



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : C08L 25/06, 53/02, 71/12</p>	<p>A1</p>	<p>(11) International Publication Number: WO 91/01352 (43) International Publication Date: 7 February 1991 (07.02.91)</p>
<p>(21) International Application Number: PCT/GB90/01112 (22) International Filing Date: 19 July 1990 (19.07.90) (30) Priority data: 8916637.5 20 July 1989 (20.07.89) GB (71) Applicant (for all designated States except US): EXXON CHEMICAL LIMITED [GB/GB]; Exxon Chemical Technology Centre, P.O. Box 1, Abingdon, Oxfordshire OX13 6BB (GB). (72) Inventors; and (75) Inventors/Applicants (for US only) : HORRION, Jacques, Paul, Eugene, Joseph [BE/BE]; Avenue Neef 35, B-4040 Tilff (BE). OUHADI, Trazollah [IR/BE]; Quai Gloesener 5, B-4000 Liege (BE).</p>		<p>(74) Agents: BAWDEN, Peter, Charles et al.; Exxon Chemical Limited, Exxon Chemical Technology Centre, P.O. Box 1, Abingdon, Oxfordshire OX13 6BB (GB). (81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent)*, DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent), SU, US. Published <i>With international search report.</i></p>
<p>(54) Title: AROMATIC POLYMER BLENDS</p> <p>(57) Abstract</p> <p>Polymer blends of improved impact strength comprise a solid aromatic polymer such as polystyrene, an elastomeric polymer such as an ethylene/propylene copolymer, and a diblock copolymer of high molecular weight containing a polystyrene block and a hydrogenated conjugated diolefin polymer block as compatibilizer.</p>		

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AROMATIC POLYMER BLENDSBACKGROUND OF THE INVENTION1. Field of the Invention

This invention relates to blends of aromatic polymers having improved impact strength, and more particularly to blends of aromatic polymer, elastomer and diblock copolymer.

2. Description of the Prior Art

Many widely used aromatic polymers, e.g. polystyrene, have an impact strength which is inadequate for some potential uses. It has therefore been proposed to improve the impact strength of such polymers by incorporating elastomeric polymers in them. However, aromatic polymers are frequently incompatible with elastomeric polymers, and incorporation of the latter into the former, even if it improves impact strength, can have a seriously adverse effect on other properties such as tensile strength.

Representative art in this area of technology is as follows.

EP-A-0021488 (Shell) discloses a graft copolymer composition of improved impact toughness. The graft copolymer comprises a monovinylaromatic polymer such as polystyrene, to which is grafted from 2 to 25 % by weight of a rubber which is a mixture of a polybutadiene elastomer and

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a styrene-butadiene two-block copolymer. The graft copolymer, also termed an interpolymer, may be prepared by mixing the polybutadiene elastomer and styrene-butadiene block copolymer with the vinyl aromatic monomer in the desired proportions and initiating the polymerization. This teaching is directed to high impact polystyrene, but employs the specified graft or interpolymers which have to be produced by the described polymerisation method, rather than the simple compatibilised blends of the instant invention.

EP-A-0148002 (Mobil) discloses blends of high impact poly (p-methyl styrene) (HIPPMs) and another polymer having higher environmental stress crack resistance (ESCR). The HIPPMs component may be a backbone polymer such as ethylene-propylene-diene elastomer grafted with polymeric units derived from PMS. The other polymer in the blend is one having high ESCR, such as polyethylene, polypropylene or polystyrene-polybutadiene diblock. Once again, this teaching is concerned with blends where the elastomer component is grafted to the continuous phase polymer, and where the high ESCR component may be a diblock copolymer; there is no teaching of the three component (at least) simple blends which are the subject of the instant invention.

US 3860551 (Dow) teaches a method of making stable emulsions of mixtures of two immiscible solutions of polymers by using an ABA or AB block copolymer wherein A or B is identical with one of the polymers. The emulsion may be in a polymerisable monomer; thus polystyrene and ethylene/propylene elastomer may be dissolved in styrene monomer with styrene-butadiene block copolymer as compatibilizer. Although not exemplified, the emulsion may apparently be heated to initiate polymerisation of the styrene solvent, thereby producing a normally solid thermoplastic product. Such a product, by virtue of its method of preparation, would comprise a graft copolymer. There is no teaching of the simple non-chemically bound blends which are the subject of the instant invention. Moreover this teaching makes no mention of the hydrogenated block copolymer required by the instant invention.

US 3907930 (Monsanto) teaches the dispersion of block copolymers such as styrene butadiene, as small particles in a polymer blend. Such blend may comprise an aromatic polymer such as polystyrene, and a diene rubber. However the diene rubber, eg polybutadiene, is grafted to the aromatic polymer and also contains said polymer as occlusions : again, not a simple blend of polymeric components. Moreover, there is no suggestion to use the block copolymer in its hydrogenated form.

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US 3972963 (Mobil) teaches the preparation of organic reinforcing fillers for rubber by anionic initiated slurry polymerization of styrene and divinylbenzene in the presence of a block copolymer dispersant that controls the particles of the resulting crosslinked polymer to a fine size. The divinyl benzene functions as crosslinking agent, and polymerization conditions are adjusted such that the product contains groups which are reactable with rubber in a normal rubber cure operation. This teaching exemplifies compounding the organic filler with rubber such as SBR under curing conditions to yield a reinforced rubber of improved physical properties. In each case the originally present block copolymer dispersant has been used up in the filler preparation process and does not exist as a free (compatibilizing) component in the final blend. Moreover, there is no suggestion to use the block copolymer in its hydrogenated form.

US 4219466 (Asahi-Dow) discloses blends of monovinyl aromatic polymer such as polystyrene, polystyrene-butadiene block copolymer and amorphous alpha-olefin polymer or copolymer, in combination with a halide flame retardant and an antimony compound. The block copolymer and amorphous polymer are necessarily present to obviate the effects of the flame retardant and antimony compound (reduced toughness,

poor mould release properties). This teaching contains no suggestion of the superior blend properties brought about by using a hydrogenated block copolymer in combination with an elastomer component. Nor does it suggest that the modifier system would be valuable for modifying the impact properties of polymers such as polyphenylene oxide derived from other than monovinyl aromatic monomers.

US 4277575 (General Electric) teaches blends of polystyrene and polyphenylene oxide which are impact modified by a synergistic combination of a polystyrene/saturated rubber diblock copolymer and a polystyrene/ethylene-butene rubber/polystyrene triblock copolymer. The blends necessarily contain the triblock component, which is not an elastomeric component as required by the instant application, by virtue of its polystyrene blocks. Such blocks are detrimental to the blends, since their presence means that weight for weight, the modifier is less effective and in any case such triblock copolymers are extremely expensive compared with commercially available random (co)polymer elastomers as contained in the blends of the instant invention.

US 4491648 (Shell) discloses thermoplastic molding compositions comprising (a) a selectively hydrogenated ABA triblock copolymer where A is a monoalkenyl arene polymer,

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such as polystyrene-polybutadiene-polystyrene (SBS); (b) a vinyl aromatic copolymer comprising a vinyl aromatic compound and an alpha, beta unsaturated cyclic anhydride, such as styrene-maleic anhydride copolymer; (c) polycarbonate; and (d) a hydrogenated diblock copolymer such as polystyrene-polybutadiene. Insofar as component (a) may be considered to be a form of elastomer, it is not a simple elastomer free of thermoplastic polymer units as is required by the instant invention.

US 4584338 (General Electric) discloses polycarbonate molding compositions comprising polycarbonate, hydrogenated AB diblock copolymer such as hydrogenated polystyrene-isoprene or butadiene, and optionally a multiphase composite interpolymer comprising an alkyl acrylate based elastomeric phase and a methacrylate based rigid thermoplastic phase. This interpolymer contains thermoplastic blocks and hence is not a simple elastomer free of thermoplastic polymer units, as is required for blends of the instant invention.

US 4612348 (Dow) discloses a method for producing a rubber concentrate which comprises polymerising a monomer system such as styrene or acrylonitrile/styrene in the presence of a low molecular weight rubber and a high molecular weight rubber, to form a blend in which the rubbers

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are grafted to the polymerised monomers. Such blends can then be introduced into eg polystyrene or acrylonitrile-butadiene-styrene copolymer to modify the properties thereof. In such blends, the rubber components have been grafted to the other polymer components during polymerisation and are unseparable therefrom, unlike the simple blends of the instant invention.

SUMMARY OF THE INVENTION

The present invention provides novel polymer blends based on aromatic polymers which have an impact strength significantly greater than that of the aromatic polymer and a tensile strength which is not significantly diminished compared with the aromatic polymer by itself. This result is achieved by incorporating into the aromatic polymer an elastomeric polymer and a compatibilising agent in the form of a diblock copolymer of specific structure and molecular weight. This diblock copolymer promotes the homogenisation of the aromatic polymer and elastomeric polymer which, in its absence, are incompatible and thus makes possible an improvement in the impact strength unaccompanied by any significant adverse effect on the tensile strength.

The polymer blends in accordance with the present invention comprise:

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(1) as continuous phase, from 40 to 95% by weight of the blend of a solid aromatic polymer;

(2) as discontinuous phase, from 2 to 50% by weight of the blend of an elastomeric polymer which does not comprise thermoplastic polymer units; and

(3) as compatibiliser for (1) and (2), from 2 to 30% by weight of a diblock copolymer of formula A-B where A constitutes 5 to 95% by weight of the copolymer and is a polystyrene block and B constitutes 95 to 5% by weight of the copolymer and is a hydrogenated block of a conjugated diolefin polymer, the said block copolymer having a number average molecular weight of at least 80,000.

DETAILED DESCRIPTION OF THE INVENTION

The solid (at room temperature) aromatic polymer constitutes 40 to 95%, preferably 50 to 95%, more preferably 70 to 90%, by weight of the blend.

The aromatic polymer constitutes the continuous phase in the blends of the invention, with the elastomeric polymer constituting the finely dispersed discontinuous phase and the diblock copolymer acting as a compatibilising agent between the two. It is believed that the A block component of compatibiliser (3) becomes incorporated in the aromatic polymer phase (1) and thus effectively contributes to the amount of this continuous phase in the blend. Accordingly it is possible for the aromatic polymer to be the continuous

phase of the blend even when it constitutes less than 50% of the blend. The B block of the compatibiliser becomes incorporated in the discontinuous phase (2). The precise proportions of components (1), (2) and (3) are selected bearing this in mind, and the AB diblock copolymer is chosen so that the blocks have an affinity for the respective continuous and discontinuous phases (although the blocks do not have to be identical with the respective phases to which they have an affinity). The blends of the invention are therefore properly termed simple blends which may be prepared by simple mixing techniques. They do not require special reactive preparations, and indeed do not constitute grafted blends which are stabilized by virtue of grafts or crosslinks between the individual polymer components.

A wide variety of aromatic polymers can be used in the present invention. Polymers based on monovinyl aromatic monomers, such as styrene homopolymers or (random or graft) copolymers having, for example, a number average molecular weight from 20,000 to 200,000 are especially preferred. Preferred styrene-based copolymers are those in which the comonomer is, for example, acrylonitrile, maleic anhydride, butadiene, or a vinyl ester or unsaturated acid such as (meth)acrylic acid or a (meth)acrylate ester, or a mixture of two or more thereof. The styrene units themselves may be substituted, e.g. with methyl or chlorine in the aromatic

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nucleus and/or with methyl on the alpha carbon atom. So called high impact polystyrene (styrene graft copolymers) can also be used in the present invention. Such polymers are widely available from numerous different suppliers. Methods of making toughened or high impact styrene polymers are described in US-A-1613673; 2616864; 2623863; 2862906; 2886553; and 2694692, all incorporated herein by reference.

Other types of aromatic polymer which can be used in the present invention include polyphenylene ether resins, for example the polymers obtained by oxidative coupling polymerisation of one or more phenol compounds such as phenol itself or substituted derivatives thereof such as the cresols, dimethyl-phenols, phenyl-phenols, e.g. 2-methyl 6-phenyl phenol, and copolymers including residues of more than one type of phenol including those already mentioned and polyhydric phenols such as bisphenol-A, resorcinol, hydroquinone, and substituted derivatives thereof. Such polyphenylene ether resins can be made for example by the processes described in US-A- 3306874, 3306875 and 3257357 all incorporated herein by reference. The polyphenylene ether resins preferably have an intrinsic viscosity of less than 0.4 dl/g as measured in chloroform at 30°C.

The compositions of the invention may also comprise, as the aromatic polymer, amorphous aromatic polyamides obtained by polycondensation of a dicarboxylic acid such as

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alpha,omega-alkane dicarboxylic acid of 4 to 10 carbon atoms, isophthalic acid, or terephthalic acid, with a diamine such as an alpha,omega-alkylene diamine of 2 to 6 carbon atoms which may be substituted on the nitrogens and/or on the alkylene group by methyl, or meta or paraphenylene diamine. Such aromatic polyamides contain at least 50% of units derived from an aromatic dicarboxylic acid and/or an aromatic diamine.

Polyphenylene sulphide analogues of the aforesaid polyphenylene ether polymers can also be used, as can be polyphenylene ether ketone resins.

Aromatic resins suitable for use in the present invention are available commercially. Blends of such resins can be used. Preferably blends of polystyrene and polyphenylene ether resins are used as component (1), in a weight ratio of 99:1 to 1:99, more preferably 80:20 to 20:80 and especially 60:40 to 40:60.

The blends of the present invention contain 2 to 50%, preferably 5 to 25% by weight of the blend, of an elastomeric polymer comprising the discontinuous phase. Such polymer component (2) preferably has an E modulus (as determined by ASTM D638) less than 400 MPa, and usually in the range of 1 to 150 MPa. Such elastomeric polymers may be natural, e.g. natural rubber or gutta percha, or synthetic.

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Synthetic polymers may, more particularly, be elastomeric homo- or co-polymers of alpha olefins of 2 to 20, usually 2 to 10 and especially 2 to 6, carbon atoms; conjugated diolefins of 4 to 6 carbon atoms, e.g. 1,3-butadiene or isoprene; non-conjugated aliphatic dienes of 4 to 16, usually 4 to 8, carbon atoms; and those elastomeric copolymers containing low levels of vinyl substituted monomers such as styrene, alpha methyl styrene, alkyl (meth)acrylates and substituted alkyl (meth)acrylates (the comonomer levels must be sufficiently low that chains of such monomer units are not formed in the copolymer, which would give it undesirable thermoplastic block properties). The elastomeric polymer may contain halogen substituents. Examples of especially suitable elastomeric polymers for use in the present invention include ethylene/propylene elastomers and similar copolymers based on ethylene and olefins of 3 to 20 carbon atoms, and other synthetic rubbers such as those based on butadiene or chlorinated butadiene polymers, ethylene/propylene/diene terpolymers (EPDM), butyl and halobutyl rubbers, and elastomeric olefinic polymers of high impact strength, e.g. low density polyethylene.

Elastomeric polymers of these various kinds are generally available commercially, and may be considered to be simple or pure elastomers which do not contain substantial amounts of thermoplastic polymer units or blocks in their

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polymer chains. The presence of such thermoplastic units or blocks generally results in blends having higher melt viscosities, which are therefore more difficult to mix, hence more energy intensive and hence more expensive. Furthermore those elastomers which do contain substantial amounts of thermoplastic units are unsuitable since on a weight for weight basis, more of the polymer has to be incorporated to obtain the desired amount of impact modification, compared with simple or pure elastomers. Preferably, therefore, the elastomeric polymer component is thought of as a random (co)polymer, without substantial thermoplastic blocks in its structure.

The polymer blends of the present invention include 1 to 30% by weight, preferably 2 to 15% by weight and more preferably 5 to 10% by weight, of the blend of the diblock copolymer. From 5 to 95% by weight of the copolymer, usually 5 to 50%, and especially 20 to 35% by weight of the copolymer, consists of a polystyrene block which may include alkyl (e.g. methyl) substituents on the aromatic rings and/or on the alpha-carbon atoms and halogen substituents on the aromatic rings. The second block of the copolymer is derived from a conjugated aliphatic diolefin of preferably 4 to 6 carbon atoms, e.g. 1,3-butadiene or isoprene, and is partly or preferably completely hydrogenated. The molecular weight of the block copolymer must be greater than 80,000 and is

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preferably in the range 120,000 to 300,000 as determined by gel permeation chromatography using standard polystyrene calibration. Such block copolymers are generally commercially available and it is especially preferred to use the block copolymer sold under the trademark Kraton-G1702X by Shell.

It is a feature of blends according to the invention that they have (compared with the continuous phase aromatic polymer alone) an improvement in Izod impact strength with a minimal decrease in tensile strength at break. Preferred blends of the invention, which find use as e.g. automotive parts and household appliance housings, are those wherein the Izod strength improvement is at least 100%, more preferably at least 200%, and the tensile strength at break decrease is no more than 40%, more preferably no more than 25%. The particular polymer types and proportions of components (1), (2) and (3) of the blends are readily selected to achieve the desired blend physical properties.

Blends in accordance with the invention may be made by incorporating the three ingredients together in suitable mixing apparatus, e.g. a two-roll mill, internal mixer or extrusion mixer (single or twin screw), at elevated temperature at which the polymers are in the molten state, e.g. 150 to 300°C. Blending is continued until the blend is homogeneous as determined by microscopic examination, i.e.

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with a uniformly dispersed elastomer phase. However, it has been found to be particularly advantageous first to blend components (2) and (3) in a ratio appropriate to yield the desired final blend proportions, and subsequently to let down this masterbatch into the appropriate aromatic polymer (1). This two step route generally yields a blend having even greater Izod impact strength improvement than a blend of the same polymers in the same proportions, prepared in a single mixing stage. Thus the scope of this invention extends to the use of a blend of components (2) and (3) as impact modifier for the continuous phase aromatic polymer component (1). Preferably in such masterbatch, and hence in the final blend, the polymers (2) and (3) are in a weight ratio of from 10:90 to 90:10, more preferably from 20:80 to 80:20, most preferably from 30:70 to 70:30, and especially about 50:50.

The blends of the present invention may include the usual additional ingredients which may be present in such polymers, e.g. fillers, antioxidants, processing aids and flame retardants. The proportions of such additional ingredients must, of course, not be so great as to interfere with the desired mechanical properties of the blends.

The following examples illustrate the invention.

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EXAMPLES

Blends were prepared by mixing the ingredients listed in the following Tables in a two-roll mill operated at 40 rpm at 190°C for 7 minutes. Also shown in the Tables are some physical properties of the blends, namely Izod impact strength (J/m) measured at room temperature in accordance with ISO R 180, and tensile strength at break (MPa) measured in accordance with ASTM D638.

TABLE I

Composition	1	2	3	4	5	6	7
Polystyrene ¹	100	80	80	100	100	100	100
Ethylene/Propylene rubber ²	-	20	-	-	-	-	-
Ethylene/propylene rubber ³	-	-	20	-	-	-	-
Kraton G1701 ⁴	-	-	-	-	-	5	10
Kraton G1702X ⁵	-	-	-	5	10	-	-
Tensile Strength at break (MPa)	35.0	23.2	26.6	-	-	-	-
Izod Impact Strength (J/m)	38	49	54	51	66	39	53

- 1: Polystyrene 158 K of BASF, of number average molecular weight approximately 100,000, MFR 190°C/10kg of 6.7 dg/min.
- 2: VISTALON 808 of Exxon Chemical, containing 77% by weight of ethylene and having a Mooney viscosity ML (1+8) at 127°C of 40.
- 3: VISTALON 606 of Exxon Chemical, containing 48% by weight of ethylene and having a Mooney viscosity ML (1+8) at 127°C of 63.
- 4: A polystyrene/hydrogenated polyisoprene block copolymer from Shell, number average molecular weight 95,000, containing 40% by weight of polystyrene.
- 5: A polystyrene/hydrogenated polyisoprene block copolymer from Shell, number average molecular weight 134,000 containing 30% by weight of polystyrene.

This Table shows that the impact strength of polystyrene is only marginally improved by incorporating either an ethylene/propylene elastomer by itself or a diblock copolymer by itself.

TABLE II

Composition	8	9	10	11	12	13	14	15	16
Polystyrene ¹	80	80	80	80	80	80	80	80	80
Ethylene/Propylene rubber ²	20	20	20	20	20	-	-	-	-
Ethylene/propylene rubber ³	-	-	-	-	-	20	20	20	20
Kraton G1701 ⁴	5	10	-	-	-	10	-	-	-
Kraton G1702X ⁵	-	-	2	5	10	-	2	5	10
Tensile Strength at break (MPa)	27.8	22.0	30.0	29.4	28.0	24.1	30.5	27.5	23.1
Izod Impact Strength (J/m)	89	139	130	164	284	150	117	250	274

1, 2, 3, 4, 5: see Table I.

The results reported in Table II show that compositions 10, 11, 12, 14, 15 and 16 in accordance with a preferred embodiment of the present invention have substantially improved Izod impact strength as compared with unmodified polystyrene (see Table I). The low molecular weight diblock copolymer Kraton G1701 improves the impact strength when used at 10%, but the degree of improvement obtained at this level, although useful, is substantially less than that obtained with the high molecular weight diblock copolymer Kraton G1702X. Compare composition 12 with composition 9 and composition 16 with composition 13.

TABLE III

Composition	17	18	19	20	21	22
Polystyrene ¹		90	80	80	80	80 80
Kraton G1701 ⁴	10	-	-	-	-	-
Kraton G1702X ⁵	-	20	-	-	-	-
Kraton G1650 ⁶	-	-	20	-	-	-
Kraton G1651 ⁷	-	-	-	20	-	-
Kraton G1652 ⁸	-	-	-	-	20	-
Cariflex 1513 ⁹	-	-	-	-	-	20
Tensile strength at break (MPa)	29.0	17.0	16.4	18.2	16.4	25.1
Izod impact strength (J/M)	53	25	92	169	120	26

1, 4, 5: See Table I.

6, 7 & 8:

poly(styrene/hydrogenated butadiene/styrene), triblock copolymers from Shell, each containing 30% by weight polystyrene, and having number average molecular weights of 72,000(6), 172,000(7) and 58,000(8).

9: poly(styrene/butadiene/styrene) triblock copolymer from Shell, containing 43% by weight of polystyrene, and a number average molecular weight of 92,700.

The results reported in Table III show that incorporation of a block copolymer by itself, whether it is a diblock copolymer or a triblock copolymer either leads to little or no improvement in the Izod impact strength (compositions 17, 18 and 22), or, if Izod impact strength is improved, tensile strength is greatly reduced, compositions 19, 20 and 21. In one case (composition 18) the impact strength was not improved and the tensile strength was badly affected.

TABLE IV

Composition	23	24	25	26	27	28	29
Polystyrene ¹	80	80	80	80	80	80	80
Ethylene/Propylene rubber ²	20	20	20	20	20	20	20
Kraton G1701 ⁴	-	5	-	-	-	-	-
Kraton G1702X ⁵	-	-	5	-	-	-	-
Kraton G1650 ⁶	-	-	-	5	-	-	-
Kraton G1651 ⁷	-	-	-	-	5	-	-
Kraton G1652 ⁸	-	-	-	-	-	5	-
Cariflex C1513 ⁹	-	-	-	-	-	-	5
Tensile strength at break (MPa)	23.2	27.8	29.4	10.8	12.9	16.1	15.1
Izod Impact strength (J/m)	49	89	164	61	46	92	44

1, 2, 4, 5: See Table I

6, 7, 8, 9: See Table III

The results reported in Table IV compare compositions 24 and 25 in accordance with the present invention which show improved Izod impact strength with limited adverse effects on tensile strength, with similar compositions in which the Izod impact strength is improved (but in general not substantially) but in which the tensile strength is substantially adversely affected.

TABLE V

Composition	30	31	32	33	34
Polystyrene ¹	80	80	80	80	80
Butyl rubber ¹⁰	20	20	20	-	-
Ethylene/propylene rubber ²	-	-	-	20	-
Ethylene/propylene rubber ³	-	-	-	-	20
Kraton G1702X ⁵	-	5	10	10	10
Tensile strength at break (MPa)	27.4	30.8	27.4	28	23.1
Izod Impact Strength (J/m)	35	84	308	284	274

1, 2, 3, 5: See Table I

10: Butyl 268 of Exxon Chemical, having 1.5 mol% unsaturation, viscosity average molecular weight (Flory) 450,000 and Mooney viscosity ML (1+8) at 127°C of 55.

The results reported in Table V show that butyl rubber can be substituted for the ethylene/propylene rubber used in the previous compositions and substantially the same results obtained. Compositions 31 to 34 in accordance with the present invention all show improved Izod impact strength as compared with composition 30 which contains no diblock copolymer without substantial adverse effect on tensile strength.

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CLAIMS

1. A polymer blend comprising:
 - (1) as continuous phase, 40 to 95% by weight of the blend of a solid aromatic polymer;
 - (2) as discontinuous phase, 2 to 50% by weight of the blend of an elastomeric polymer which does not comprise thermoplastic polymer units; and
 - (3) as compatibiliser for (1) and (2), 1 to 30% by weight of a diblock copolymer of formula A-B where A constitutes 5 to 95% weight of the said copolymer and is a block of a styrene polymer and B constitutes 95 to 5% by weight of the said copolymer and is a block of a hydrogenated conjugated diolefin polymer, the said block copolymer having a number average molecular weight of at least 80,000.
2. A polymer blend according to claim 1 comprising 70 to 90% by weight of the solid aromatic polymer, 5 to 25% by weight of the elastomeric polymer, and 5 to 10% by weight of the diblock copolymer.
3. A polymer blend according to claim 1 [claim 1 or 2] wherein the solid aromatic polymer is a polystyrene or a polyphenylene ether or a mixture thereof.
4. A polymer blend according to claim 1 [any one of claims 1 to 3] wherein the elastomeric polymer has an E modulus in the range 1-150 MPa.

5. A polymer blend according to claim 4 wherein the elastomeric polymer is an ethylene/propylene copolymer, an ethylene/propylene/diene terpolymer, a polymer of a conjugated aliphatic diene of 4 to 6 carbon atoms, butyl rubber, or halobutyl rubber.

6. A polymer blend according to claim 1 [any one of the preceding claims] wherein the diblock copolymer contains 5 to 50% by weight of a styrene polymer block and 50 to 95% by weight of the hydrogenated conjugated diolefin polymer block.

7. A polymer blend according to claim 6 wherein the diblock copolymer contains 20 to 35% by weight of a polystyrene block and 65 to 80% by weight of a hydrogenated block of polybutadiene or polyisoprene.


8. A method of producing a polymer blend according to claim 1 [any one of the preceding claims] which comprises forming a preblend of components (2) and (3), and blending the preblend and component (1) to form the desired polymer blend.

9. A method according to claim 8 wherein the preblend comprises components (2) and (3) in a weight ratio of from 20:80 to 80:20, more preferably from 30:70 to 70:30.

10. The use of a preblend as defined in claim 9 in the production of polymer blends according to claim 1 [any one of claims 1 to 7].

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/01112

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: C 08 L 25/06, 53/02, 71/12		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC5	C 08 L	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	EP, A1, 0080666 (GENERAL ELECTRIC COMPANY) 8 June 1983, see the abstract; claims 1, 4, 6-7, 10; page 3, line 20 - page 4, line 17; page 6, lines 1-2 --	1,3,5
X	EP, A1, 0119647 (GENERAL ELECTRIC COMPANY) 26 September 1984, see the abstract; claims 1-3 --	1,3
X	EP, A2, 0133487 (GENERAL ELECTRIC COMPANY) 27 February 1985, see the abstract; page 7, lines 1-2 --	1,5
<p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
10th October 1990	30 OCT, 1990	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 MISS T. TAZELAAR	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
X	EP, A2, 0176060 (BASF AG) 2 April 1986, see the abstract; claim 1; page 4, line 36 - page 5, line 2 --	1,3
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT
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For more details about this annex : see Official Journal of the European patent Office, No. 12/82