
195, No.1, 2001, p.103-14

PLASMA-INDUCED IMMOBILISATION OF POLYETHYLENE GLYCOL ONTO POLYVINYLIDENE FLUORIDE MICROPOROUS MEMBRANE

Wang P; Tan K L; Kang E T; Neoh K G
Singapore,National University

PVDF microporous membranes with surface-immobilised polyethylene glycol (PEG) are prepared by the argon plasma-induced grafting of PEG. The PEG is pre-coated on the membrane surface, including the pore surfaces, by dipping the membrane in a PEG/CHCl3 solution prior to the argon plasma exposure. The microstructure and composition of the PEG-grafted PVDF (PEG-g-PVDF) membranes are characterised by attenuated total reflectance FT-IR, X-ray photoelectron spectroscopy and thermogravimetric analysis. A moderate radio-frequency plasma power and plasma treatment time leads to a high concentration of the grafted PEG polymer. Morphology of the modified membranes is studied by scanning electronic microscopy. The pore size and water flux of the modified membranes are also characterised. The flux decreases with increasing surface concentration of the grafted PEG polymer, while the pore size remains almost unchanged. Protein adsorption experiments reveal that the PEG-g-PVDF membranes with a PEG graft concentration, defined as the (CO)/(CF2) ratio above 3.2 exhibits good anti-fouling properties. 24 refs.

SINGAPORE

Accession no.831616

Item 336
European Rubber Journal
183, No.10, Oct.2001, p.32

TURNING PTFE LIPS AROUND FOR LONGER LIFE RADIAL SEALS

White L

Freudenberg has developed a new generation of radial engine-sealing rings, using lips made from PTFE. With these second-generation seals, the company has turned the PTFE lip around, so it faces the direction of the atmosphere, rather than the oil. The novel seal requires a smaller housing, is easier to assemble, gives better lubrication and also integrates dust-protection into the sealing lip. All of this increases the seal’s durability and, consequently, its service life. The company says PTFE is ideally suited to sealing crankshafts as a result of its high resistance to extreme temperatures and the increasingly aggressive constituents of modern engine oil additives.

FREUDENBERG DICHTUNGS- UND SCHWINGUNGSTECHNIK
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.831445

Item 337
Chemistry of Materials
13, No.9, Sept. 2001, p.2933-9

PREPARATION OF POROUS CARBON BY DEFLUORINATION OF POLYTETRAFLUOROETHYLENE AND THE EFFECT OF GAMMA-IRRADIATION ON THE POLYMER

Liang T-T; Yamada Y; Yoshizawa N; Shiraishi S; Oya A
Japan,National Institute of Advanced Industrial Science and Technology; Gunma,University

Details are given of the preparation of porous carbon materials by direct reduction of PTFE powder with potassium vapour. The structural changes of the powder with heat treatment were analysed by Raman spectroscopy. Changes in the pore structure were examined using nitrogen adsorption. Experiments were also carried out on gamma-irradiated PTFE samples and results were compared. The formation mechanism of the porous carbons is discussed in terms of polymer aggregation. 23 refs.

JAPAN

Accession no.831090

Item 338
Macromolecules
34, No.19, 11th Sept. 2001, p.6680-3

DIFFUSION OF DECAFLUOROPENTANE IN AMORPHOUS GLASSY PERFLUORODIOXOLE COPOLYMER BY PULSE FIELD GRADIENT NMR SPECTROSCOPY

Wang Y; Meresi G; Gosselin J; Azar D; Wen W-Y; Jones A A; Inglefield P T
Clark University

Pulse field gradient diffusion measurement were made on the decafluoropentane molecule in tetrafluoroethylene-bistrifluoromethyldifluorodioxole copolymers. The proton spectrum consisted of two overlapping line shapes and the decay of the echo amplitude with increasing gradient required the use of two apparent diffusion constants. 13 refs.

USA

Accession no.831058

Item 339
Journal of Polymer Science: Polymer Physics Edition
39, No.17, 1st Sept.2001, p.2130-9

TRANSCRYSTALLIZATION KINETICS OF POLY(VINYLIDENE FLUORIDE)

Hassan Benkhati; Ton That Minh Tan; Jungnickel B-J
DKI

An Avrami-Ozawa analysis of the curves from differential scanning calorimetry of the isothermal and non-isothermal crystallisation of polyvinylidene fluoride (PVdF) on different substrate materials was found to support information obtained from polarisation microscopy concerning the transcrystallisation of this polymer. The methods and equations used, which related transcrystalline nucleation conditions, dimensionality of growth and resulting texture, are described. It was shown that the support materials are critical in the development of transcrystallinity in PVdF, with polymeric supports such as polyethylene terephthalate, polytetrafluoroethylene and polyimide inducing transcrystallinity whilst glass and metallic substrates do not. 27 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.830208

Item 340
Journal of Polymer Science: Polymer Physics Edition
39, No.17, 1st Sept.2001, p.1995-2004

SUPERDRAWING OF POLYTETRAFLUOROETHYLENE VIRGIN POWDER ABOVE THE STATIC MELTING TEMPERATURE

Ryokei Endo; Tetsuo Kanamato
Tokyo,Science University

A novel two-stage draw method is described which gives oriented polytetrafluoroethylene (PTFE) fibres with some of the highest tensile properties ever reported. The technique involves extrusion drawing of the PTFE powder at temperatures below the melting point of the polymer, followed by a pin draw at temperatures above the static melting temperature. Draw ratio achievable depends on both stages of draw, with the amount available at the second stage depending on temperature. Above temperatures of 360 degrees centigrade, total melting of the polymer resulted in a loss of ductility. The drawn fibres were highly crystalline with a large crystallite size parallel to the chain axis, and with a chain orientation function of more than 99 percent. Drawn polymers were characterised using X-ray diffraction, optical birefringence, tensile properties and density. 28 refs.

JAPAN

Accession no.830196

Item 341
Polymer
42, No.19, 2001, p.8137-51

SOLID-STATE 1H-STATIC, 1H-MAS, AND 1H-19F/19F-1H CP/MAS NMR STUDY OF POLY(VINYL FLUORIDE)

Ando S; Harris R K; Holstein P; Reinsberg S A; Yamauchi K
Tokyo,Institute of Technology; Durham,University; Sinus-Messtechnik GmbH; Bruker Japan Co.Ltd.

A semicrystalline polymer, poly(vinyl fluoride) (PVF) has been investigated by solid state 1H-19F cross polarisation NMR with magic angle spinning (CP/MAS), 19C-1H CP/MAS, 1H fast MAS NMR, solution-state 19F NMR and static solid-state pulsed and broad line NMR measurements. The static 1H pulsed NMR measurements showed the two-phase (immobile and mobile) nature, and the Goldman-Shen type phase selection indicated a lamellar size of c. 4.2 nm. A solid state 19F CP/MAS spectrum shows a featureless lineshape but the mobile region was observed by a newly developed DIVAM pulse sequence. Relaxation times and time constants, and 1H-19F CP experiments, were used to study dipolar interactions in the polymer. The hetero-nuclear dipolar oscillation behaviours and the effective time constants determined from these experiments are consistent with each other. Also, the value of NF/NH (N is spin density), estimated from the CP-drain curve is equivalent to that calculated from the chemical structure. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; JAPAN; UK; WESTERN EUROPE

Accession no.826659

Item 342
Polymer Journal (Japan)
33, No.3, 2001, p.301-2
STRUCTURE MODEL FOR THE COOPERATIVE DOMAIN IN FERROELECTRIC TRANSITION OF POLY(VINYLIDENE FLUORIDE) FORM I
Takahashi Y
Osaka,University

Domain structures play an important role in the crystal phase transitions of crystalline polymers including ferroelectric transitions. Poly(vinylidene fluoride) form I is a ferroelectric polymer in which the molecular orientation changes by 180 degree reversal in its crystalline region under an electric field. The cooperative domain structure in form I is surrounded by glide type disorders parallel to (110) and (010) planes. The shape of the domain structure in form I is a pseudo hexagon. 6 refs.

JAPAN

Accession no.826630

Item 343
Kunststoffe Plast Europe
91, No.7, July 2001, p.50-2
PTFE POLYAMIDE COMPOUNDS. A NEW GROUP OF MATERIALS
Hupfer B; Lehmann D; Reinhardt G; Lappan U; Geissler U; Lunkwitz K; Kunze K
Dresden,Institut fuer Polymerforschung; Dresden,Technische Universitat

The preparation, properties and end-use applications of PTFE-polyamide 6 block copolymers are described. These copolymers are produced by the chemical coupling of PTFE and polyamide 6 via reactive extrusion and exhibit good surface-slip behaviour and low wear. End-use applications of these copolymers include sliding bearings for a range of applications. (Kunststoffe, 91, No.7, 2001, p.96-9)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.826414

Item 344
International Polymer Science and Technology
28, No.6, 2001, p.T/64-8
STRUCTURE AND PROPERTIES OF FLUOROPLASTIC AND ULTRAHIGH MOLECULAR WEIGHT POLYETHYLENE PRODUCED BY SHOCK-WAVE PRESSING
Adamenko N A; Arisova V N; Fetisov A V
Volgograd,State Technical University

The influence of shock-wave pressing treatment on powdered PTFE and UHMWPE is investigated, with reference to changes in molecular structure and the formation of properties during subsequent sintering. The properties of pressings of dispersed polymers were studied by comparing specimens of different density after shock wave treatment and static pressing by compression tests to GOST 4651 and tensile tests to GOST 11262-80. The degree of crystallinity, physical broadening of the lines, and the size of the crystallites were determined by X-ray diffraction analysis. 6 refs. (Article translated from Plasticheskie Massy, No.10, 2000, p.12)

RUSSIA

Accession no.826057

Item 345
Journal of Polymer Science: Polymer Physics Edition
39, No.12, 15th June 2001, p.1371-80
DEVELOPMENT OF ORIENTED STRUCTURE AND PROPERTIES ON DRAWING OF POLY(VINYLIDENE FLUORIDE) BY SOLID STATE EXTRUSION
Nakamura K; Masayuki N; Kanamoto T; Takahashi Y; Furukawa T
Tokyo,Science University

Gel films of poly(vinylidene fluoride)(PVDF) were uniaxially drawn by solid-state coextrusion and the development of an oriented structure, as well as mechanical and electrical properties were studied as a function of the extrusion draw ratios (EDR). Investigation by wide angle X-ray diffraction showed that the alpha crystals in the original gel films were gradually transformed into oriented beta crystals with increasing EDR. At EDR of 9, the highest achieved, the drawn product consisted of a highly oriented fibrous morphology, with only beta crystals present, even when drawn near to the melting temperature. The dynamic Young’s modulus along the draw direction also increased with EDR. The electrical properties of ferroelectricity and piezoelectricity were also greatly enhanced on solid-state coextrusion. The D-E square hysteresis loop became significantly sharpened with increasing EDR. The crystallinity value of 73-80% for film with an EDR of 9, estimated from the electrical properties, compares well with that calculated from the ratio of the crystallite size along the chain axis to the meridonal small angle X-ray scattering (SAXS) long period. These results and the appearance of a strong SAXS maximum, suggest that the oriented structure and properties of beta-PVDF can be explained in terms of a crystal/amorphous series arrangement along the draw axis. They also show that this technique can produce a highly oriented and crystalline beta-PVDF film with enhanced electrical, mechanical and thermal properties. Finally, the mechanical and electrical properties obtained for beta-PVDF are among the highest ever reported. 32 refs.

JAPAN

Accession no.825484

Item 346
International Polymer Science and Technology
28, No.7, 2001, p.T/44-8

STUDY OF THE THERMODYNAMIC PARAMETERS OF COMPOSITE MATERIALS BASED ON POLYTETRAFLUOROETHYLENE AND ULTRAFINE FILLERS

Sleptsova S A; Okhlopkova A A

The use is investigated of ultrafine inorganic compounds as polymer modifiers for the development of polymeric friction-resistant materials with an enhanced level of surface characteristics. Their use as fillers in PTFE is shown to lead to an improvement in the wear resistance of the filled PTFE whilst retaining the strength properties of the initial polymer. The thermodynamics of crystallisation of the polymer in the presence of ultrafine inorganic compounds is studied and the interaction in the PTFE-filler boundary regions, in order to explain the properties of the composites containing nanometric particles of inorganic compounds. Thus, on the basis of results of thermodynamic investigations, the characteristics have been established of crystallisation of the composite from the melt in the presence of nanometric filler particles. A correlation is noted between the enthalpies of melting, crystallisation, and interaction and the properties of the composites which permit control of the properties of the materials during processing. 14 refs. (Article translated from Plasticheskie Massy, No.11, 2000, p.26)

RUSSIA

Accession no.824297

Item 347
Polymer
42, No.15, 2001, p.6409-6418

SURFACE MODIFICATION OF POLY (TETRAFLUOROETHYLENE) FILMS BY POLYMERIZATION OF GLYCIDYL METHACRYLATE FOR ADHESION ENHANCEMENT WITH EVAPORATED COPPER

Zou X P; Kang E T; Neoh K G; Cui C Q; Lim T B
Singapore,University; Singapore,Institute of Microelectronics

Polytetrafluoroethylene films are surface modified by H2 plasma treatment, and by plasma polymerisation and deposition of glycidyl methacrylate in the presence and absence of H2 plasma pre-activation of the PTFE substrates. Modification was carried out to enhance the adhesion of the polymer with evaporated copper. Effective defluorination and hydrogenation of the PTFE surface, and enhanced adhesion of evaporate Cu to the PTFE surface resulted from the H2 plasma treatment. A high epoxide concentration was preserved in the plasma polymerised glycidyl methacrylate layer on the PTFE surface (pp-GMA-PTFE surface) for plasma polymerisation carried out at a low RF power. A high adhesion strength for the Cu/pp-GMA-PTFE assembly was obtained only in the presence of the H2 plasma pre-activation of the PTFE substrates prior to the plasma polymerisation and deposition of GMA. The deposited pp-GMA layer on the PTFE surface could be readily removed by acetone extraction, in the absence of H2 plasma pre-activation. The adhesion enhancement obtained was due to the covalent bonding of the pp-GMA layer with the PTFE surface preservation of the epoxide functional groups in the pp-GMA layer, and strong interaction of evaporated Cu atoms with epoxide and carboxyl groups of GMA chains. 42 refs.

SINGAPORE

Accession no.823561

Item 348
Journal of Adhesion Science and Technology
15, No.6, 2001, p.727-46

SURFACE MODIFICATION OF POLY(TETR AFLUOROETHYLENE) FILMS BY PLASMA POLYMERISATION AND UV-INDUCED GRAFT COPOLYMERISATION FOR ADHESION ENHANCEMENT WITH ELECTROLESSLY-DEPOSITED COPPER

Yang G H; Kang E T; Neoh K G
Singapore,National University

Hydrogen plasma-pretreated PTFE films were surface modified either by plasma polymerisation and deposition of glycidyl methacrylate or by UV-induced graft copolymerisation with glycidyl methacrylate. The chemical composition and structure of the modified films were analysed by X-ray photoelectron spectroscopy and FTIR spectroscopy and the adhesive strength of electrolessly deposited copper to the modified surfaces evaluated by T-peel adhesion strength measurements. Adhesion strength data revealed that the plasma polymerised and UV-graft copolymerised glycidyl methacrylate polymer chains were covalently bonded to the plasma pretreated PTFE and were spatially distributed in the copper matrix. 39 refs.

SINGAPORE

Accession no.823103

Item 349
Journal of Reinforced Plastics and Composites
20, No.9, 2001, p.766-85

FATIGUE FRACTURE MECHANISMS OF PARTICLE AND FIBER FILLED PTFE COMPOSITES

Gan Y X; Aglan H; Faughnan P; Bryan C
Tuskegee,University; US,NASA,Kennedy Space Center

The effect of filler type on the fatigue fracture mechanisms of PTFE composites, a silica particle-filled PTFE (Garlock 3502) and a glass fibre-filled PTFE (Garlock 8573), was studied. Tension-tension fatigue crack propagation tests were conducted on both materials at room temp. at a frequency of 3 Hz. The results obtained are discussed with particular reference to fatigue lifetime, fatigue crack propagation speed, and fatigue fracture surface morphology and failure mechanisms. 46 refs.

GARLOCK INC.
USA

Accession no.821765

Item 350
Antec 2001.Conference proceedings.
Dallas, Texas, 6th-10th May, 2001, paper 88

RHEOLOGY OF POLYTETRAFLUOROETHYLENE AS RELATED TO PASTE EXTRUSION

Ariawan A B; Ebnesajjad S; Hatzikiriakos S G
British Columbia,University; duPont de Nemours E.I.,& Co.Inc.
(SPE)

Three grades of polytetrafluoroethylene (PTFE) homopolymers of different molecular weights, and PTFE with slight branching resulting from the incorporation of less than 0.5% of a second perfluorinated monomer, were characterised using a capillary rheometer. The parameters studied included: the contraction angle, capillary diameter, and the length:diameter ratio of the die; the temperature and extrusion speed; and the molecular weight and structure of the PTFE. It was established that these parameters significantly affected the capillary extrusion pressure which was an important factor in the creation of fibrils during paste extrusion. Fibrils were determined using Raman microscopy, and the degree of fibrillation was correlated with the extrudate tensile strength. 9 refs.

CANADA; USA

Accession no.821588

Item 351
Journal of Materials Science Letters
20, No.6, 15th March 2001, p.581-4

OVERLOADING FAILURE ANALYSIS OF PARTICULATE AND SHORT FIBER FILLED PTFE COMPOSITES

Gan Y X; Chu F; Aglan H; Faughnan P; Bryan C
Tuskegee,University; US,NASA,Kennedy Space Center

The deformation and failure behaviour of a silica particle-filled PTFE and a glass fibre-filled PTFE under monotonic tensile loading was studied. The effect of filler type on the tensile failure behaviour was examined in relation to the fracture surface morphology. The morphological features and the failure mechanisms were correlated. The tensile behaviour of PTFE materials was found to be dependent on the filler properties, silica particles changing the TS to a lesser extent than did glass fibre filler. Both of the materials exhibited very good ductility under overloading conditions. 24 refs.

USA

Accession no.820507

Item 352
Plasticheskie Massy
No.11, 2000, p.26-9
Russian

STUDY OF THE THERMODYNAMIC PARAMETERS OF COMPOSITE MATERIALS BASED ON POLYTETRAFLUOROETHYLENE AND ULTRAFINE FILLERS

Sleptsova S A; Okhlopkova A A

Results are presented of a study of the mutual effect of the physico-mechanical, frictional and thermodynamic characteristics of composites based on polytetrafluoroethylene and ultrafine inorganic compounds. 14 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

Accession no.819981

Item 353
Plastics Additives and Compounding
3, No.6, June 2001, p.6

POLYIMIDE POWDER BOOSTS FLUOROPOLYMER PERFORMANCE

Aurum PD400/PD450 polyimide powders have been introduced by Mitsui Chemicals America Inc. as performance enhancing additives for fluoropolymers and engineering thermoplastics. The addition of these polyimide powders to PTFE results in substantially lower wear factors and higher resistance to abrasion and creep under high pressure/velocity and extreme temperature conditions when compared with conventional bearing-grade compositions. The properties of Aurum PD400/450 polyimide are tabulated.

MITSUI CHEMICALS AMERICA INC.
USA

Accession no.818707

Item 354
Macromolecules
34, No.9, 24th April 2001, p.3050-9

STRUCTURE OF CHLOROTRIFLUOROETHYLENE/VINYLIDENE FLUORIDE RANDOM COPOLYMERS AND HOMOPOLYMERS BY MOLECULAR DYNAMICS SIMULATIONS

Gee R H; Fried L E; Cook R C
California,University

Molecular dynamics simulations were conducted on CTFE/VDF copolymers over a wide range of compositions and temps. including the volumetric Tg, particular attention being paid to the copolymer (Kel-F 800) with an approximate 3:1 mole ratio of CTFE to VDF. Structural features of the polymers and copolymers were characterised using pair correlation functions and wide-angle X-ray scattering spectra. Calculated WAXS spectra for Kel-F 800 were compared with experimental results and were found to be in good agreement. The X-ray peak associated with interchain spacing was found to shift to larger scattering angles as the concentration of the CTFE comonomer decreased, suggesting a transition between CTFE and VDF homopolymer interchain packing structures, consistent with earlier experiments. The strong compositional dependence was traced to packing involving the CF2 moiety. The effect of Coulombic interactions on polymer structure was also examined. 48 refs.

3M CO.
USA

Accession no.817727

Item 355
Polymer
42, No.11, 2001, p.4981-87

ANNEALING EFFECTS ON THE CURIE TRANSITION TEMPERATURE AND MELTING TEMPERATURE OF POLY(VINYLIDENE FLUORIDE/TRIFLUOROETHYLENE) SINGLE CRYSTALLINE FILMS

Barique M A; Ohigashi H
Yamagata,University

Single crystalline films of ferroelectric copolymer of poly(vinylidene fluoride/trifluoroethylene) (75:25 mol %) were prepared by uniaxial stretching of solvent cast films followed by crystallisation/annealing at 140 degrees C. The effects of re-annealing on the Curie transition temperature Tc, melting point Tm, and structures of these films were investigated using differential scanning calorimetry and X-ray diffraction. Accumulative re-annealing in the ferroelectric phase just below Tc caused a large increase in Tc by 17 degrees C without distinctive change in Tm, while prolonged re-annealing in the hexagonal phase caused an increase in Tm by 5 degrees C with a slight decrease in Tc. Reannealing at a temperature below Tc removed the gauche conformational defects in molecular chains as seen by X-ray diffraction study. Re-annealing in the hexagonal phase for long periods leads to rearrangement of chain molecules through their sliding motion along the chain axis to eliminate crystal defects and improve preferential orientation distribution of crystal axes perpendicular to (110)/(200) planes in the film. 33 refs.

JAPAN

Accession no.815937

Item 356
Macromolecular Symposia
Vol.164, Feb.2001, p.411-9

FRACTIONATED CRYSTALLISATION IN BLENDS OF FUNCTIONALISED POLYTETRAFLUOROETHYLENE AND POLYAMIDE

Haubler L; Pompe G; Lehmann D; Lappan U
Dresden,Institut fuer Polymerforschung

Blends of PTFE/polyamide (PTFE/PA) are prepared to combine the good processing properties of PA with the excellent sliding properties of PTFE. To compatibilise the immiscible components the chemical reaction of functional groups of modified PTFE (micro powder produced by electron irradiation in air) and polar PA during a reactive extrusion process is used. The parameters influencing the efficiency of the in-situ reaction both components are varied. The crystallisation and melting behaviour of the different blends is investigated by DSC. In dependence on the degree of compatibilisation the phenomenon of fractionated crystallisation of the dispersed PTFE component is observed. In this way a qualitative characterisation of the dispersity of PTFE in dependence on the functionality of the components and the processing conditions is possible, and therefore an estimation of the efficiency of the in-situ reaction. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.815909

Item 357
Reactive and Functional Polymers
47, No.3, April 2001, p.201-13

SYNTHESIS, CHARACTERISATION, AND ELECTROCHEMICAL TRANSPORT PROPERTIES OF THE POLY(ETHYLENEGLYCOL)-GRAFTED POLY(VINYLIDENEFLUORIDE) NANOPOROUS MEMBRANES

Yu Liu; Lee J Y; Kang E T; Peng Wang; Tan K L
Singapore,National University

The polymers methoxy (poly(ethylene glycol) monomethacrylate (PEGMA), graft-copolymerised poly(vinylidene fluoride) (PVDF), or the P(PEGMA)-g-PDFE copolymers were synthesised, the PVDF homopolymer dissolved in N-methyl-2-pyrrolidone (NMP) was treated with ozone, and the peroxide content of the product was determined by assay with 2,2-diphenyl-1-picrylhydrazyl (DPPH). The activated PVDF was subjected to thermal graft copolymerisation with the PEGMA macromonomer in NMP. Contact angle measurements, FTIR spectroscopy, X-ray photoelectron microscopy, and elemental analysis were used to characterise the microstructures and compositions of the P(PEGMA)-g-PVDF copolymers. The P(PEGMA)-g-(PVDF) copolymer was used to prepare nanoporous membranes by phase inversion, and scanning electron microscopy was used to study the membrane morphology. The feasibility of using the P(PEGMA)-g-(PVDF) copolymer as polymer electrolytic membranes for lithium-ion batteries is explored. The ionic conductivity, transference number, and electrochemical stability values of the membranes were measured. 35 refs.

SINGAPORE

Accession no.815406

Item 358

Journal of Applied Polymer Science

80, No.11, 13th June 2001, p.1891-7

EFFECTS OF VARIOUS KINDS OF FILLERS ON THE TRIBOLOGICAL BEHAVIOR OF POLYTETRAFLUOROETHYLENE COMPOSITES UNDER DRY AND OIL-LUBRICATED CONDITIONS

Zhao-Zhu Zhang; Wei-Min Liu; Qun-Ji Xue
Chinese Academy of Sciences

The tribological behaviour of polytetrafluoroethylene containing 30 vol% inorganic fillers (metals, metal oxides, metal sulphides, graphite, ceramics, whiskers and fibres) was investigated using a ring-on-block test under dry and liquid paraffin-lubricated conditions. Wear surfaces and debris were studied using scanning electron and optical microscopy. The behaviour under dry conditions was dependent upon the uniformity and thickness of the transfer film. Under lubricated conditions the friction coefficients decreased by one order of magnitude and the wear rate by 1-3 orders of magnitude. Fatigue cracks developed due to absorption of the liquid paraffin, and hence the tribological behaviour was dependent upon the compatibility between the matrix and the filler. 14 refs.

CHINA

Accession no.814340

Item 359

Polymer

42, No.13, 2001, p.5661-7

CHANGES IN CHEMICAL STRUCTURE AND MECHANICAL BEHAVIOUR OF PVDF WITH PROCESSING AND THERMOMECHANICAL TREATMENTS

El Mohajir B-E; Heyamns N
Brussels,Free University

Samples of PVDF were injection moulded or compression moulded. DSC and dynamic mechanical analysis were then used to follow the evolution of the structure of PVDF after different annealing treatments or deformation. The processing technique significantly affected the quantities of the amorphous and crystalline phases and their interphase. Higher crystallinity was observed in compression moulded than in injection moulded samples because of the low cooling rate and tha absence of shear. The effect of subsequent annealing on these phases depended on the position of the annealing temperature in relation to the upper glass transition temperature of PVDF. Deformation induced a change from the alpha conformation to the beta conformation in injection moulded samples of PVDF. The beta conformation affected the mechanical behaviour of the material. 17 refs

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.813990

Item 360

Journal of Applied Polymer Science

80, No.5, 2nd May 2001, p.716-27

LAMINATION OF CONDUCTIVE POLYPYRROLE FILMS TO POLYTETRAFLUOROETHYLENE FILMS VIA INTERFACIAL GRAFT COPOLYMERISATION

Lim V W L; Kang E T; Neoh K G; Tan K L
Singapore,National University

A simple technique for the lamination of a conductive polymer film to an inert dielectric polymer film is demonstrated. The electrochemically synthesised and p-toluenesulphonic acid-doped polypyrrole (PPY) film is laminated simultaneously to the argon plasma-pretreated PTFE film during the thermally induced graft copolymerisation of the PTFE surface with a functional monomer. The graft copolymerisation is carried out using glycidyl methacrylate (GMA) monomer containing 20% v/v hexamethyldiamine (HMDA) and in the absence of any polymerisation initiator. Thermally induced graft copolymerisation of the GNIA monomer on the PPY surface is minimal. The lap shear and T-peel adhesion strengths of the laminates are found to be dependent on the GMA graft concentration on the PTFE surface, which, in turn, is affected by the plasma pretreatment time of the film. To increase the GMA graft concentration for the enhancement of adhesion strength, the plasma-pretreated PTFE surfaces are premodified via UV-induced graft copolymerisation with GMA prior to the simultaneous thermal graft copolymerisation and lamination process. The modified surfaces and interfaces are characterised by X-ray photoelectron spectroscopy (XPS). Through XPS measurements of the delaminated surfaces, it is found that the PPY/PTFE laminates fail predominantly by cohesive failure inside the PTFE substrate. 39 refs.

SINGAPORE

Accession no.812973

Item 361

Journal of Polymer Science: Polymer Physics Edition

39, No.7, 1st April 2001, p.750-6

REVERSIBILITY OF THE LOW-TEMPERATURE TRANSITIONS OF POLYTETRAFLUOROETHYLENE AS REVEALED BY TEMPERATURE MODULATED DIFFERENTIAL SCANNING CALORIMETRY

Androsch R
Halle,Martin-Luther-Universitat

Temperature-modulated differential scanning calorimetry reveals distinct differences in the kinetics of the low-temperature phase transitions of PTFE. The triclinic to trigonal transition at 292 K is partially reversible as long it is not complete. As soon as the total sample is converted, supercooling is required to nucleate the reversal of the helical untwisting involved in the transition. The trigonal phase can be annealed in the early stages after transformation with a relaxation time of about five minutes.

The dependence of the reversing heat capacity on the modulation amplitude, after a metastable equilibrium has been reached, is explained by a non-linear, time-independent increase of the heat-flow rate, perhaps caused by an increased true heat capacity. The order-disorder-transition at 303 K from the trigonal to a hexagonal condis phase is completely reversible and time-independent. It extends to temperatures as low as the transition at 292 K or even lower. Qualitatively, the thermal history and crystallisation conditions of PTFE do not affect the transition kinetics, that is, melt-crystallised film and as-polymerised powders show similar transition behaviours, despite largely different crystallinities. 23 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.811194

Item 362
Macromolecules
34, No.6, 13th March 2001, p.1764-71
MISCIBILITY STUDY ON FLUORINATED TETRAFLUOROETHYLENE COPOLYMER-COPOLYMER BLENDS
Pucciariello R; Villani V; Ruiz de Ballesteros O
Potenza,Basilicata Universita; Napoli,Universita Federico II

The miscibility of blends of PTFE-co-(hexafluoropropylene) containing 1 mol% of comonomer and PTFE-co-(perfluoromethylvinyl ether) containing 2-10 mol% of comonomer was studied using DSC and X-ray diffraction. The miscibility was found to depend more on the difference in comonomer content between the two components than upon the blend composition and the crystallisation conditions. 43 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.811052

Item 363
Macromolecules
34, No.6, 13th March 2001, p.1533-5
NEW APPROACH TO SURFACE FUNCTIONALIZATION OF FLUOROPOLYMERS
Coupe B; Wei Chen
Mount Holyoke,College

The adsorption behaviour of PVAL to poly(tetrafluoroethylene-co-hexafluoropropylene) (FEP) from aqueous solution was studied. The adsorption of PVAL to the FEP/water interface was shown to be a new approach for the surface modification of fluoropolymers. The adsorption dramatically improved the wettability. The effects of PVAL concentration, adsorption kinetics, ionic strength and stepwise deposition on the adsorbed amount and wettability were examined and the results were discussed. 24 refs.

USA

Accession no.811018

Item 364
Journal of Applied Polymer Science
80, No.2, 11th April 2001, p.230-41
VISCOELASTIC AND PRESSURE-VOLUME-TEMPERATURE PROPERTIES OF POLY(VINYLIDENE FLUORIDE) AND POLY(VINYLIDENE FLUORIDE)-HEXAFLUOROPROPYLENE COPOLYMERS
Mekhilef N
Atofina Chemicals Inc.

Pressure-volume-temperature relationships were determined for poly(vinylidene fluoride) (PVDF) and poly(vinylidene fluoride-co-hexafluoropropylene) (HFP) copolymers over the pressure range 200-1200 bar and the temperature range 40-230 C. Specific volumes were determined, and differential scanning calorimetry was used to obtain the crystallisation temperature at atmospheric pressure. The specific volume of PVDF varied between 0.57 and 0.69 cu cm/g at atmospheric pressure, whilst at high pressure (1200 bar) it varied between 0.55 and 0.64 cu cm/g. The melting point of the copolymers decreased with increasing HFP content, but there was no significant change in the specific volume. The Tait equation was used to predict the specific volume as a function of temperature and pressure at temperatures above the melting point. The calculated compressibility in the liquid state was slightly dependent upon molecular weight, and strongly dependent upon HFP content. 12 refs.

USA

Accession no.810743

Item 365
Journal of Applied Polymer Science
80, No.7, 16th May 2001, p.1063-70
ELECTRICAL CHARACTERISTICS OF FLUORINATED CARBON BLACK-FILLED POLY(VINYLIDENE FLUORIDE) COMPOSITES
Wu G; Zhang C; Miura T; Asai S; Sumita M
Tokyo Institute of Technology

Fluorinated carbon black-filled poly(vinylidene fluoride) (PVDF) composites were investigated and the dispersion and electrical properties of these composites were studied as a function of the fluorine content. By increasing the fluorine content carbon particles tend to stick together and form large aggregates. The percolation concentration increases to a high concentration, whereas the percolation process becomes gradual. The fluorinated carbon black-filled PVDF composites exhibit a high PTC intensity and low NTC effect as shown by the temperature dependence of resistivity measurements. The dielectric behaviour was also investigated. 20 refs.

JAPAN

Accession no.810313

Item 366
Patent Number: US 6140437 A1 20001031
FLUORINE-CONTAINING ELASTIC

COPOLYMERS, CURABLE COMPOSITION CONTAINING THE SAME AND SEALANT MADE THEREFROM

Kitaichi M; Saito H; Iwasaki Y; Kishine M
Daikin Industries Ltd.

A fluorine-containing elastomeric copolymer comprising 55 to 62 mole % of repeating units derived from tetrafluoroethylene and 38 to 45 mole % of repeating units derived from perfluoro(methyl vinyl ether) is obtained by radically polymerising the monomers in the presence of a diiodide compound of given formula. It has a Mooney viscosity (ML1+10 100C) between 20 and 150 and excellent compression set at high temperature.

JAPAN; USA

Accession no.809230

Item 367

Patent Number: US 6133389 A1 20001017 2000

AMORPHOUS TETRAFLUOROETHYLENE-HEXAFLUOROPROPYLENE COPOLYMERS

Anolick C; Petrov V A; Smart B E; Stewart C W; Wheland R C; Farnham W B; Feiring A E; Qiu W
Du Pont de Nemours E.I.,& Co.

Disclosed herein are novel amorphous tetrafluoroethylene-hexafluoropropylene (TFE-HFP) dipolymers, and other copolymers containing TFE, HFP and a third monomer, many of which are more random than previous amorphous TFE-HFP copolymers, as well as a novel high productivity continuous process for making these polymers. The polymers are particularly useful in the form of coatings, films and encapsulants.

USA

Accession no.809101

Item 368

Patent Number: US 6136893 A1 20001024

METHOD FOR CONCENTRATING AQUEOUS DISPERSION OF FLUORINE-CONTAINING POLYMER

Yamashita M; Miura T; Murakami S; Kawachi S; Hayashi T; Hosokawa K
Daikin Industries Ltd.

A method is provided for concentrating an aqueous dispersion of fluorine-containing polymer particles containing a surfactant, which is applicable to a fluorine-containing polymer such as PTFE, being easily fibrillated and assuring low energy, low cost and short term concentration only by using various kinds of surfactants in a small amount. The method for concentrating an aqueous dispersion of fluorine-containing polymer particles containing the surfactant by feeding the aqueous dispersion of fluorine-containing polymer particles containing the surfactant in an amount of 2.0 to 8.0% by weight based on a solid content of the fluorine-containing polymer to a micro filtration membrane having a pore size of 0.01 to 1 micron with aqueous dispersion feeding means which does not substantially generate shearing force and then removing the aqueous medium containing the surfactant from the aqueous dispersion.

JAPAN; USA

Accession no.808968

Item 369

Patent Number: US 6162885 A1 20001219

MULTI-AXIALLY ORIENTATED AMORPHOUS PTFE MATERIAL

Ruefer B G

The invention is an amorphous polytetrafluoroethylene or PTFE polymer that is composed of multi-axially oriented PTFE polymer chains. The multi-axial orientation allows the invention to exhibit consistent strength in more than one direction, exhibit excellent creep resistance, and exhibit flexural fatigue resistance.

USA

Accession no.808447

Item 370

Journal of Applied Polymer Science

79,No.9,28th Feb.2001, p.1541-8

GLASS-TRANSITION TEMPERATURE OF POLY(VINYLIDENE FLUORIDE)-POLY(METHYL ACRYLATE)BLENDS: INFLUENCE OF AGING AND CHAIN STRUCTURE

Maiti P; Dikshit A K; Nandi A K
Indian Association for the Cultivation of Science

The glass transition temperature (Tg) of (polyvinylidene fluoride)(PVF2)-poly(methyl acrylate)(PMA) blends is directly related to the ageing time. The plots of Tg against log t(time) are linear and their slopes depend on the head to head (H-H) defect contents of the PVF2 specimens and on the blend compositions. The values of the polymer-polymer interaction parameter are directly related to the H-H defect of the PVF2 for constant blend composition. The Tg value of the blend is thus inversely proportional to the H-H defect of the PVF2 specimen. After ageing over a longer period the decrease in Tg with the H-H defects is less than that of the unaged blends. The possible reasons for the results obtained are discussed. 23 refs.

INDIA

Accession no.808157

Item 371

International Journal of Adhesion and Adhesives

21, No.1, 2001, p.59-64

MODIFICATION OF THE ADHESION PROPERTIES OF PTFE BY A MAGNESIUM TREATMENT

Combellas C; Richardson S; Shanahan M E R; Thiebault A
ESPCI; Paris,Ecole Nationale Superieure des Mines; London,University,Imperial College

Various surface treatments based on solutions of solvated electrons were applied to PTFE. The effects on adhesion of modified surface properties of the PTFE were investigated by bonding a rubbery epoxy, with PETP backing, to it and effecting peel tests at various rates. All the treatments led to improved adhesion. The basic solution of solvated electrons in the presence of magnesium led to reasonable adhesion, but improvements appeared not to be related to treatment time. As failure apparently occurred cohesively within the PTFE, near the surface, it was proposed that surface treatment also led to some local degradation of the PTFE. Inclusion of low concentrations of alkali metal ions into the solution of solvated electrons led to increased adhesion, particularly in the cases of Na and K. Failure surfaces suggested partial cohesive failure within the rubbery epoxy, near the interface. Increased adhesion was thought to be partly due to better wetting of the PTFE by the rubbery epoxy before cure, combined with increases in surface roughness, subsequent to the PTFE surface treatment, leading to mechanical keying. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; UK; WESTERN EUROPE

Accession no.807270

Item 372

Patent Number: EP 1077231 A1 20010221

COMPOSITIONS OF LOW MELT VISCOSITY POLYTETRAFLUOROETHYLENE

Lahijani J

Dupont de Nemours E.I.,& Co.

Polytetrafluoroethylene having a specific melt viscosity at 372C is combined with a non-fluorinated heat stable polymer, such as polyaryleneetherketone, for melt processing and for improving the properties of the heat stable polymer.

EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE-GENERAL

Accession no.806659

Item 373

Patent Number: EP 1077230 A1 20010221

MELT-FABRICABLE POLYTETRAFLUOROETHYLENE

Lahijani J

DuPont de Nemours E.I.,& Co.

Melt fabricable compositions of at least 50 wt.% polytetrafluoroethylene contain polyaryletherketone. Optionally, part of the polytetrafluoroethylene is a PTFE micropowder.

EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE-GENERAL

Accession no.806658

Item 374

Polymer

42, No.8, 2001, p.3731-43

DEVELOPMENT OF STRUCTURAL HIERARCHY IN INJECTION-MOULDED PVDF AND PVDF/PMMA BLENDS. III. SPATIAL VARIATION OF SUPERSTRUCTURE AS DETECTED BY SMALL-ANGLE LIGHT SCATTERING

Wang Y D; Cakmak M

Akron,University

The results are reported of a study of the size and shape of the superstructure developed in injection moulded PVDF and PVDF/PMMA blends carried out using microbeam and conventional small-angle light scattering. The effects of mould temperature and injection speed on the evolution of superstructure are discussed as is the influence of increasing PMMA concentration on spherulite size. 49 refs.

USA

Accession no.806172

Item 375

Progress in Organic Coatings

40, Nos.1-4, Dec.2000, p.185-90

PROGRESS OF FLUOROPOLYMERS ON COATING APPLICATIONS. DEVELOPMENT OF MINERAL SPIRIT SOLUBLE POLYMER AND AQUEOUS DISPERSION

Takayanagi T; Yamabe M

Asahi Glass Co.Ltd.

Recent developments in fluoroolefin-vinyl ether copolymer(FEVE, Lumiflon from Asahi Glass) for use in mild-solvent paint systems and waterborne paint systems are described. Mineral spirit-soluble FEVE copolymers for both one-component and crosslinkable two-component mild-solvent paint systems are discussed. FEVE aqueous dispersion polymers are described for non-crosslinkable one-component latex paint system, crosslinkable two-component emulsion paint system with isocyanate, having a high hydroxyl value, and one-component crosslinkable emulsion paint system containing carboxyl functionality reactive with hydrazide. 7 refs. (25th Athens Conference on Organic Coatings, Vouliagmeni, Greece, July 1999)

JAPAN

Accession no.805133

Item 376

Progress in Organic Coatings

40, Nos.1-4, Dec.2000, p.55-60

ACRYLIC-FLUOROPOLYMER MIXTURES AND THEIR USE IN COATINGS

Iezzi R A; Gaboury S; Wood K

ATOFINA Chemicals Inc.

An acrylic modifier resin is usually added to PVDF resin for coating applications to improve the adhesion to substrates and the pigment dispersion. The acrylic modifier is traditionally physically blended with the PVDF resin, resulting in a mixture on a macromolecular scale. The development by ATOFINA Chemicals of a method for mixing fluoropolymer and acrylic resin on a micromolecular scale is described. It is shown that, as a result of this intimate mixing and the various acrylic and fluoropolymer monomers that can be used, a wide range of properties can be achieved in solvent-base dispersion coatings and waterborne coatings. 6 refs. (25th Athens Conference on Organic Coatings, Vouliagmeni, Greece, July 1999)

USA

Accession no.805122

Item 377

International Polymer Science and Technology

27, No.12, 2001, p.T/94-6

STUDY OF THE PHYSICAL PROPERTIES OF COMPOSITES BASED ON POLYTETRAFLUOROETHYLENE WITH CONDUCTIVE FILLERS OF COMPLEX COMPOSITION

Kovalenko N A; Syrovatskaya I K

Russian Academy of Sciences

The use of a mixture of finely dispersed coke and ultradispersed graphite as a complex conductive filler in a composite based on PTFE, is demonstrated to increase the stability of the electrical parameters of the composite by 10-15%, enabling the resistivity and the temperature of self-regulation to be controlled. Such conductive composites can be used as polymer heaters. Details are given of developmental work carried out at the Institute of Non-Metallic Materials. 5 refs. (Translated from Plasticheskie Massy, No.4, 2000, p.9)

RUSSIA

Accession no.803080

Item 378

Polymer

42, No.5, 2001, p.2223-33

THREE DIMENSIONAL MORPHOLOGY OF PVDF SINGLE CRYSTALS FORMING BANDED SPHERULITES

Toda A; Arita T; Hikosaka M

Hiroshima,University

The morphology of PVDF single crystals grown from melt and from blends with polyethyl acrylate (PEA), PVDF/PEA = 0.5/99.5 and 30/70 by weight is investigated. The single crystals, of relatively higher molecular weight, are grown isothermally in the temperature range where banded spherulites are formed with sufficient crystallisation time. The crystals are extracted by dissolving amorphous PEA and PVDF crystals formed on quenching. The three-dimensional morphology of the single crystals is examined by transmission electron microscopy (bright field, dark field and diffraction) with a tilting stage. For all cases, the tilting of chains (approximately 25-27 deg.) to the fold surface is confirmed. The three-dimensional shape of all the crystals is chair type for the 30/70 blend and pure PVDF. In chair crystals, spiral terraces keep the handedness in each growth direction. From this evidence, it is proposed that the chair crystals with consecutive creation of spiral terraces of the same sense are responsible for the twisting relationship between crystallites in the radial direction of the banded spherulites. 35 refs.

JAPAN

Accession no.802505

Item 379

Patent Number: US 6114452 A1 20000905

PERFLUOROELASTOMER COMPOSITION HAVING EXCELLENT HEAT STABILITY

Schmiegel W W

DuPont de Nemours E.I.,& Co.

The perfluoroelastomer component of the compositions is a copolymer having a number of carbonyl-containing functional groups and copolymerised monomer units comprising a perfluoroolefin, a perfluoro(vinyl) ether and a nitrile-containing cure site monomer. The curative component is other than an organotin compound and includes peroxides, ammonium salts, aromatic amino compounds, bisamidrazones and bisamidoximes.

USA

Accession no.801708

Item 380

Patent Number: US 6114446 A1 20000905

POLYMER COMPOSITION CAPABLE OF FORMING SURFACE SLIDABLE ON WATER

Narisawa I; Takeishi M; Murase H

Kansai Paint Co.Ltd.

A polymer composition capable of forming a super-hydrophobic surface, which is difficult to be wetted with water and from which an adhered waterdrop can easily slide down, comprises (A) a reaction product formed by reacting (a) a hydroxyl group-containing fluoropolymer obtained by copolymerising a fluoroolefin, a hydroxyl group-containing vinyl monomer and another unsaturated monomer capable of copolymerisation therewith, (b) an epoxy-terminated siloxane polymer of given formula at the equivalent ratio of the hydroxyl groups of the fluoropolymer (a) to the epoxy groups of the siloxane polymer (b) of 1/0.05 to 1/0.8, in the presence of (c) a sulphonic acid compound, and (B) a polyisocyanate compound, which may be blocked, or a melamine type crosslinking agent.

JAPAN; USA

Accession no.801702

Item 381

Journal of Applied Polymer Science

79, No.5, 31st Jan.2001, p.801-7

STUDY ON NOVEL WATERPROOF AND MOISTURE-PERMEABLE POLY(VINYLIDENE FLUORIDE) MICROPORE MEMBRANE-COATED FABRICS

Wei Zhaohui; Gu Zhenya

Tianjin,Institute of Textile Science & Technology

The suitability of PVDF as a waterproof and moisture-permeable material, as a substitute for PTFE, for the manufacture of high-performance textiles was investigated. Particular attention was paid to the design of casting solution composition (including solvent, additives and polymer), to possible methods for production of durably bound coated micropore membrane fabrics and to their influences on membrane properties. The pore size, porosity and membrane thickness of the PVDF micropore membrane were shown to approach those of PTFE. 18 refs.

CHINA

Accession no.800776

Item 382

Patent Number: US 6103843 A1 20000815

(CO)POLYMERIZATION PROCESS OF FLUORO-CONTAINING MONOMERS FOR OBTAINING HYDROGEN CONTAINING POLYMERS

Abusleme J A; Chittofrati A

Ausimont SpA

Polymerisation process of unsaturated perfluoromonomers, fluoro-containing monomers and optionally in the presence of hydrogen containing olefins, for obtaining polymers containing hydrogen and fluorine, which utilises a microemulsion comprising the following components: (a) water; (b) a fluoropolyoxyalkylene having hydrogen-containing end groups and/or hydrogen-containing repeating units; (c) a fluorine-free organic radical initiator for the polymerisation of fluoro-containing monomers, soluble in component (B); (d) a fluoro-containing surfactant.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.800486

Item 383

Patent Number: US 6117555 A1 20000912

WATER REPELLENT COATING COMPOSITION, AND COATED FILMS AND COATED ARTICLES USING THE SAME

Fujimori S; Takahashi M; Ishitani M; Tsuru S; Iwasawa A; Yamamoto F; Kurosawa S

Nippon Telegraph & Telephone Corp.

A water repellent coating composition comprises a fluororesin powder having a specific surface area ranging from 27 to 48 m2 /g and a molecular weight ranging from 10,000 to 100,000; an acrylic-silicone binder resin; and a solvent. The fluororesin may be preferably at least one resin selected from polytetrafluoroethylene resins, tetrafluoroethylene/perfluoro(alkyl vinyl ether) copolymer resins, and tetrafluoroethylene/hexafluoropropylene copolymer resins. The coating composition can be used in various fields including constructions, civil engineering, transportation, communication. The coating films and coated articles produced with the water repellent coating composition exhibit excellent water repellency, antisnow- or antiice-sticking properties, and weatherability.

JAPAN; USA

Accession no.800368

Item 384

Patent Number: US 6117547 A1 20000912

POLYTETRAFLUOROETHYLENE FIBER

Kelmartin J T P; Roberts G M; Dolan J W; Minor R B

Gore Enterprise Holdings Inc.

A PTFE fibre that is adapted to be sewn at high speeds. The fibre has a toughness greater than about 0.36 grams per denier (g/d). A range for the toughness is from about 0.36 to about 1.01 g/d, with a preferred range being from about 0.50 to about 0.80 g/d. The toughness of the inventive PTFE fibre is most preferably about 0.60 g/d. The inventive fibre has a peak engineering stress greater than about 1.6 g/d and a break strain greater than about 15.5 percent. A preferred range for the peak engineering stress is from about 3.0 g/d to about 5.0 g/d, and a preferred range for the break strain is from about 20 percent to about 50 percent. Most preferably, the peak engineering stress is about 4.4 g/d, and the break strain is about 24 percent. In another aspect, this invention provides a process for making a fibre that involves providing a PTFE fibre and heating the PTFE fibre to a temperature of from about 30 degree C. to about 500 degree C., while overfeeding the PTFE fibre at an overfeed of up to about 70 percent. A preferred range for the temperature is from about 350 degree C. to about 450 degree C., and a preferred range for the overfeed in the overfeeding step is from about 10 percent to about 20 percent. Most preferably, the temperature in the heating step is about 400 degree C. and the overfeed in the overfeeding step is about 15 percent. The PTFE fibre may be used as a filament for an improved dental floss, and is also suited for an improved bearing material.

USA

Accession no.800365

Item 385

Patent Number: EP 1059342 A1 20001213

MIXTURES OF FLUOROPOLYMER DISPERSION

Marchese E; Visca M; Lenti D

Ausimont SpA

These comprise a) one or more dispersions composed of TFE homopolymers or copolymers having average particle sizes ranging from 180 to 400 nm, b) one or more TFE copolymer dispersions with one or more monomers containing at least one ethylene unsaturation. The amount of comonomer is such that the dispersion contains a number of fibrils lower than 10% of the total number of particles, the fibrils being polymer particles having a length/diameter (L/D) ratio higher than 5. The dispersion average particle sizes of the dispersion are smaller than about 90 nm and component b) contains an amount of comonomer such that the resulting polymer is not elastomeric and is not thermoprocessable.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.799350

Item 386
Antec 2000.Conference proceedings.
Orlando, Fl., 7th-11th May, 2000, paper 394

PRESSURE-VOLUME-TEMPERATURE DEPENDENCE IN POLYVINYLIDENE FLUORIDE AND POLYVINYLIDENE FLUORIDE-HEXAFLUOROPROPYLENE COPOLYMERS

Mekhilef N
Elf Atochem North America Inc.
(SPE)

The influence of molecular weight and composition on the pressure-volume-temperature relationships of polyvinylidene fluoride homopolymers and poly(vinylidene fluoride-co-hexafluoropropylene) copolymers were determined over the pressure range 20-120 MPa and the temperature range of 40-230 C. Differential scanning calorimetry was used to simulate the cooling process and to determine the crystallisation and melting temperatures at atmospheric pressure. Increasing molecular weight increased the specific volume, and the introduction of hexafluoropropylene decreased the melting point and the specific volume in comparison with the pure homopolymer. There was good agreement between the experimental data and the TAIT state equation. 5 refs.

USA

Accession no.799180

Item 387
Antec 2000.Conference proceedings.
Orlando, Fl., 7th-11th May, 2000, paper 264

HEAT AFFECTED ZONE STRUCTURE IN VIBRATION WELDED POLYVINYLIDENE FLUORIDE AND ITS COPOLYMER

Valladares D; Cakmak M
Akron,University
(SPE)

Poly(vinylidene fluoride) and poly(vinylidene fluoride-ran-hexafluoropropylene) injection moulded samples were vibration welded at a frequency of 60 Hz, an amplitude of 0.85 mm, under a pressure of 515 kPa, the weld time being varied by varying the number of cycles. This permitted studies of the evolution of the heat affected zone of the resulting welds, which was studied using scanning electron microscopy and a matrixing microbeam X-ray technique. The dynamic changes which occurred early in the welding process started at highly localised regions, followed by the development of an adhesive character. In subsequent stages these regions coalesced with the establishment of a wave pattern oriented normally in the vibration direction. Subsequently the crests of the waves adjacent to the side surfaces extruded fibrillar structures in the vibration direction. The development of these features was partly attributed to the high melt elasticity of the polymers. 23 refs.

USA

Accession no.798546

Item 388
Patent Number: US 6100318 A1 20000808

FREE-FLOWING POLYTETRAFLUOROETHYLENE MOLDING POWDER

Zipplies T
Dyneon GmbH

Free-flowing polytetrafluoroethylene moulding powders are obtained if a finely divided non free-flowing powder of an optionally modified polytetrafluoroethylene is agglomerated in an aqueous medium which contains a trialkylamine oxide and the agglomerates are dried.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.797954

Item 389
Patent Number: US 6103815 A1 20000815

FLUORINATED CARBON FILLED LATEX FLUOROCARBON ELASTOMER

Mammino J; Ferguson R M; Heeks G J; Henry A W; Badesha S S; Tarnawskyj I W; Knier F E; Abkowitz M A; Law K-Y
Xerox Corp.

A composition comprising a latex fluorocarbon elastomer and fluorinated carbon, xerographic component surfaces comprising such latex fluorocarbon elastomer and fluorinated carbon compositions, and image forming apparatus including such xerographic components are disclosed herein.

USA

Accession no.797934

Item 390

International Journal of Adhesion and Adhesives

20, No.6, 2000, p.467-76

MODIFICATION OF POLY(TETRAFLUOROE THYLENE) AND COPPER FOIL SURFACES BY GRAFT POLYMERISATION FOR ADHESION IMPROVEMENT

Wu J Z; Kang E T; Neoh K G; Cui C Q; Lim T B

Singapore,National University; Singapore,Institute of Microelectronics

Laminates of copper foil and PTFE were produced by the surface graft polymerisation of glycidyl methacrylate on a PTFE film, which had been pretreated with an argon plasma with simultaneous thermal lamination to a surface modified copper foil either in the presence of an epoxy resin adhesive or in the presence of a mixture of glycidyl methacrylate and hexamethylene diamine. The copper foil surfaces were treated with a silane coupling agent followed by argon plasma activation and UV-induced graft polymerisation with glycidyl methacrylate. X-ray photoelectron spectroscopy and water contact angle measurements were used to characterise the treated surfaces and the adhesion of the laminates was determined by T-peel testing. 30 refs.

SINGAPORE

Accession no.796639

Item 391

Patent Number: US 6086970 A1 20000711

LUBRICIOUS SURFACE EXTRUDED TUBULAR MEMBERS FOR MEDICAL DEVICES

Ren B Q

SciMed Life Systems Inc.

A catheter tube having improved strength and lubricity is disclosed. The catheter tube can be used advantageously as a guide wire tube for small profile intravascular catheters. The tube can be formed by extruding a mixture of thermoplastic polymeric material, hard particles, lubricating particles, and a lubricant. The lubricant is preferably an external lubricant capable of forming a film over the tube surfaces. One tube is formed of polyamide, molybdenum disulphide particles, PTFE particles, and zinc stearate. Applicants believe the hard disulphide particles and lubricating PTFE particles protrude from the tubular surfaces and are coated with a film of lubricating zinc stearate. The film is believed to reduce the friction and resulting PTFE elongation caused by a guide wire sliding over the PTFE protrusions.

USA

Accession no.795650

Item 392

Patent Number: US 6099791 A1 20000808

METHODS OF MANUFACTURE OF MULTIAXIALLY ORIENTED FLUOROPOLYMER FILMS

Shannon D; McIntyre J; Kuo C; McCollam C; Peterson R

Baxter International Inc.

Porous fluoropolymer films, such as PTFE films, formed by a method including the steps of (a) forming a fluoropolymer (e.g., PTFE) paste, (b) extruding, calendering, or otherwise processing the paste to form a film extrudate, (c) causing the film extrudate to be calendered in a first directional axis, (d) subsequently calendering the film extrudate in a second directional axis which is different from the first directional axis, (e) subsequently calendering the film extrudate in at least one additional directional axis which is different from said first and second directional axes, thereby forming a multiaxially calendered film extrudate, (f) drying the multiaxially calendered film extrudate, and (g) radially expanding the multiaxially calendered film extrudate to form a radially oriented fluoropolymer (e.g., PTFE) film. The porous fluoropolymer films formed by this method are multiaxially oriented and exhibit isotropic strength properties.

USA

Accession no.793874

Item 393

Journal of Polymer Science: Polymer Physics Edition

38, No.21, 1st Nov.2000, p.2832-40

SOLUBILITY OF VINYLIDENE FLUORIDE POLYMERS IN SUPERCRITICAL CARBON DIOXIDE AND HALOGENATED SOLVENTS

Dinoia T P; Conway S E; Jong Sung Lim; McHugh M A

Johns Hopkins University; Korea,Institute of Science & Technology; Virginia,Commonwealth University

The cloud point behaviours of PVDF and vinylidene fluoride-22 mol % hexafluoropropylene copolymer were studied at temps. up to 250C and pressures up to 3000 bar in supercritical carbon dioxide and halogenated solvents. Cloud point pressures for both polymers decreased as the solvent polarisability, polar moment per molar volume and density increased. It was, however, extremely difficult to dissolve either fluoropolymer in chlorotrifluoromethane, which had a large polarisability and a small dipole moment. Carbon dioxide was an effective solvent because it complexed with the C-F dipole at low temps. where energetic interactions fixed the phase behaviour. Polymer structure also had a marked effect on the cloud point pressure. 47 refs.

KOREA; USA

Accession no.792538

Item 394

Patent Number: US 6063855 A1 20000516

PROCESS FOR THE MANUFACTURE OF VINYLIDENE FLUORIDE POWDER COATINGS

Pecsok R L; Dohany J E

This involves dispersing at least one pigment in an aqueous dispersion or latex of a fluorine-free polymer, which is compatible with the vinylidene fluoride polymer and, if

needed, conventional paint additives, which may include a polyoxyalkylene glycol block polymer. The aqueous pigment dispersion is then blended with the vinylidene fluoride polymer powder, milled, dried and classified to obtain the specified particle size.
USA

Accession no.791914

Item 395
Journal of Materials Science Letters
19, No.19, 1st Oct.2000, p.1735-8
HIGH PROTON CONDUCTIVITY IN ZRP-PTFE COMPOSITES
Park Y-I; Kim J-D; Nagai M
Musashi,Institute of Technology

A report is presented on the preparation and characterisation of two types of fast proton-conducting organic-inorganic hybrid composites composed of alpha- or gamma-zirconium phosphate and PTFE. The bonding structure of hydroxyl groups and water in these composites and composite microstructure were investigated using various techniques, including FTIR spectroscopy, X-ray diffraction and field emission scanning electron microscopy. The effect of electrical anisotropy on proton conductivity was evaluated by the application of low and high pressure and the influence of the addition of the zirconium phosphate on proton conductivity examined. Increased proton conductivity is considered to be due to high ion mobility on the surface of the zirconium phosphate particles. 14 refs.
JAPAN

Accession no.791753

Item 396
Journal of Materials Science Letters
19, No.18, 15th Sept.2000, p.1591-4
PROTON CONDUCTIVITY IN AMORPHOUS PHOSPHATE-PTFE COMPOSITE
Park Y I; Kim J D; Nagai M
Musashi,Institute of Technology

The fabrication process and properties are reported for proton-conducting organic-inorganic composites comprising of amorphous phosphate and PTFE (P-PTFE composite):PTFE membrane in which an amorphous phosphate phase is incorporated via in situ sol-gel reaction for di-isopropyl phosphate. 12 refs.
JAPAN

Accession no.791466

Item 397
Polymer Science Series A
42, No.8, Aug.2000, p.922-8
ION-PAIR MECHANISM OF THE ELECTRIC POLARIZATION IN IRRADIATED POLY(TETRA FLUOROETHYLENE)
Khatipov S A; Zhutaeva Y R; Smirnova N A; Sichkar V P
Moscow,Karpov Institute of Physical Chemistry

Isothermal depolarisation studies in irradiated poly(tetrafluoroethylene) (PTFE) as a function of temperature, time and field strength were carried out. Evidence suggested the formation of stable electron-hole pairs in the bulk polymer and thus a mechanism for this formation was proposed. Polymer samples irradiated in different ways were subjected to ac and dc measurements which revealed a correlation between the polarising effects and the concentration of middle and terminal peroxide macroradicals formed in the PTFE samples irradiated in the presence of oxygen. 20 refs.
RUSSIA

Accession no.791143

Item 398
Patent Number: US 6071452 A 20000606
PROCESS OF MAKING POLYTETRAFLUOROETHYLENE FIBER
Kelmartin T P; Roberts G M; Dolan J W; Minor R B
Gore Enterprise Holdings Inc.

A PTFE fibre that is adapted to be sewn at high speeds. The fibre has a toughness greater than about 0.36 grams per denier (g/d). A range for the toughness is from about 0.36 to about 1.01 g/d, with a preferred range being from about 0.50 to about 0.80 g/d. The toughness of the inventive PTFE fibre is most preferably about 0.60 g/d. The inventive fibre has a peak engineering stress greater than about 1.6 g/d and a break strain greater than about 15.5 percent. A preferred range for the peak engineering stress is from about 3.0 g/d to about 5.0 g/d, and a preferred range for the break strain is from about 20 percent to about 50 percent. Most preferably, the peak engineering stress is about 4.4 g/d, and the break strain is about 24 percent. In another aspect, this invention provides a process for making a fibre that involves providing a PTFE fibre and heating the PTFE fibre to a temperature of from about 300.degree. C. to about 500.degree. C., while overfeeding the PTFE fibre at an overfeed of up to about 70 percent. A preferred range for the temperature is from about 350. degree. C. to about 450.degree. C., and a preferred range for the overfeed in the overfeeding step is from about 10 percent to about 20 percent. Most preferably, the temperature in the heating step is about 400.degree. C. and the overfeed in the overfeeding step is about 15 percent. The PTFE fibre may be used as a filament for an improved dental floss, and is also suited for an improved bearing material.
USA

Accession no.790812

Item 399
Patent Number: US 6066707 A1 20000523
TETRAFLUOROETHYLENE THERMOPROCESSABLE COPOLYMERS
Colaianna P; Abusleme J A
Ausimont SpA

Tetrafluoroethylene (TFE) thermoprocessable copolymers, consisting of: (A) from 0.1 to 15% by moles of a fluorodioxol of a specified formula wherein RF is a perfluoroalkyl having from 1 to 5 carbon atoms; X1 and X2, equal to or different from each other, are --F or --CF3 ; Z is selected from --F, --H and --Cl; (B) from 0 to 15% by moles of a perfluorinated monomer selected from hexafluoropropene (HFP) and a perfluoroalkylvinylether of formula CF2=CF--OR'f wherein R'f is a perfluoroalkyl C2-C4 or their mixtures; excluding the value 0 for the amount of the monomer (B); and (C) TFE forming the remaining part to 100%; with the proviso that the total amount of the monomers (A) and (B) is lower than or equal to 20% by mole.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.790692

Item 400
Journal of Physics D
33, No.19, 7th Oct.2000, p.2483-8
STUDY OF FERROELECTRIC POLARIZATION IN POLYVINYLIDENE FLUORIDE USING THE CONSTANT CURRENT METHOD
Wisniewski C; Ferreira G F L; Moura W A; Giacometti J A
Sao Carlos,Universidade Federal

Details are given of the use of the constant current method to study the electric polarisation on conducting free vacuum treated PVDF with two constant current experiments being carried out in sequence with a short-circuiting period in between. The dependence of ferroelectric and metastable polarisation on the electric field is discussed. 25 refs.

BRAZIL

Accession no.789577

Item 401
Journal of Polymer Science: Polymer Chemistry Edition
38, No.19, 1st Oct.2000, p.3498-509
SURFACE MODIFICATION OF POLY(T ETRAFLUOROETHYLENE) FILMS BY PLASMA POLYMERIZATION OF GLYCIDYL METHACRYLATE AND ITS RELEVANCE TO THE ELECTROLESS DEPOSITION OF COPPER
Yang G H; Kang E T; Neoh K G
Singapore,National University

Results of studies of the above are presented and discussed, particular attention being paid to effect of argon plasma treatment on surface composition of PTFE, mechanism of GMA plasma polymerisation and deposition, influence of radiofrequency power on the structure and composition of the plasma-polymerised glycidyl methacrylate(GMA)-PTFE(pp-GMA-PTFE) surface, influence of carrier gas flow rate on the structure and composition of the pp-GMA-PTFE surface, influence of the system pressure on the structure and composition of the pp-GMA-PTFA surface, influence of the monomer temp. on the structure and composition of the pp-GMA-PTFE surface, surface morphology of the pp-GMA-PTFE film, and adhesion strength between the electrolessly deposited copper and the pp-GMA-PTFE film. 31 refs.

SINGAPORE

Accession no.789292

Item 402
Macromolecules
33, No.17, 22nd Aug.2000, p.6460-5
MELT-PROCESSABLE POLYTETRAFLUOROETHYLENE
Tervoort T; Visjager J; Graf B; Smith P
Zurich,University

Details are given of the identification of a window of medium polymer viscosities/molar masses that permits ordinary melt processing of PTFE into objects with mechanical properties similar to HDPE. Compounding and recycling are discussed. 32 refs.

SWITZERLAND; WESTERN EUROPE

Accession no.789041

Item 403
Patent Number: US 6060167 A1 20000509
NON-CHALKING RELEASE/WEAR COATING
Morgan R A; D'Haenens L G P J
DuPont de Nemours E.I.,& Co.

A release coating of thermally stable, essentially non-fluorocarbon polymer and low molecular weight fluorocarbon polymer is made non-chalking, i.e. does not cause waxy buildup on fabrication equipment producing articles having the coating thereon, by a special polymerisation process for making the fluorocarbon polymer, viz. aqueous dispersion polymerisation using conventional initiator, dispersing agent, and chain transfer agent, but also having carboxylic acid, salt, ester or peroxide thereof, or alkanol or ester thereof or ketone present during the polymerisation. Alternatively, the additive can be fluorosurfactant which contains carbon-hydrogen bonding and which also serves as the dispersing agent in the polymerisation medium.

USA

Accession no.787378

Item 404
Patent Number: US 6048484 A1 20000411
PROCESS FOR FORMING A SEAMLESS TUBE OF EXPANDED PTFE FROM A SHEET OF

EXPANDED PTFE

House W D; Moll K W; Zukowski S L
Gore W.L.,& Associates Inc.

A thin-walled tube of porous polytetrafluoroethylene is made using corresponding male and female dies to deform a precursor sheet of porous PTFE, which has been restrained about its perimeter. Preferably, the porous PTFE sheet is heated to a temperature of less than the crystalline melting temperature during the tube-forming process. The precursor material is preferably a multiaxially expanded PTFE sheet. This precursor material may optionally have been previously exposed to heat above the melting temperature of PTFE. The tube is as thin or thinner than the precursor sheet.

USA

Accession no.787292

Item 405
Polymer Science Series A
42, No.6, June 2000, p.679-88

THERMODYNAMICS OF GAS AND VAPOUR SORPTION BY AMORPHOUS GLASSY AF TEFLONS

Yampol'skii Y P; Berezkin V G; Popova T P;
Korikov A P; Freeman B D; Bondar V I; Merkel T C
Russian Academy of Sciences; North Carolina,State University

The sorption of gases and organic vapours in amorphous copolymers of 2,2-bis-trifluoromethyl-4,5-difluoro-1,3-dioxol and tetrafluoroethylene (F amorphous teflons), known as gas-permeable materials possessing a high free volume, are studied by methods of inverse gas chromatography and volumetry. Measurements are performed for a wide range of sorbates from He to n-C13H28. The gas and vapour solubility coefficients S increase with the content of perfluorodioxol monomers, reaching very high values for a copolymer containing 87% of this monomer. Analysis of the sorption isotherms shows that this property is related to the Henry solubility coefficients kD being unusually high as compared to the hydrogen-containing polymers. The excess enthalpy of mixing deltaHm as function of the size of sorbate molecules (e.g. of their critical volume Vc) exhibits a minimum. The coordinate minimum Vc(min) can be considered as an estimate of the free volume element of the copolymer. Joint analysis of the volumetric and chromatographic data allows a new relationship to be established between logS and squared critical temperature of a sorbate. 35 refs.

RUSSIA; USA

Accession no.786827

Item 406
Chemistry of Materials
12, No.7, July 2000, p.2039-49

EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE EFFECT OF LUBRICANT STRUCTURE ON THE BONDING KINETICS OF PERFLUOROALKYLPOLYETHERS ON CH X AMORPHOUS HYDROGENATED CARBON

Waltman R J
IBM Storage Systems

Perfluoropolyethers (PFPEs) are widely used as topical lubricants on rigid magnetic media to provide a low wear interface. The tribological reliability of the disk storage device is strongly dependent upon the mobile state of the lubricant. The kinetics of the bonding of molecularly thin (11 A) Demnum-OH films to the CHx amorphous, hydrogenated carbon overcoat is investigated. The focal point is to investigate how differences in the PFPE chemical structure, in particular the backbone, affect both the flexibility of the lubricant chain and their interactions with the carbon surface. The bonding rate of Demnum-OH on CHx is investigated by recording the changes in the infrared spectrum of Demnum-OH as a function of time, temperature and molecular weight. The bonding kinetics are described by a differential rate equation that has a time dependent rate coefficient, k(t) = kot -h. The functional form of the time dependence in the bonding kinetics is interpreted to reflect the ability of the lubricant to adopt configurations compatible with bonding. The kinetic results for the Demnum-OH bonding, k(t) alpha t -0.5, indicate a stiff chain compared to Zdol, where k(t) alpha t -1.0. The differences in the observed time dependence are related to the chemical structure of the monomer units and the energetic barriers to internal rotation about the C-O and C-C bonds. These results suggest significant confinement of the Demnun chain consistent with a more solid-like adsorbed film structure compared to flexible (high Cl:C2 ratio) Zdol. 32 refs.

USA

Accession no.786810

Item 407
Chemical and Engineering News
78, No.36, 4th Sept.2000, p.11-2

FLUOROPOLYMER BREAKTHROUGH

Freemantle M

Researchers at the Swiss Federal Institute of Technology have succeeded in developing melt processable blends of PTFE. The material can be extruded into rods, fibres and films, and compounded with additives and other polymers. PTFE has not previously been melt processable due to the extremely high viscosity of its molten state. Investigations were carried out on blends of PTFE containing low molecular weight, low viscosity micropowders that are commonly used as additives in inks and coatings and the more common high viscosity materials in various composition ratios. Intermediate viscosity blends were obtained which were capable of melt processing.

SWISS FEDERAL INSTITUTE OF TECHNOLOGY
SWITZERLAND; WESTERN EUROPE

Accession no.786500

Item 408
Patent Number: US 6054083 A1 20000425

PROCESS FOR PREPARATION OF POLYTETRAFLUOROETHYLENE MOLDING POWDER

Asano M; Tanigawa S; Shimodoh A; Shimizu T; Kawachi S
Daikin Industries Ltd.

PTFE coarse particles are finely pulverised into particles in the wet state, thus enabling the finely pulverised particles to be washed as they are and the amount of impurities to be lowered efficiently. After washing, agglomeration granulation is carried out to produce PTFE moulding powder. The polytetrafluoroethylene coarse particles are obtained by suspension polymerisation of tetrafluoroethylene and are finely pulverised, in the wet state to provide an average particle size, particularly in the range of 10 to 100 micrometers. After washing, mechanical force is applied to the washed powder in the wet state for agglomeration granulation to produce particles having an average particle size in the range of 200 to 800 micrometers.

JAPAN; USA

Accession no.786416

Item 409
Patent Number: US 6068931 A1 20000530

SELF-LUBRICATING BEARING MATERIAL AND PLAIN BEARING OF SUCH A BEARING MATERIAL

Adam A; Grunthaler K-H; Hodes E
Federal-Mogul Wiesbaden GmbH

A self-lubricating bearing material is described, as well as a plain bearing of such a bearing material, the performance of which, under lubricant-free conditions, is so markedly improved that pv values of up to 6 MPa/m/s are achieved in an average load and speed range. The self-lubricating bearing material comprises a PTFE-containing polymer matrix with fillers comprising PbO and at least one metal fluoride. The PbO content is from 15-55 vol.% and the metal fluoride content is from 0.1-14 vol.%. Preferred metal fluorides are CaF.sub.2, PbF.sub.2 and MgF.sub.2. The addition of further fillers such as hard materials, pigments or fibrous material is possible. The proportion of further additives may amount to up to 40 vol.% of the PbO/metal fluoride fillers.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.786149

Item 410
Macromolecules
33, No.15, 25th July 2000, p.5638-43

SURFACE MODIFICATIONS OF EXPANDED POLY(TETRAFLUOROETHYLENE) SHEETS ASSISTED BY CARBON DIOXIDE ANTENNA COUPLING MICROWAVE PLASMA

Chen-Yang Y W; Liao J D; Kau J Y; Huang J; Chang W T; Chen C W
Chung-Yuan Christian University; Yeu Ming Tai Chemical Industrial Co.Ltd.; Taiwan,Central Police University

The surfaces of expanded PTFE(ePTFE) sheets were chemically modified using carbon dioxide cold plasma generated by antenna coupling guided microwave. The plasma-pretreated ePTFE surface did not obviously change in terms of morphology of node structure but increased surface tension and promoted subsequent capability to graft polymerise with acrylic acid. The modified ePTFE were then characterised using FTIR-ATR and X-ray photoelectron spectroscopy. The morphologies of ePTFE surfaces and the cross-sectioned side of acrylic acid-grafted ePTFE were examined by SEM and FTIR microscopy. Experimental results indicated that acrylic acid penetrated to a depth of about 60 micrometres and bonded on the surfaces of nodes and fibrils. Generation of COF species on the ePTFE surfaces by carbon dioxide plasma contributed to this initiation effect. The present data also supported the theory that plasma generated by the carbon dioxide antenna-coupling microwave system could efficiently activate the exposed ePTFE surfaces of interior fibrils and nodes. 22 refs.

TAIWAN

Accession no.786008

Item 411
Macromolecules
33, No.16, 8th Aug.2000, p.6031-41

BLENDS OF A PERFLUOROSULFONATE IONOMER WITH POLYVINYLIDENE FLUORIDE. EFFECT OF COUNTERION TYPE ON PHASE SEPARATION AND CRYSTAL MORPHOLOGY

Landis F A; Moore R B
Southern Mississippi,University

Details are given of the effect of counterion type on the phase separation behaviour of blends of PVDF with Nafion PTFE. The manner in which the strength of the electrostatic crosslinks in Nafion affects the crystalline morphology of the PVDF component in the blend was evaluated. 61 refs.

USA

Accession no.785797

Item 412
Patent Number: EP 1028139 A2 20000816

POLYTETRAFLUOROETHYLENE MOLDED ARTICLES COATED WITH FUSED FLUOROPOLYMER RESIN

Nishio T
DuPont-Mitsui Fluorochemicals Co.Ltd.

Disclosed is a moulded article of polytetrafluoroethylene or modified polytetrafluoroethylene having a fluoropolymer resin coating. The coating comprises a heat-flowable tetrafluoroethylene copolymer and has a surface with a reduced roughness compared to the moulded article prior to coating. The coating is preferably a fused powder, most preferably formed by electrostatically applying a fluoropolymer powder resin to the moulded PTFE article. The fluoropolymer powder preferably comprises a mixture of heat-flowable tetrafluoroethylene copolymer powder and a polytetrafluoroethylene that has a temperature of crystallisation of at least 305C and a heat of crystallisation of at least 50J/g. The surfaces of the articles are smoother than the original articles so that they resist adhesion of chemical contaminants and have applicability for chemical containers and transport pipes in the rigorously clean environment of the semiconductor industry.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; WESTERN EUROPE-GENERAL

Accession no.785558

Item 413

Journal of Polymer Science: Polymer Physics Edition

38, No.13, 1st July 2000, p.1734-48

ASAXS STUDY OF STYRENE-GRAFTED SULFONATED POLY(VINYLIDENE FLUORIDE) MEMBRANES

Torkkeli M; Serimaa R; Etelaniemi V; Toivola M; Jokela K; Paronen M; Sundholm F
Helsinki,University

Small-angle and wide-angle X-ray scattering and anomalous small-angle X-ray scattering (ASAXS) were used to investigate proton-conducting membranes prepared by radiation induced styrene grafting and sulphonation of commercial poly(vinylidene fluoride)(PVDF) films. The membranes were found to retain the lamellar and highly orientated structure of the original PVDF films. The sulphonate groups aggregate in the central part of the amorphous layers, where they form a weakly ordered structure that does not show any preferred orientation. This suggests that the structure is lamellar with alternate metal-sulphonated hydrate and PVDF-polystyrene layers. 22 refs.

EUROPEAN UNION; FINLAND; SCANDINAVIA; WESTERN EUROPE

Accession no.784612

Item 414

Polymer

41, No.23, Nov.2000, p.8311-20

PHASE SEPARATION AND GELATION BEHAVIORS IN POLY(VINYLIDENE FLUORIDE)/TETRA(ETHYLENE GLYCOL) DIMETHYL ETHER SOLUTIONS

Po-Da Hong; Che-Min Chou
Taiwan,National University of Science & Technology

The relation between the phase separation behaviour and gelation behaviour in the above solutions was studied by time-resolved light scattering and gelation kinetic analyses. The mechanism and characteristics of gelation were investigated, together with the dependence on temp. and concentration. A combination of the phase diagram and the results of gelation kinetics studies showed that the gelation behaviours of the solutions could be separated into three diverse regions. Depending on the initial thermodynamic conditions, the gelation processes could be divided into two major parallel reactions. 28 refs.

TAIWAN

Accession no.783084

Item 415

Journal of Applied Polymer Science

77, No.4, 25th July 2000, p.733-9.

LIGHT SCATTERING CHARACTERIZATION OF POLY(TETRAFLUOROETHYLENE-CO-PERFLUOROMETHYL VINYL ETHER) COPOLYMER

Zhou S-Q; Liang D-H; Chu B; Xu P; Lai J
Stony Brook,State University; Gore W.L.,& Associates Inc.

The copolymer of tetrafluoroethylene and perfluoromethyl vinyl ether was characterised using static and dynamic light scattering methods. The copolymer was dissolved in perfluoro-2-butyltetrahydrofuran and a proprietary solvent Flutec PP11. Molecular weight, molecular weight distribution, chain dimensions and conformation were determined. 15 refs.

USA

Accession no.782736

Item 416

Journal of Polymer Science: Polymer Physics Edition

38, No.11, 1st June 2000, p.1512-20

INFRARED STUDY OF THE EFFECTS OF HYDRATION ON CATION-LOADED NAFION THIN FILMS

Blanchard R M; Nuzzo R G
Illinois,University

The effects of hydration on the vibrational spectra of cation-exchanged Nafion thin films were studied. Nafion is a copolymer consisting of a PTFE backbone and a varying density of sulphonate-terminated perfluoroether side chains. The cations selected for study, apart from the initial H+ form of the membrane, were Na+, NH4+, tetramethylammonium, tetrabutylammonium, hexadecyltrimethylammonium and tris(2,2'-bipyridine)osmium(II). A flow cell was used to follow the changes occurring in a 1000A film in response to variations in the humidity of a nitrogen purge gas flowing through the cell. The structural changes occurring due to the binding of water to these cation-exchanged membranes was followed across a broad range of water contents with IR difference spectroscopy. The results demonstrated a complex role for water in mediating the polyanion-cation interactions. Side-chain reconstruction could play an important role in the ion-binding and transport properties of the ionomer domains. 30 refs.

USA

Accession no.781025

Item 417

Patent Number: US 6027779 A1 20000222

THIN-WALL POLYTETRAFLUOROETHYLENE TUBE

Campbell C V; Goffena D G M; Lewis J D; Myers D J; Sparling C M

Gore W.L.,& Associates Inc.

A thin-wall PTFE (polytetrafluoroethylene) tube in the form of a tube of porous expanded PTFE film wherein the porous PTFE film has a microstructure containing a multiplicity of fibrils oriented substantially parallel to each other. The tube has a wall thickness of less than about 0.25 mm and is made from at least one first layer and at least one second layer of porous PTFE film, wherein the fibrils of the first and second layers are oriented substantially perpendicular to each other. Preferably the fibrils of the at least one first layer are oriented substantially parallel to the longitudinal axis of the tube and the fibrils of the at least one second layer of porous PTFE film are oriented substantially circumferential to the tube. The first and second layers may be inner and outer layers respectively, or alternatively their relationship may be reversed. Alternatively, either of the first and second film layers may be replaced with alternative reinforcing components such as a braid or at least one reinforcing rib. The reinforcing rib is preferably in the form of a helically-wrapped metal wire located between the first and second layers.

USA

Accession no.780983

Item 418

Macromolecular Symposia

Vol.152, March 2000, p.211-22

FLUORINATED POLYMERIC MATERIALS FOR THE PROTECTION OF MONUMENTAL BUILDINGS

Ciardelli F; Aglietto M; Castelvetro V; Chiantore O; Toniolo L

Pisa,University; Torino,Universita; CNR,Centro Gino Bozza

The structures of acrylate and methacrylate polymers were designed to optimise the fluorine content of the final polymer or copolymer while obtaining improved chemical and photochemical stability, film forming ability and impermeability to water, which might contain aggressive chemicals. The suitability of the new polymers as protective coatings on stone was then evaluated by testing their UV stability and selective permeability to water vapour versus condensed water. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.778698

Item 419

Journal of Polymer Science: Polymer Physics Edition

38, No.9, 1st May 2000, p.1155-66

MISCIBILITY AND SURFACE CHARACTERIZATION OF A POLY(VINYLIDENE FLUORIDE)-POLY(VINYL METHYL KETONE) BLEND BY INVERSE GAS CHROMATOGRAPHY

Al-Ghamdi A; Al-Saigh Z Y

Columbus,State University

The miscibility and surface characterisation of PVDF/poly(vinyl methyl ketone) (PVMK) blends were studied using inverse gas chromatography (IGC) over a range of blend compositions and temperatures. Very small amounts of alkane, acetate and alcohol solutes were injected into the chromatography column to probe the dispersive, dipole and hydrogen bonding interactions with the blend. The dispersive component of the surface energy ranged from 18.70-64.30 mJ/sq.m between 82C and 163C. The PVDF/PVMK interaction parameters were slightly positive for most of the solutes used, but some miscibility was found at all compositions. The miscibility was greatest at a 50:50 w/w blend composition. The interaction parameters obtained by IGC agreed well with those obtained by DSC on the same blends. 44 refs.

USA

Accession no.777870

Item 420

Patent Number: US 6013719 A 20000111

APPLICATIONS OF LOW MELT VISCOSITY POLYTETRAFLUOROETHYLENE

Lahijani J

Du Pont de Nemours E.I.,& Co.

Low melt viscosity polytetrafluoroethylene (PTFE), i.e. having a melt viscosity of 50 to 100000 Pa.s at 372 deg C, is combined with non-fluorinated thermally stable polymer such as polyarylene etherketone to provide melt-fabricability application for the low MV PTFE and provide improved properties for the thermally stable polymer.

USA

Accession no.777659

Item 421

Patent Number: US 6013688 A 20000111

PVDF MICROPOROUS MEMBRANE AND METHOD

Pacheco M M; Pacheco J F

Corning-Costar Corp.

Methods for making microporous polyvinylidene fluoride (PVDF) membranes from vinylidene fluoride polymers and the products produced are disclosed. The PVDF microporous membranes have a significantly faster flow rate at a given pore size as compared to equally-sized microporous mambranes made by conventional procedures. The PVDF microporous membranes also have significantly smaller pore sizes than conventional microporous PVDF membranes. The present membranes have unique macrostructural features responsible, in part, for their unique functional properties. The process includes dissolving the polymer in a liquid which includes a solvent and a co-solvent for the polymer. The dissolution of the polymer can be at temperatures ranging from about 20 deg C to about 50 deg C while the formation of the microporous membrane can be at temperatures ranging from about -10 deg C to 50 deg C. Selection of appropriate operating parameters of temperature and solvent/co-solvent concentration can optimise the membrane at a given nominal pore size, flow rate, and polymer distribution.

USA

Accession no.777628

Item 422
Macromolecular Symposia
151, Feb.2000, p.515-20

SYNTHESIS AND CHARACTERISATION OF CORE-SHELL COLLOIDS WITH FLUOROCARBON CORES

Othegraven J; Piazza R; Bartsch E
Mainz,University; Milano,Politecnico

The synthesis of core-shell particles with polycrystalline fluorocarbon (MFA) cores (derived from preformed seeds) and highly crosslinked PS shells via essentially surfactant-free emulsion polymerisation is reported. The composite latexes in aqueous dispersion and in THF solution are characterised by light scattering, asymmetric field flow fractionation and TEM. The results indicate that while in aqueous dispersion one obtains core-shell particles with a narrow size distribution and a sharp fluorocarbon/PS interface, the dissolution of the latexes in THF leads to hollow sphere structures of crosslinked PS. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; ITALY; WESTERN EUROPE

Accession no.776735

Item 423
Polymer Degradation and Stability
68, No.2, April 2000, p.299-305

ENVIRONMENTAL STRESS CRACKING OF POLYVINYLIDENE FLUORIDE AND WELDS IN ALKALINE SOLUTIONS

Hinksman P; Isaac D H; Morrissey P
Wales,University; National Power plc

A study is carried out to investigate the resistance of PVDF to high pH aqueous sodium hydroxide solutions. In addition to surveying the conditions that cause environmental stress cracking in test samples machined from injection moulded plaques, interest centres on regions of formed components that might contain high residual stresses in particular vibration welded samples. The first series of experiments involves subjecting standard test samples to fixed strains in three-point bend testing rigs and immersing them in highly alkaline environments. As expected, higher strains cause more problems for the material, with a cut off limit at about 5% strain, below which no measurable effects are observed in any environment within the timescale (63 days) of the experiments. Even above 5% strain, PVDF is found to be resistant to NaOH solutions of pH 12.5 and 13, although significant effects are seen as the pH is increased to 13.5, 14 anti 14.39. Under these high strain, high pH conditions, the damage is manifest as discolouration of the samples due to dehydrofluorination. It is found that the time between immersion in the solution and the observation of initial discolouration is the most useful parameter for characterising the relative severity of environments. Tests on welded samples indicate that the flash from the welding process contains high residual strains, but tensile residual stresses in the bulk material at the weld line are relatively small. Weld strength is about 90% of that measured for the bulk material but failure at welds is relatively brittle. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.776037

Item 424
Polymer Degradation and Stability
68, No.2, 2000, p.231-8

THERMAL STABILITY OF RADIATION GRAFTED PTFE-G-POLYSTYRENE SULPHONIC ACID MEMBRANES

Nasef M M
Malaysia,Universiti Teknologi

The thermal stability of grafted PTFE-g-polystyrene sulphonic acid obtained by grafting of styrene onto PTFE films followed by sulphonation is studied using thermogravimetric analysis (TGA) and oven heat treatment under nitrogen atmosphere. The TGA results are analysed in correlation with the membrane two-step preparation procedure and the variation of the degree of grafting. The membranes, found to undergo a three-step degradation pattern due to dehydration, desulphonation and decomposition of the PTFE matrix effect of desulphonation on some physicochemical properties of the membranes such as ion exchange capacity and water, are investigated with respect to the degree of grafting, temperature and time of heat treatment. 27 refs.

MALAYSIA

Accession no.776028

Item 425
International Polymer Science and Technology
27, No.2, 2000, p.T/86-T/90. (Translation of Plasticheskie Massy, No.8, 1999, p.17)

INFLUENCE OF AN ACTIVATED MODIFIER ON THE DEFORMATION AND STRENGTH AND FRICTIONAL PROPERTIES OF POLYTETRAFLUOROETHYLENE

Okhlopkova A A; Ammosov N G; Broscheva P N

The study of the behaviour of a composite material in friction under conditions of high loads showed that the introduction of activated modifiers into PTFE increases the wear resistance of the material as compared with composites containing a non-activated filler of the same concentration. The mechanism of increase of wear resistance of materials during service is shown to be connected with an increase in adhesive interaction of components in the composite. It is shown that by varying the concentration of ultradispersed filler, it is possible to control processes of structure formation in the polymer, and thereby, the properties of the composite as a whole. Mechanical activation techniques are used to produce ultradispersed fillers including spinels of cobalt, magnesium and copper, which are introduced into powder PTFE by dry mixing. 5 refs.

RUSSIA

Accession no.773587

Item 426

Patent Number: US 6020033 A 20000201

METHOD OF MAKING POLYFLUOROORGANO COMPOSITES

Kern J F W

International Business Machines Corp.

A method for reducing the corrosive chemical vapour permeability of a polyfluoroorgano resin substrate which comprises coating its outer surface with a vinylidene dichloride copolymer. The method produces a polyfluoroorgano resin substrate-vinylidene dichloride copolymer composite, for example a TEFLON-perfluoralkyl vinylether copolymer pipe having its surface immediate to the environment treated with a vinylidene dichloride/vinyl chloride copolymer.

USA

Accession no.773319

Item 427

Macromolecules

33, No.7, 4th April 2000, p.2616-25

THERMOREVERSIBLE GELATION OF POLY(VINYLIDENE FLUORIDE) IN DIESTERS: INFLUENCE OF INTERMITTENT LENGTH ON MORPHOLOGY AND THERMODYNAMICS OF GELATION

Dikshit A K; Nandi A K

Indian Association for the Cultivation of Science

The physical properties of thermoreversible poly(vinylidene fluoride) (PVF) gels in diesters with 0-7 intermittent carbon atoms was investigated. The gels consisted of alpha-phase PVF crystals, with a spheroidal morphology when $n = 0$, a mixed morphology when $n = 1$, and a fibrillar-like morphology for higher values of n. The enthalpy of gel formation and gel fusion, determined by differential scanning calorimetry, exhibited a linear relationship with PVF concentration for PVF-diethyl oxalate gels, but the other diesters gave positive deviations from linear. Plots of the deviation as a function of PVF weight diffraction were used to determine the compositions of the polymer solvent complexes. Polymer solvent compound formation was also studied using molecular mechanics calculations. Discrepancies between molecular modelling and the morphology of diethyl oxalate and diethyl melonate are explained in terms of the molecular mobility of the solvent and the enthalpy of complexation. For a given PVH concentration, the gel melting temperature, gelation temperature and enthalpy of complexation increased with increasing number of intermittent carbon atoms, indicating that the intermittent length of the diesters had both an enthalpic and entropic contribution to the gel behaviour. 32 refs.

INDIA

Accession no.773205

Item 428

Journal of Applied Polymer Science

76, No.8, 23rd May 2000, p.1207-16

SURFACE MODIFICATION OF POLYTETRAFLUOROETHYLENE WITH TETRAETHOXYSILANE BY USING REMOTE ARGON/DINITROGEN OXIDE MICROWAVE PLASMA

Chun T I; Choi S C; Taschner C; Leonhardt A; Kaufmann R; Rehwinkel C; Rossbach V

Dong-eui University; Pusan,National University; Dresden,Institute of Solid State & Materials Research; Deutsches Wollforschungsinstitut; Dresden,Technische Universitat

The results are reported of a study of the use of remote microwave plasma for the polymerisation and deposition of tetraethoxysilane on the surface of PTFE. The effect of microwave power on the deposition rate of the tetraethoxysilane and the structure of the interface between the deposited polymer film and the PTFE surface, as determined using SEM equipped with energy dispersive X-ray analysis, are discussed. The chemical composition of the surface of the organosilicone polymer, as determined using ATR-FTIR and XPS is also considered. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.772080

Item 429

Macromolecules

33, No.5, 7th March 2000, p.1682-5

SYNTHESIS OF LINEAR TETRAFLUOROETHYLENE-VINYL ACETATE COPOLYMER IN CARBON DIOXIDE

Lousenberg R D; Shoichet M S

Toronto,University

Details are given of the preparation of a series of tetrafluoroethylene-vinyl acetate copolymers in carbon dioxide by a free radical mechanism. Molecular structures before and after hydrolysis are discussed. 17 refs.

CANADA

Accession no.771277

Item 430

Journal of Applied Polymer Science

76, No.2, 11th April 2000, p.220-7

PROTON EXCHANGE MEMBRANES PREPARED BY SIMULTANEOUS RADIATION GRAFTING OF STYRENE ONTO POLY(TETRAFLUOROETHYLENE-CO-HEXAFLUOROPROPYLENE) FILMS. 1. EFFECT OF GRAFTING CONDITIONS

Nasef M M; Saidi H; Nor H M
Malaysia,Universiti Teknologi

The effect of grafting conditions on the degree of grafting of styrene onto FEP films by simultaneous irradiation were investigated at room temperature. Grafting conditions studied were monomer concentration, solvent type, irradiation dose and dose rate. Some characteristics of the grafted films, such as molecular structure, crystallinity and tensile properties, were determined as a function of the degree of grafting and the kinetics of grafting discussed. 19 refs.

MALAYSIA

Accession no.769375

Item 431

Macromolecules

33, No.3, Feb.2000, p.933-46

REORIENTATIONAL DYNAMICS OF PVDF/PMMA BLENDS BY BROAD-BAND DIELECTRIC RELAXATION SPECTROSCOPY

Sy J W; Mijovic J
Brooklyn,Polytechnic University

Details are given of a comprehensive investigation of the reorientational dynamics of PVDF/PMMA blends. Dielectric relaxation spectroscopy was performed over a wide range of frequency and temperature on wholly amorphous, crystalline, and crystallising blends of varying composition. The origins, temperature dependence, composition dependence and spectral characteristics were established for a number of relaxation processes. 70 refs.

USA

Accession no.768994

Item 432

Polymer Engineering and Science

40, No.3, March 2000, p.761-7

ENVIRONMENTAL STRESS CRACKING OF POLYVINYLIDENE FLUORIDE IN SODIUM HYDROXIDE. EFFECT OF CHAIN REGULARITY

Maccone P; Brinati G; Arcella V
Ausimont R & D

A study was made of the environmental stress cracking of three samples of PVDF having different degrees of crystallinity in 30 wt.% sodium hydroxide solution. Samples of PVDF having different numbers of regiodefects and a limited number of chain branching defects were subjected to various levels of constant strain at 23C. They were analysed by DSC and subjected to tensile and flexural testing prior to environmental testing. The influence of chain regularity and structural defects on the resistance of PVDF to crack formation is discussed. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.768239

Item 433

Macromolecules

33, No.1, 11th Jan.2000, p.120-4

BRANCHING AND CROSSLINKING IN RADIATION-MODIFIED PTFE. A SOLID-STATE NMR INVESTIGATION

Fuchs B; Scheler U
Dresden,Institute of Polymer Research

High-resolution fluorine 19 NMR was used to investigate the structural changes resulting from PTFE electron irradiation under vacuum. A quantitative analysis of the data was used to establish the density of side groups and branches. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.764731

Item 434

Journal of Materials Science

35, No.2, 15th Jan. 2000, p.299-306

MORPHOLOGY AND PHASE TRANSITION OF HIGH MELT TEMPERATURE CRYSTALLISED POLYVINYLIDENE FLUORIDE

Gregorio R; Capitao R C
Sao Carlos,Universidade Federal

A systematic study was made of the isothermal crystallisation of PVDF from the melt at elevated temperatures using IR spectroscopy and polarised light optical microscopy. The dependence of the solid-state alpha to gamma transformation process on crystallisation time and temperature was investigated and an attempt made to explain the existence of ringed spherulites at the centre and non-ringed spherulites at the edges, observed at high temperature crystallisation. 12 refs.

BRAZIL

Accession no.764274

Item 435

Journal of Polymer Science: Polymer Physics Edition

38, No.2, 15th Jan.2000, p.297-308

AN EQUILIBRIUM STUDY ON THE DISTRIBUTION OF STRUCTURAL DEFECTS BETWEEN THE LAMELLAR AND AMORPHOUS PORTIONS OF POLY(VINYLIDENE FLUORIDE) AND (VINYLIDENE FLUORIDE-TETRA FLUORO ETHYLENE) COPOLYMER CRYSTALS

Dikshit A K; Nandi A K

Indian Association for the Cultivation of Science

The study determined that in polyvinylidene fluoride and vinylidenefluoride tetrafluoroethylene crystals a substantial amount of H-H defects had entered the system. Using chromium based etching, scanning electron microscopy was used to find that only the amorphous portions of films of the polymers had been etched, without affecting the crystalline lamella. F NMR was used to find the sequence distribution of the samples and their etched species. It was also found that the head to head defects were more prevalent in the amorphous portion than in the crystalline lamella. 36 refs.

INDIA

Accession no.763882

Item 436

Polymer Testing

19, No.2, 2000, p.131-42

DYNAMIC MECHANICAL TESTING OF THE CREEP AND RELAXATION PROPERTIES OF POLYVINYLIDENE FLUORIDE

Vinogradov A M; Holloway F

Montana,State University; Hewlett-Packard

The time-dependent properties of PVDF, a thin film piezoelectric polymer, were investigated. The study was based on the assumptions of linear viscoelasticity theory of hereditary type and time-temp. equivalent principle (Boltzmann's superposition principle). A developed experimental programme involved quasi-static creep tests and dynamic mechanical tests. The results obtained validated the assumptions of linear viscoelasticity in application to PVDF thin films and provided a consistent empirical database relating to the creep and relaxation properties of PVDF in the material directions parallel and perpendicular to the orientation of the aligned molecular chains of the polymer. 11 refs.

USA

Accession no.761320

Item 437

Patent Number: EP 969055 A1 20000105

FLUOROPOLYMER DISPERSIONS

Visca M; Lenti D; Malvasi M; Marchese E

Ausimont SpA

Mixtures of dispersions are produced from a dispersion composed of tetrafluoroethylene copolymers having an average particle size in the range of 180 to 400 nm and a dispersion composed of a (co)polymer dispersion of tetrafluoroethylene or thermoplastic copolymers of tetrafluoroethylene and having an average particle size ranging from 20 to 60 nm. The ratio between the particle sizes of the second dispersion compared with that of the first dispersion is lower than 0.3.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE

Accession no.759866

Item 438

Journal of Applied Polymer Science

60, No.11, 13th June 1996, p.2017-24

STUDIES ON GAMMA-RADIATION TREATMENT OF POLYTETRAFLUOROETHYLENE POWDER

Lunkwitz K; Buerger W; Geissler U; Petr A; Jehnichen D

Dresden,Institute of Polymer Research

gamma-Irradiation of PTFE in the presence of air was shown to result in degradation of polymer chains by insertion of oxygen. At first, in the low dose range below 400 kGy, an increase in crystallinity could be observed due to main chain scission in the amorphous part of the macromolecules. An increase in dose to about 1000 kGy caused progressive degradation of molec.wt. as well as an increasing degree of carboxylation of PTFE and increased concentration of trifluoromethyl groups in near-surface regions. At constant irradiation temp., the properties of irradiated PTFE were only slightly dependent on dose rate and starting material. The degree of carboxylation of the irradiated unsintered PTFE was significantly lower than that of electron-irradiated PTFE under comparable conditions. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.591381

Item 439

Macromolecules

26, No. 18, 30th Aug. 1993, p.4765-9

DEGRADATION MECHANISMS OF POLY(VINYL FLUORIDE) FILMS

Farneth W E; Aronson M T; Uschold R E

du Pont de Nemours E.I.,& Co.Inc.

The mechanism of degradation of PVF films in both oxidative and nonoxidative environments was examined. In nonoxidative environments, the homogeneous pyrolysis of related small molecules like 2-fluoropropane or 2-fluoropentane constitutes a useful model for both the product distributions and the rates. The oxidative chemistry, however, occurs at much lower temperatures and will dominate the degradation mechanism at even small partial pressures of oxygen. It is a radical chain process leading to oxygen incorporation in the polymer, main chain cleavage, and formation of new acylfluoride chain ends. Hydrogen fluoride is formed in both mechanisms.

In the oxidative chemistry, a plausible route to hydrogen fluoride is the hydrolysis of acyl fluorides by water vapour generated in situ. 20 refs.

USA

Accession no.493352

Item 440

Polymer Communications

27,No.10,Oct.1986,p.310-4

MICROWAVE HEAT-DRAWING OF POLYVINYLIDENE FLUORIDE

Nakagawa K;Amano M

NTT ELECTRICAL COMMUNICATIONS LABS.

A microwave heat-drawing technique was applied to PVDF rods and compared with that of conventional outside heat-drawing. The drawing behaviour was also compared with that of polyoxymethylene using the same microwave heating furnace. 27 refs.

JAPAN

Accession no.321154

Item 441

Macromolecules

19,No.7,July 1986,p.1935-8

BLENDS OF POLY(VINYLIDENE FLUORIDE) AND POLY(VINYL FLUORIDE)

Guerra G;Karasz F E;MacKnight W J

MASSACHUSETTS,UNIVERSITY

Evidence for immiscibility in both the crystalline and amorphous phases was presented. X-ray diffraction patterns were relatively insensitive to blend composition and like those found in previous studies. Corresponding DSC scans gave well-defined and separate melting peaks of the component homopolymers to show immiscibility in the crystalline phase. Because of high crystallinity unequivocal determination of Tg was not possible by DSC. However dynamic mechanical analysis (modulus and loss tangent vs temperature) indicated that the main relaxations (alpha, beta) of the homopolymers were present in the blend spectra, implying immiscibility of the amorphous phase. 19 refs.

USA

Accession no.317246

Item 442

Polymer Engineering and Science

22,No.4,March 1982,p.234-40

PROPERTY-MORPHOLOGY RELATIONSHIPS OF POLYMETHYL METHACRYLATE/ POLYVINYLIDENE FLUORIDE BLENDS

Mijovic J; Hong-Lie Luo; Chang Dae Han

An investigation was carried out into the property-morphology relationships of blends of PMMA and polyvinylidene fluoride compounded in a twin-screw extruder and then injection moulded. Mechanical properties of the blends of various compositions were studied by dynamic mechanical and impact strength measurements. The presence of crystalline regions in the blends was determined by DSC and the morphology of fracture surfaces was studied by SEM. The effect of annealing on the relationships was also examined. Compatible blends were formed over a wide range of blend composition and crystalline regions were detected in all blends containing 40% or more PVDF. 18 refs.

Accession no.209927

Item 443

High-Temperature and Flame-Resistant Fibers. Symposium Proceedings.

Applied Polymer Symposia 21,New York,28th-29th August 1973,p.89-100. 62(14)-96

POLY(ETHYLENE-CHLOROTRIFLUOROETHYLENE) FIBRES

ROBERTSON A B

(ACS)

The fibre forming potentials of ethylene-monochlorotrifluoroethylene (e-ctfe) copolymer were studied. The fibre has a combination of properties previously unavailable in an organic fibre. Its chemical resistance and flammability characteristics approach those of perfluorocarbon fibres, while its mechanical properties approach those of nylon 6. The density advantage gives e-ctfe fibres a 23% greater yield per pound than perfluorocarbon fibres which, in combination with its strength advantage, allows weavers to meet fixed strength requirements with lighter weight fabrics. 5 refs.

Accession no.283

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(item numbers in abstracts)

Company Index

(item numbers in abstracts)

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