615697

FORM 1
REGULATION 9

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-1973

APPLICATION FOR A PATENT

We HIMONT INCORPORATED

of 2801 Centerville Road, New Castle County, Delaware, U.S.A.

hereby apply for the grant of a Patent for an invention entitled:

ELASTOPLASTIC COMPOSITIONS AND PROCESS FOR PREPARING THEM

which is described in the accompanying complete specification. This Application is a Convention Application and is based on the Application numbered: 22946 A/87 for a Patent or similar protection made in Italy on 11 December 1987.

Our address for service is:

GRIFFITH HACK & CO.
71 YORK STREET
SYDNEY N.S.W. 2000
AUSTRALIA

DATED this 7th day of December, 1988.

HIMONT INCORPORATED
By their Patent Attorneys

GRIFFITH HACK & CO.

TO: THE COMMISSIONER OF PATENTS
COMMONWEALTH OF AUSTRALIA

004107 07/12/88

HM 3750

ASSIGNEE-APPLICANT

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952 (AS AMENDED)

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT

(Name of applicant) In support of an Application made by: HIMONT INCORPORATED

(Title) for a patent for an invention entitled:

"Elastoplastic compositions and process for preparing them".

(Full name of signatory) (Address of signatory) I, H. P. Appleby

of Three Little Falls Centre, 2801 Centerville Road, P. O. Box 15439, Wilmington, Delaware 19850-5439, United States of America

do solemnly and sincerely declare as follows:

1. I am authorised by the above mentioned applicant for the patent to make this Declaration on its behalf.

2. The name and address of each actual inventor of the invention is as follows:

(Insert details of inventor/s)

Mauro BASSI - 33, Via Panfilio - 44100 Ferrara, Italy -
Enea GARAGNANI - 9, Via Jolanda Bonfieni - 44100 Ferrara, Italy -
Giuseppe GORINI - 82, Corso Porta Po - 44100 Ferrara, Italy -

(Insert details of assignment, etc.) and the fact(s) upon which the applicant is entitled to make this application are as follows:

The applicant is the assignee of the said invention from the said inventors

(Delete paragraphs 3 and 4 for Non-Convention application) 3. The basic application(s) as defined by Section 141 of the Act was(were) made as follows:

Country Italy (Serial No. 22946 A/87 ..... on December 11, 1987 .....

in the name(s) ....Himont Incorporated.....

and in ..... on .....

in the name(s) .....

and in ..... on .....

in the name(s) .....

4. The basic application(s) referred to in the preceding paragraph of this Declaration was(were) the first application(s) made in a Convention country in respect of the invention the subject of this application.

(Place and date of signing) Declared at New Castle County, Delaware U.S.A. this 11th day of January, 1989

HIMONT INCORPORATED

Signed: .....

Position: H. P. Appleby
Vice President, Administration & General Counsel.

GRIFFITH HASSEL & FRAZER, P.O. BOX 2133, G.P.O., SYDNEY, N.S.W. 2001 AUSTRALIA

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(56) Prior Art Documents
AU 19760/88 C08L 23/12, 23/08
US 4311628
US 4690976

(57) Claim

1. An elastoplastic composition comprising a continuous crystalline polyolefin phase and at least two polymeric phases dispersed in the polyolefin phase, the first of the polymeric phases comprising particles of a dynamically cured EPDM rubber and the secord of the polymeric phases comprising particles of an amorphous thermoplastic styrene polymer, wherein the EPDM rubber is a copolymer of propylene with ethylene and/or with an alpha olefin of formula CH_2=CHR in which R is an alkyl radical having 2-10 carbon atoms, and with a copolymerizable diene, the weight ratio of polyolefin phase to the EPDM rubber ranges between 10:90 and 75:25 and the weight ratio of the styrene polymer to the polyolefin phase ranges between 10:90 and 60:40.

4. A composition as claimed in any one of the preceding claims wherein the polyolefin phase is high isotactic polypropylene and the styrene polymer is selected from polystyrene, impact resistant polystyrene and copolymers of styrene with acrylonitrile containing up to 30% by weight of acrylonitrile.

COMMONWEALTH OF AUSTRALIA 615697

PATENTS ACT 1952 Form 10

COMPLETE SPECIFICATION

FOR OFFICE USE

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Int. Cl:

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Complete Specification–Lodged:
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Related Art:

TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:

ELASTOPLASTIC COMPOSITIONS AND PROCESS FOR PREPARING THEM

The following statement is a full description of this invention, including the best method of performing it known to me/us:–

The present invention relates to elastoplastic compositions comprising a continuous crystalline polyolefin phase and at least two polymeric phases dispersed in the polyolefin phase of which one phase comprises particles of a dynamically cured EPDM rubber and the other phase comprises particles of an amorphous and thermo-

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plastic styrene polymer.

Elastoplastic compositions based on crystalline polymers of olefins and of dynamically cured EPDM rubbers are well known in literature.

Such compositions and the preparation thereof by mixing tne components under rubber dynamic curing conditions are described in particular in U.S. patents 3,806,558, 4,130,535 and 4,311,628.

The compositions prepared by the dynamic curing method exhibit the drawback, which is common to all the compositions based on plastomeric resins and on cross-linked elastomers, of being the more difficult to be processed, the higher is the percentage of cross-linked elastomeric component contained in them.

For example, compositions comprising a cross-linked EPDM rubber in an amount higher than 70-75 % by weight referred to the polyolefin phase are fully unprocessable.

The most interesting curative systems utilized for the rubber c u r i n g exhibit furthermore the drawback of giving rise to remarkable corrosions phenomena of the equipment during mastication of the components.

Thus, there is a growing necessity to have available elastoplastic compositions which are readily processable and do not require the use of curative systems leading to the abovesaid corrosion phenomena.

It was suggested, in the case of compositions comprising a crystalline olefinic polymer and a uncured saturated ethylene-propylene rubber, to incorporated styrene polymers into said compositions in order to improve the elastomeric characteristics of the compositions (published Japanese patent application No. 17137/83).

The compositions disclosed in the Japanese application are prepared by hot mixing the polyolefin and the rubber, by operating in the presence of styrene and of a peroxide.

In these compositions the rubber is uncured, wherefore the processability problems, which are typical of the compositions in which the rubber is present in the cured state, are not encountered.

It has now surprisingly been found that it is possible to obtain elastoplastic compositions comprising a crystalline olefin polymer and a cured EPDM rubber, endowed with improved processability characteristics even in the presence of a high content of cured rubber, and which do not require the use of curative systems leading to corrosion phenomena, when the polyolefin phase comprises, besides the cured rubber, also a thermoplastic and amorphous styrene polymer in the form of dispersed particles, preferably, of which at least 80% has a maximum size, preferably, below 5 µm.

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Accordingly, in a first aspect, the present invention provides an elastoplastic composition comprising a continuous crystalline polyolefin phase and at least two polymeric phases dispersed in the polyolefin phase, the first of the polymeric phases comprising particles of a dynamically cured EPDM rubber and the second of the polymeric phases comprising particles of an amorphous thermoplastic styrene polymer, wherein the EPDM rubber is a copolymer of propylene with ethylene and/or with an alpha olefin of formula CH_2=CHR in which R is an alkyl radical having 2-10 carbon atoms, and with a copolymerizable diene, the weight ratio of polyolefin phase to the EPDM rubber ranges between 10:90 and 75:25 and the weight ratio of the styrene polymer to the polyolefin phase ranges between 10:90 and 60:40.

Advantageously in the compositions according to the present invention at least 80% of the particles of the dispersed EPDM rubber have a maximum particle size below 5 µm.

Preferably, the particle sizes of both the dispersed phases are such that at least 80% has a maximum size below 5 µm particularly below 2 µm.

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Determination of the particle size is carried out by electronic microscopy.

Utilizale styrene polymers are all the amorphous polymers and copolymers having thermoplastic nature.

Examples of such polymers are "crystal" polystyrene (PS), impact polystyrene (HIPS), the thermoplastic copolymers of styrene with acrylonitrile and maleic anhydride, the partially hydrogenated styrene-butadiene block copolymers.

Examples of partially hydrogenated styrene-butadiene block copolymers are represented by the copolymers described in U.S. patent 4,107,130.

Polystyrene (PS and HIPS), the copolymers of styrene with acrylonitrile containing up to 30% by weight of acrylonitrile, the styrene-ethylene-butene block copolymers (produced by Shell Oil and known under the trade name KRATON® G 1652) are the preferred materials.

In a second aspect, the present invention provides a process for preparing a composition according to the first aspect. The process comprises the steps of homogeneously mixing the polyolefin phase and the styrene polymer, adding the EPDM rubber and mixing to yield a homogenous blend, adding a curative system to the blend, and masticating the blend at a temperature in the range from 150° to 280°C for a time sufficient to achieve the desired degree of curing.

Preferably, the curative system comprises a non-halogenated phenolic resin in an amount of from 1% to 10% by weight of the EPDM rubber.

In order to obtain dispersions, in which the sizes

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of the particles have the above-indicated values, it is necessary to utilize, during the homogenization step of the styrene polymer with the polyolefin resins, suitable compatibilizing agents such as graft copolymers of styrene on polyolefins, graft copolymers of EPDM rubber on polystyrene or on styrene--acrylonitrile copolymers and the styrene-propylene block copolymers.

These compatibilizing agents are utilized in an amount generally ranging from 5 to 50% by weight calculated on the polyolefin-polystyrene blend.

Styrene block copolymers containing blocks of monomeric units compatible with the polyolefins, such as the styrene-ethylene-butene block copolymers, are also suited to prepare dispersions having the desired dimensional characteristics.

With a view to obtaining a homogeneous dispersion of the polystyrene phase it is advisable to previously prepare an alloy with the polyolefin; such alloy is then utilized to prepare the elastoplastic compositions of the invention.

For the preparation of the alloys, all the methods suitable for obtaining an intimate mixing and homogenization of the components are utilizable. For example, it is possible to operate in an internal mixer or in an extruder or in a system composed of a mixer and a granulator.

For example, an alloy can be properly prepared by dry--mixing the polyolefin in a turbomixer, and optionally HIPS

polystyrene, in the presence of a peroxide and of styrene added in such amount as to form the desired percentage of polystyrene homopolymer and of graft copolymer of styrene on the polyolefin. It is operated at temperatures at which no softening and consequent thickening of the polymer can occur.

As regards the sizes of the dispersed particles of the styrene polymer present in the alloys, it has been found that final compositions can be obtained still having satisfactory properties even when the dispersed phase or at least 80% of it has a maximum size of 40 μm.

The useful crystalline polyolefin resins comprise (high, mean or low density) polyethylene and the polymers of the alpha olefins of formula CH_2=CHR in which R is an alkyl radical of 1-8 carbon atoms prepared by using Ziegler-Natta stereospecific catalysts.

High isotacticity index polypropylene is the preferred polymer. Further useful alpha polyolefins are polybutene, poly-4-methyl-1-pentene, polyhexene.

In the compositions of the invention the olefin polymer can be present in a modified form as compared with the starting polymer. That is due to interactions with the curative system, the styrene polymer and the EPDM rubber, which can cause also a sensible lowering of the crystalline melting point (determined by D.S.C.).

The EPDM rubbers are copolymers of propylene with ethylene and/or with another alpha olefin having formula CH_2=CHR in which R is an alkyl radical of 2-10 carbon atoms, and with a diene monomer which is present preferably in an amount ranging from 1 to 10% by weight calculated on the copolymer total weight. Preferably the diene is of the non-conjugated type.

Suitable diene monomers are for example 1,4-hexadiene; 2-methyl-1,4-pentadiene; 1,4,9-decatriene; 1,5-cyclooctadiene; 1-methyl-1,5-cyclooctadiene; 1,4-cyclopentadiene; dicyclopentadiene; ethylidenenorbornene; 4-methyl-1,4-hexadiene; 5-methyl-1,4-hexadiene; the substitution derivatives of such monomers.

Examples of olefin monomers of formula CH_2=CHR are propylene, 1-butene, 1-pentene, 1-hexene, 4-methyl-1-pentene, 3-methyl-1-pentene, 3,3-dimethyl-1-butene, 3-methyl-1-hexene, 2,4,4-trimethyl-1-pentene.

The ethylene-propylene-diene terpolymers containing from 25 to 50% by weight of copolymerized propylene units are preferred.

In the compositions, the olefin polymer/EPDM rubber ratio is in the range of from about 10/90 to about 75/25, e.g. from about 10/90 to about 60/40 and preferably from 15/85 to 50/50; the styrene polymer/polyolefin ratio is generally in the range of from about 10/90 to about 60/40 and preferably from 30/70 to 50/50.

The ratio between the total weight of the polyolefin and of the styrene polymer and the weight of the EPDM rubber generally ranges from 20/80 to 70/30 and preferably from 25/75 to 60/40.

Mineral fillers, carbon black, colored pigments, plasticizers, stabilizers, extender oils, and in general all the

conventional ingredients of the elastoplastic compositions comprising EPDM rubbers can be present in the compositions of the invention.

The compositions are prepared by masticating homogeneous blends of the components, under EPDM rubber dynamic curing conditions..

It is possible to operate according to the dynamic curing methods described in U.S. patents 4,130,535 and 4,311,628, utilizing the curative systems therein described.

However it has been found - this being an additional feature of the invention - that it is not necessary, for preparing the compositions of the invention, to use curative systems of corrosive nature like those comprising a phenolic resin and an activator.

A fully unexpected result resides in that it is sufficient to use a non-halogenated phenolic resin alone without using activators such as hydrated tin salts and organic acids such as the oxalic, salicylic, malonic and succinic acids.

Non-halogenated phenolic resins are described in U.S. patents 3,287,440, 3,709,840 and 4,311,628.

Useful non-halogenated resins are also available on the market; for example, such resins can be purchased from Schenectady Chemicals Inc. under the trade name FXRA-148.

The temperature conditions under which mastication is conducted (ranging from 150° to 280° C) and the shear rate employed (300-400 s^{-1}) are furthermore sensibly lower than the ones utilized so far.

According to a preferred procedure, a homogeneous blend of olefin polymer, styrene polymer with the EPDM rubber and, optionally, with fillers is prepared by operating at a temperature sufficient to melt the olefin polymer and for a time sufficient to obtain a homogeneous blend. The phenolic resin is then added and mastication is continued at a temperature at which rubber cure occurs.

Preferably, the EPDM rubber is fully cured. Full curing of the rubber means the cure in which the rubber is extractable for less than 2% with cyclohexane at room temperature or for less than 4% with boiling xylene (as regards the methods of determining the extractability in cyclohexane and xylene, reference is made to U.S. patent 4,806,558).

The blending and/or mastication process can be carried out in an internal mixer, or in an extruder, or in a system consisting of an internal mixer and of a granulator.

It is possible also to operate in a plurality of apparatuses arranged in series, in the first ones the intimate blending and homogenization of the composition occurs while curing takes place in the others.

The mastication temperature at which curing occurs is generally in the range from 150° to 280°C and preferably from 180° to 220°C.

The following examples are given merely to illustrate the invention and are not to be considered as a limitation of the scope thereof.

Example 1

Table 1 shows the composition of a reactive mixture utilized for the preparation of polypropylene-polystyrene alloys useful to prepare the elastoplastic compositions of the invention.

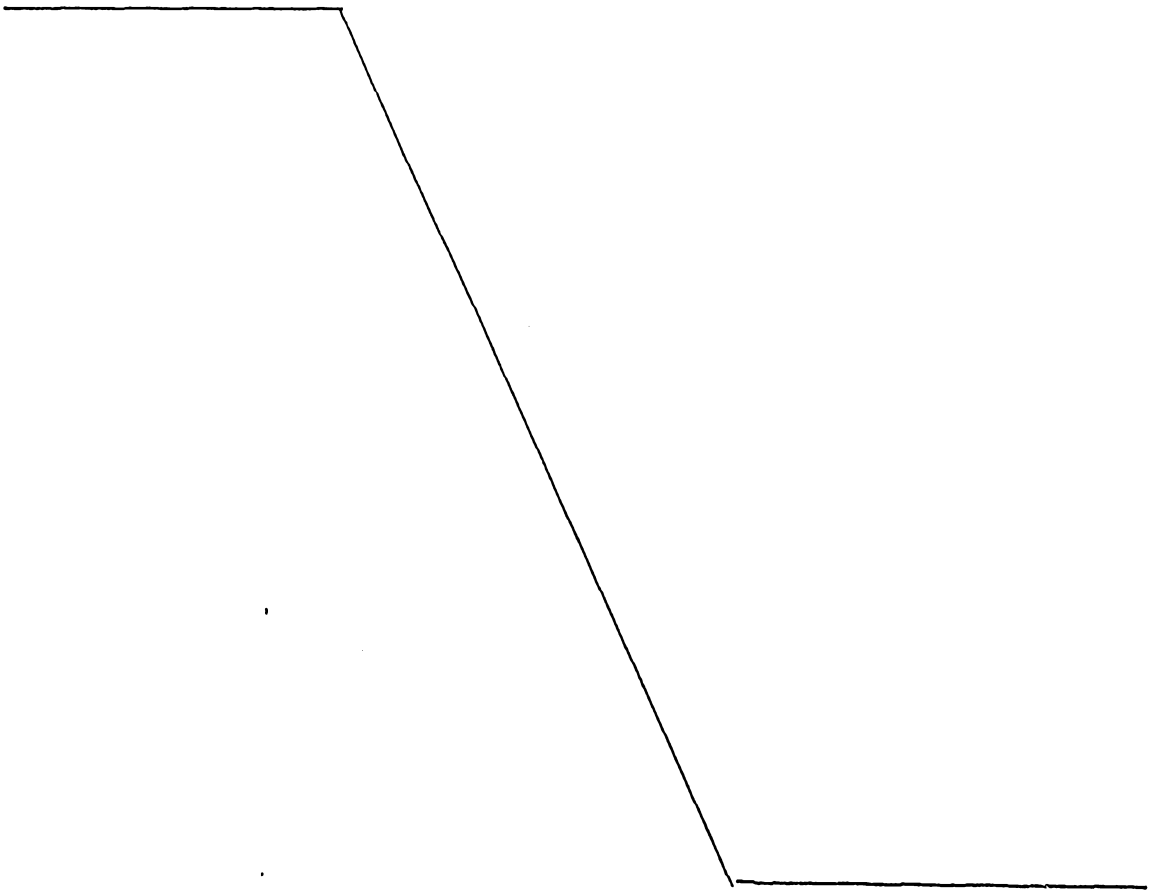

Table 1 COMPOSITION OF THE REACTIVE MIXTURE AND OF THE THERMOPLASTIC ALLOYS SO OBTAINED

Thermoplastic alloy		1	2
Reactive mixture composition (parts by weight)	Polypropylene (PP) (Moplen® FL X020)	64.2	49.1
	t.butylperoxypivalate (in solution at 15%)	1.0	1.2
	Impact polystyrene (HIPS)	--	34.6
	Styrene	34.5	14.8
	Irganox® 1010 (*)	0.2	0.2
	SHT (**)	0.1	0.1
Alloy composition (parts by weight)	Polypropylene	60	45
	Polystyrene (PS)	30	--
	HIPS + PS	--	45
	PP-g-PS graft copolymer + PP-g-S	10	--
	PP-g-HIPS graft copolymer + PP-g-S	--	10

(*) a phenolic stabilizer sold by Ciba-Geigy (based on pentaerythrityl tetrakis (3,5-ditert-butyl-4-hydroxyphenyl propionate)

(**) synthetic hydrotalcite

The alloys were prepared under dry conditions by using a turbomixer operating in a nitrogen atmosphere.

To the polypropylene in flakes and to the HIPS in pellets, if any, the peroxide and subsequently, under heating and in small batches, the styrene were added.

After the styrene was fully added in 1 hour, stirring was continued for additional 2 hours under slight cooling to prevent the temperature from exceeding 130°C in order to avoid softening and consequent thickening of the polymer.

The products were gradually cooled and then stabilized with 0.2% of Irganox® 1010 and 0.1% of SHT, whereafter they were extruded at 210°C.

Selective extractions with methylethylketone and chloroform and subsequent infrared analyses, carried out on the various fractions, revealed in both products the presence of about 10% of polystyrene-g-polypropylene graft copolymer.

The maximum size of the dispersed styrene polymer phase was for at least 80% of less than 2 μm.

Table 2 shows the compositions and the main characteristics of the elastoplastic compositions prepared from the polymeric alloys defined in Table 1.

Table 2 ELASTIC AND RHEOLOGICAL CHARACTERISTICS OF THE ELASTOPLASTIC COMPOSITIONS

Sample	1 (comparative)	2	3
Ethylene-propylene-ethylidene-norbornene terpolymer * (Dutral® TER 537 E2)	64	64	64
Polypropylene (Moplen® Q 30P)	6.5	--	--
Impact- polystyrene	6.5	--	--
Thermoplastic alloy 2 of Table 1	--	13	--
Thermoplastic alloy 1 of Table 1	--	--	13
Master FX-RA-148 of Schenectady **	7.2	7.2	7.2
p-toluenesulfonic acid	0.4	0.4	0.4
Zinc oxide	7.4	7.4	7.4
Oil	8	8	8
PP/(PP + EPDM) ratio	0.169	0.155	0.196
Pressure, in kg/cm^2, (KPa) recorded in TR 15 at 230°C and a take-off rate of 9.5 cc/minute	150 (15000)	110 (11000)	75 (7500)
Extrudate appearance	not smooth	smooth	smooth
Tension set at 23°C at 200%, %	breaks	20	20
Compression set at 100°C, 22 hours, %	45	27	23

* containing 50% by weight of extender oil.

** Master FX-RA-148

is composed of : 50% of phenolic resin SP 1045

50% of barium sulfate.

The compositions reported herein, analogously with all the ones of the following examples, were prepared by introducing the polymeric components into a Brabender internal mixer and, after a short mixing period, by adding the curing system and subsequently the zinc oxide and the extender oil.

Thereafter the mixing was carried out for 3 minutes at a temperature of 200°C.

The composition was then discharged from the internal mixer and was subjected to the following determinations :

- Processability, by measuring the head pressure during extrusion tests in an extruder. In such tests, the extruder was of type TR 15 (single-screw, 15 mm diameter), and it was operated at a temperature of 230°C, with a 2.5 mm ID die, a L/D ratio = 20 and at a take-off rate of 9.5 cc/minute.
- Tension set at 200%, measured at 23°C, according to ASTM D-412.
- Compression set after 22 hours at 100°C, according to ASTM D-395.

The advantages deriving from the use of the alloys comprising the amorphous styrene phase are apparent also for the harder elastoplastic compositions having higher crystalline olefin resin/elastomeric terpolymer ratios (see Table 3).

Dutral® TER 537 E2 is an EPDM rubber produced by DUTRAL S.p.A.; Moplen® Q 30P is sold by HIMONT ITALIA S.p.A.

Table 3 ELASTIC AND RHEOLOGICAL CHARACTERISTICS OF ELASTOPLASTIC COMPOSITIONS BASED ON THERMOPLASTIC ALLOY 2

Sample	1 (comparative)	2	3 (comparative)	4
Dutral® TER 537 E2 *	59	59	52	52
Moplen® Q 30P	18	--	25	--
Thermoplastic alloy 2 (see Table 1)	--	18	--	25
Master FX-RA-148 produced by Schenectady	7.2	7.2	7.2	7.2
p-toluenesulfonic acid	0.4	0.4	0.4	0.4
Zinc oxide	7.4	7.4	7.4	7.4
Oil	8	8	8	8
PP/(PP + EPDM) ratio	0.379	0.215	0.490	0.302
Pressure, in Kg/cm^2 (KPa) recorded in TR 15 at 230°C at a take-off rate of 9.5 cc/minute	50 (5000)	25 (2500)	40 (4000)	25 (2500)
Tension set at 23°C at 200%, %	breaks	breaks	breaks	breaks
Compression set at 100°C, 22 h, %	36	34	64	55
Hardness, Shore A	70	70	85	85

* containing 50% by weight of extender oil.

In the elastoplastic compositions of Table 2 (samples 2 and 3) and Table 3 (samples 2 and 4) more than 90% of the particles of the dispersed phase have a maximum size below 2 μm.

Example 2

Table 4 shows the compositions of various alloys utilized for preparing the elastoplastic compositions.

Table 4 COMPOSITIONS OF THE ALLOYS UTILIZED FOR PREPARING ELASTOPLASTIC COMPOSITIONS

Alloy	1	2
Moplen Q 30P	50	50
Ultrastyr W 275 *	50	--
Ultrastyr AES Y42 **	--	50

* Ultrastyr W 275 is a polystyrene grafted with 10% of Dutral TER 044 (Ultrastyr is a product sold by MONTEDIPE S.p.A.)

** Ultrastyr AES Y42 is a styrene-acrylonitrile copolymer (75% S - 25% AN) grafted with 30% of Dutral TER 044 (EPDM rubber sold by DUTRAL S.p.A.).

Table 5 shows compositions and main characteristics of the compositions prepared from the above-indicated alloys.

In alloy 1, the maximum size of more than 80% of the dispersed phase present in alloy 1 was of 40 μm.

Table 5 ELASTIC AND RHEOLOGICAL CHARACTERISTICS OF ELASTOPLASTIC COMPOSITIONS

Sample	1	2
Dutral® TER 537 E2 *	64	64
Thermoplastic alloy 1 (see Table 4)	13	--
Thermoplastic alloy 2 (see Table 4)	--	13
Master FX-RA-148 of Schenectady	7.2	7.2
p-toluenesulfonic acid	0.4	0.4
Zinc oxide	7.4	7.4
Oil	8	8
PP/(PP + EPDM) ratio	0.169	0.169
Pressure, in Kg/cm^2 (KPa) recorded in TR 15 at 230°C at a take-off rate of 9.5 cc/minute	80 (8000)	110 (11000)
Extrudate appearance	smooth	smooth
Tension set at 23°C at 200%, %	21	20
Compression set at 100°C, 22 h, %	27	25

* containing 50% by weight of extender oil

Example 3

Table 6 shows the compositions of some alloys utilized for preparing elastoplastic compositions.

Table 6 COMPOSITION OF THE ALLOYS UTILIZED FOR PREPARING ELASTOPLASTIC COMPOSITIONS

Alloy	1	2	3	4
Moplen® Q 30P	42	50	62	69
Kraton® G 1652	58	50	38	31

Table 7 shows the composition and characteristics of the compositions prepared with such alloys.

In alloys 1-4, more than 90% of the particles of the dispersed (polystyrene) phase has a maximum size below 1-2 μm.

10 169 28536

Table 7

ELASTIC AND RHEOLOGICAL CHARACTERISTICS OF COMPOSITIONS BASED ON THERMOPLASTIC ALLOYS OF TABLE 6

Sample	1	2	3	4	5 comparison	6 comparison
Dutral® TER 537–E2 (50% oil)	64	64	64	64	70.8	66
Moplen® Q 30P	—	—	—	—	6.2	11
Alloy 1	13	—	—	—	—	—
Alloy 2	—	13	—	—	—	—
Alloy 3	—	—	13	—	—	—
Alloy 4	—	—	—	13	—	—
Master FX–RA–148 of Schenectady	7.2	7.2	7.2	7.2	7.2	7.2
p–toluenesulfonic acid	0.4	0.4	0.4	0.4	0.4	0.4
Zinc oxide	7.4	7.4	7.4	7.4	7.4	7.4
Oil	8	8	8	8	8	8
PP/(PP + EPDM) ratio	0.147	0.169	0.200	0.219	0.15	0.25
Pressure, in Kg/cm^2 (KPa) recorded in TR 15 at 230°C at a take–off rate of 9.5 cc/minute	130 (13000)	115 (11500)	90 (9000)	70 (7000)	90 (9000)	55 (5500)
Extrudate appearance	smooth	smooth	smooth	smooth	melt fracture	melt fracture
Tension set at 23°C at 200%, %	—	—	16	—	breaks	breaks
Compression set at 100°C, 22 h, %	23	22	24	25	16	24

Also these compositions prove to be very interesting as they exhibit excellent elastic characteristics also at high temperatures as well as a good processability.

Example 4

Example 4 regards compositions in which a non-halogenated phenolic resin alone is used as a curative.

Table 8 shows the compositions and characteristics of such compositions.

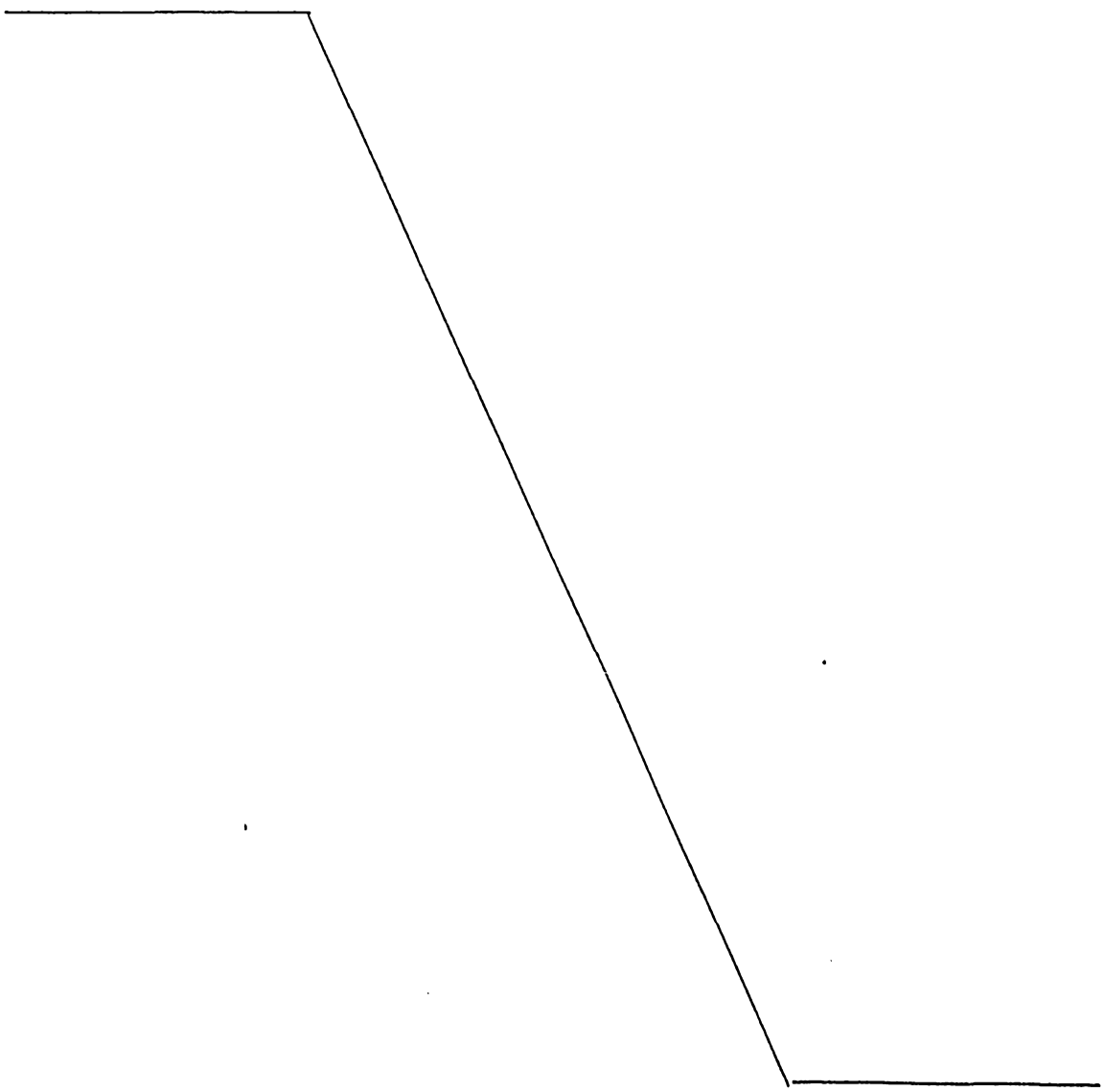

Table 8 COMPOSITION AND CHARACTERISTICS OF ELASTOPLASTIC COMPOSITIONS CURED IN THE ABSENCE OF P-TOLUENESULFONIC ACID

Sample	1	2	3 (comparison)
Dutral® TER 537 E2 (50% oil)	68	68	71.5
Moplen® Q 30P	8.5	8.5	9
Ultrastyr® W 275	4	--	--
Kraton® G 1652	--	4	--
Master FX-RA-148 of Schenectady	4	4	4
Zinc oxide	7.5	7.5	7.5
Oil	8	8	8
PP/(PP + EPDM) ratio	0.200	0.200	0.20
Pressure, in Kg/cm^2 recorded in TR 15 at 230°C at a take-off rate of 9.5 cc/minute	100	100	80
Extrudate appearance	smooth	smooth	melt fracture
Tension set at 23°C at 200%, %	14	14	breaks
Compression set at 100°C, 22 h, %	16	18	20
Hardness, Shore A	56	50	58

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An elastoplastic composition comprising a continuous crystalline polyolefin phase and at least two polymeric phases dispersed in the polyolefin phase, the first of the polymeric phases comprising particles of a dynamically cured EPDM rubber and the second of the polymeric phases comprising particles of an amorphous thermoplastic styrene polymer, wherein the EPDM rubber is a copolymer of propylene with ethylene and/or with an alpha olefin of formula CH_2=CHR in which R is an alkyl radical having 2-10 carbon atoms, and with a copolymerizable diene, the weight ratio of polyolefin phase to the EPDM rubber ranges between 10:90 and 75:25 and the weight ratio of the styrene polymer to the polyolefin phase ranges between 10:90 and 60:40.

2. A composition as claimed in claim 1 wherein at least 80% of the particles of the first and second polymeric phases have a maximum size of 5 μm.

3. A composition as claimed in claim 1 or claim 2 wherein the EPDM rubber is fully cured.

4. A composition as claimed in any one of the preceding claims wherein the polyolefin phase is high isotactic polypropylene and the styrene polymer is selected from polystyrene, impact resistant polystyrene and copolymers of styrene with acrylonitrile containing up to 30% by weight of acrylonitrile.

5. A composition as claimed in claim 1 or claim 2 wherein the styrene polymer is a styrene-ethylene-butene-styrene block copolymer.

6. A composition as claimed in any one of claims 1 to 3 wherein the styrene polymer is compatibilized with the polyolefin phase by using a compatibilizing agent.

7. A composition as claimed in claim 6 wherein the compatibilizing agent is a graft copolymer of styrene on a polyolefin.

8. A composition as claimed in claim 6 wherein the compatiblizing agent is a graft copolymer of an EPDM rubber on polystyrene or on a copolymer of styrene with acrylonitrile.

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9. A composition as claimed in any one of the preceding claims further comprising an extender oil and a mineral filler.

10. An elastoplastic composition substantially as herein described with reference to any non-comparative Example.

11. A process for preparing a composition as claimed in any one of the preceding claims comprising the steps of homogeneously mixing the polyolefin phase and the styrene polymer, adding the EPDM rubber and mixing to yield a homogenous blend, adding a curative system to the blend, and masticating the blend at a temperature in the range from 150° to 280°C for a time sufficient to achieve the desired degree of curing.

12. A process as claimed in claim 11 wherein the curative system comprises a non-halogenated phenolic resin in an amount of from 1% to 10% by weight of the EPDM rubber.

13. A process as claimed in claim 11 or claim 12 wherein the EPDM rubber is fully cured.

14. A process for preparing an elastoplastic composition substantially as herein described with reference to any non-comparative Example.

15. An article manufactured from a composition as claimed in any one of claims 1-10.

DATED this 16th day of July 1991

HIMONT INCORPORATED

By their Patent Attorneys

GRIFFITH HACK & CO.

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