

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization

International Bureau

(43) International Publication Date

04 January 2018 (04.01.2018)



(10) International Publication Number

WO 2018/002273 A1

(51) International Patent Classification:

C08L 69/00 (2006.01)

C08L 33/04 (2006.01)

C08L 51/00 (2006.01)

Published:

— with international search report (Art. 21(3))

(21) International Application Number:

PCT/EP2017/066217

(22) International Filing Date:

29 June 2017 (29.06.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

16.56102

29 June 2016 (29.06.2016)

FR

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: COMPOSITION COMPRISING A THERMOPLASTIC POLYMER, A MULTISTAGE POLYMER AND A (METH) ACRYLIC POLYMER, ITS METHOD OF PREPARATION AND ITS USE

(57) Abstract: The present invention relates to a composition comprising thermoplastic polymer, a multistage polymer and a (meth) acrylic polymer. The present invention relates also to an impact modified composition comprising thermoplastic polymer, a multistage polymer and a (meth) acrylic polymer. In particular the present invention it relates to a method for making an impact modifier composition comprising, a multistage polymer and a (meth) acrylic polymer and its use in thermoplastic polymers.



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Composition comprising a thermoplastic polymer, a multistage polymer and a (meth)acrylic polymer, its method of preparation and its use

5 **[Field of the invention]**

[001] The present invention relates to a composition comprising thermoplastic polymer, a multistage polymer and a (meth)acrylic polymer.

10 [002] The present invention relates also to an impact modified composition comprising thermoplastic polymer, a multistage polymer and a (meth)acrylic polymer.

[003] In particular the present invention it relates to a method for making an impact modifier composition comprising, a multistage polymer and a (meth)acrylic polymer and its use in thermoplastic
15 polymers.

[Technical problem]

[004] Impact modifiers or additives are widely used to improve the impact strength for thermoplastic compositions with the aim to
20 compensate their inherent brittleness, notch sensitivity and crack propagation. So an impact modified polymer is a polymeric material whose impact resistance and toughness have been increased by the incorporation of phase micro domains of a rubbery material. This is usually done due to the introduction of microscopic rubber
25 particles into the polymer matrix that can absorb the energy of an impact or dissipate it.

[005] It is known practice to add an impact additive, which modifies the impact strength, comprising an elastomeric phase or rubber. Such a rubber can be part of a multistage polymer in form
30 of core shell particles, with one stage that is a rubber or the elastomeric phase. These particles are prepared by emulsion polymerization to form a dispersion and can for example be recovered in powder form. They generally comprise a succession of "hard" and "soft" layers. Two-layer (soft-hard) or three-layer
35 (hard-soft-hard) particles may thus be found. The particle size is generally less than 1 μm and more particularly between 50nm and

500 nm. The outer layer or a grafted shell is in order to have the adhesion and compatibility with the thermoplastic matrix.

[006] The performance of the impact modification is a function of the particles size, especially of the rubber part of the particle, and its quantity. There is an optimal average particle size in order to have the highest impact strength for a given quantity of added impact modifier particles

[007] These primary impact modifier particles are usually added in form of powder particles to the thermoplastic material. These powder particles are agglomerated primary impact modifier particles. During the blending of the thermoplastic material with the powder particles the primary impact modifier particles are regained and are dispersed more or less homogenously dispersed in the thermoplastic polymer material.

[008] While the particle size of the impact modifier particles in the range of nanometers, the range of the agglomerated powder particles is in the range of micrometers

[009] It important to have an impact modifier powder that has no negative influence on the thermoplastic polymer composition and its processability. One negative influence is especially fluidity or viscosity of the thermoplastic polymer comprising the impact modifier. The fluidity or viscosity should not change significantly in order to have the same, as the neat thermoplastic polymer without any impact modifier.

[010] A decrease in fluidity or an increase in viscosity of the polymer composition signifies either longer processing at same temperature. Or the temperature of the polymer composition has to be increased in order to regain fluidity or viscosity level, giving a risk of higher thermal exposition of the polymer composition.

[011] The objective of the present invention is to obtain a polymeric composition that comprises a thermoplastic polymer and a multistage polymer that can be transformed and/or processed as the neat thermoplastic polymer, while still increasing impact strength.

[012] An objective of the present invention is also to obtain an impact modified polymeric composition that comprises a thermoplastic polymer and a multistage polymer that can be transformed and/or processed as the neat thermoplastic polymer.

5 [013] An additional objective of the present invention is a process to prepare a polymeric composition that comprises a thermoplastic polymer, a multistage polymer and a (meth)acrylic polymer, said polymeric composition can be transformed and/or processed as the neat thermoplastic polymer.

10 [014] Another objective of the present invention is to find an impact modifier composition comprising a multistage polymer in a thermoplastic polymer for increasing its impact strength and without increasing its viscosity.

[015] Another additional objective of the present invention is to find a method to introduce a multistage polymer in a thermoplastic polymer for increasing its impact strength and without increasing its viscosity.

[016] Still another objective of the present invention is the use of a multi stage polymer in an impact modifier composition in a thermoplastic polymer without significantly increasing of the viscosity of the thermoplastic polymer.

[BACKGROUND OF THE INVENTION]Prior art

25 [017] The document EP1963416 discloses high flow polyester compositions. The composition comprises at least one polyester and at least one flow enhancing ingredient and also comprises further impact modifiers and property-enhancing thermoplastic such as polycarbonate.

30 [018] The document EP 2465881 discloses an impact modified thermoplastic composition with hydrolytic sensitivity to obtain higher fluidity while keeping high impact strength. The thermoplastic polymer is polycarbonate with a core-shell impact modifier as multistage polymer.

[019] None of the prior art documents discloses a composition, a process or use according to the present invention.

[Brief description of the invention]

5 [020] Surprisingly it has been found that a polymeric composition comprising

- a) a thermoplastic polymer (TP1) and
- b) a multi stage polymer and
- c) a (meth)acrylic polymer (P1),

10 wherein the quantity of multi stage polymer in the composition is between 0.1wt% and 50wt% and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol, yields to a polymeric composition with increased impact strength without an increase of viscosity of composition.

15 [021] Surprisingly it has also been found that a polymeric composition comprising

- a) a thermoplastic polymer (TP1) and
- b) a multi stage polymer and
- 20 c) a (meth)acrylic polymer (P1),

wherein the quantity of multi stage polymer in the composition is between 0.1wt% and 50wt% and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol, can be used for increasing the impact strength of the composition without
25 increasing its viscosity.

[022] Surprisingly it has also been found that a process for manufacturing a polymeric composition comprising the step of

- a) blending a thermoplastic polymer (TP1) with a polymeric
30 composition (PC1) comprising a multistage polymer and a
(meth) acrylic polymer (P1),

wherein the quantity of multi stage polymer in the composition is between 0.1wt% and 50wt% and that the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol
35 yields to a composition with increased impact strength without an increase of viscosity of composition.

[Detailed description of the invention]

[023] According to a first aspect, the present invention relates to a polymeric composition comprising

- a) a thermoplastic polymer (TP1) and
- b) a multi stage polymer,
- c) a (meth)acrylic polymer (P1),

wherein the quantity of multi stage polymer in the composition is between 0.1wt% and 50wt% and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol.

[024] According to a second aspect, the present invention relates to a process for manufacturing a polymeric composition comprising the step of

- a) blending a thermoplastic polymer (TP1) with a multistage polymer and a (meth) acrylic polymer (P1) that has a mass average molecular weight Mw of less than 100 000g/mol,

wherein the quantity of multi stage polymer in the polymeric composition is between 0.1wt% and 50wt%.

[025] According to a third aspect, the present invention relates to a process for manufacturing a polymeric composition comprising the step of

- a) blending a thermoplastic polymer (TP1) with a polymeric composition (PC1) comprising a multistage polymer and a (meth) acrylic polymer (P1) that has a mass average molecular weight Mw of less than 100 000g/mol,

wherein the quantity of multi stage polymer in the polymeric composition is between 0.1wt% and 50wt%.

[026] In a fourth aspect the present invention relates to the use of a polymeric composition comprising

- a) a thermoplastic polymer (TP1) and
- b) a multi stage polymer,
- c) a (meth)acrylic polymer (P1),

wherein the quantity of multi stage polymer in the polymeric composition is between 0.1wt% and 50wt% and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than

100 000g/mol for increasing the impact strength of the composition without increasing its viscosity .

[027] In a fifth aspect the present invention relates to the use of an impact modifier composition comprising

- b) a multi stage polymer,
- c) a (meth)acrylic polymer (P1),

in a thermoplastic polymer (TP1)

wherein the quantity of multi stage polymer in the complete composition is between 0.1wt% and 50wt% and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol for increasing the impact strength of the thermoplastic polymer (TP1) without increasing the viscosity of thermoplastic polymer (TP1) comprising the multi stage polymer and meth)acrylic polymer (P1).

[028] By the term "polymer powder" as used is denoted a polymer comprising powder grains in the range of at least 1 micrometer (μm) obtained by agglomeration of primary polymer or polymers or oligomers comprising particles in the nanometer range.

[029] By the term "primary particle" as used is denoted a spherical polymer particle comprising particles in the nanometer range. Preferably the primary particle has a weight average particle size between 20nm and 800nm.

[030] By the term "particle size" as used is denoted the volume average diameter of a particle considered as spherical.

[031] By the term "copolymer" as used is denoted that the polymer consists of at least two different monomers.

[032] By "multistage polymer" as used is denoted a polymer formed in sequential fashion by a multi-stage polymerization process. Preferred is a multi-stage emulsion polymerization process in which the first polymer is a first-stage polymer and the second polymer is a second-stage polymer, i.e., the second polymer is formed by emulsion polymerization in the presence of the first emulsion polymer.

[033] By the term "(meth)acrylic" as used is denoted all kind of acrylic and methacrylic monomers.

[034] By the term "(meth)acrylic polymer" as used is denoted that the (meth)acrylic polymer comprises essentially polymers comprising (meth)acrylic monomers that make up 50wt% or more of the (meth)acrylic polymer.

5 [035] By the term "impact modifier" as used is understood a material that once incorporated in a polymeric material increases the impact resistance and toughness of that polymeric material by phase micro domains of an elastomeric or rubbery material or rubber polymer.

10 [036] By the term "rubber" as used is denoted to the thermodynamic state of the polymer above its glass transition.

[037] By the term "rubber polymer" as used is denoted a polymer that has a glass transition temperature (T_g) below 0°C.

15 [038] By saying that a range from x to y in the present invention, it is meant that the upper and lower limit of this range are included, equivalent to at least x and up to y.

[039] By saying that a range is between x and y in the present invention, it is meant that the upper and lower limit of this range are excluded, equivalent to more than x and less than y.

20

[040] The composition according to the invention is thermoplastic polymer (TP1), a multi stage polymer and a (meth) acrylic polymer (P1) has a mass average molecular weight M_w of less than
25 100 000g/mol, wherein the quantity of multi stage polymer in the composition comprising the three components is between 0.1wt% and 50wt%, based on the sum of the three components a), b) and c).

[041] Preferably the quantity of multi stage polymer in the composition is at least 0.3wt%, more preferably at least 0.8wt%,
30 still more preferably at least 1wt% and advantageously at least 1.5wt%, based on the sum of the three components a), b) and c).

[042] Preferably the quantity of multi stage polymer in the composition is at most 40wt%, more preferably at most 30wt%, still more preferably at most 28wt% and advantageously at most 25wt%,
35 based on the sum of the three components a), b) and c).

[043] Preferably the quantity of multi stage polymer in the composition is between is between 0.3wt% and 40wt% and more

preferably between 0.8wt% and 30wt%, still more preferably between 1wt% and 28wt% and advantageously between 1.5wt% and 25wt%, based on the sum of the three components a), b) and c).

[044] Preferably the quantity of (meth) acrylic polymer (P1) in the composition is between 0.005wt% and 47.5wt%, preferably between 0.015wt% and 45wt%, more preferably between 0.04wt% and 27wt%, still more preferably between 0.05wt% and 25wt% and advantageously between 0.075wt% and 22.5wt%, based on the sum of the three components a), b) and c).

[045] With regard to the (meth)acrylic polymer (P1), it has a mass average molecular weight M_w of less than 100 000g/mol, preferably less than 90 000g/mol, more preferably less than 80 000g/mol, still more preferably less than 70 000g/mol, advantageously less than 60 000 g/mol, more advantageously less than 50 000 g/mol and still more advantageously less than 40 000 g/mol.

[046] The (meth)acrylic polymer (P1), it has a mass average molecular weight M_w above 2 000g/mol, preferably above 3000g/mol, more preferably above 4000g/mol, still more preferably above 5 000g/mol, advantageously above 6 000 g/mol, more advantageously above 6 500 g/mol and even more advantageously above 7 000 g/mol, still more advantageously above 10 000 g/mol and most advantageously above 12 000 g/mol .

[047] The mass average molecular weight M_w of (meth)acrylic polymer (P1) is between 2 000g/mol and 100 000g/mol, preferable between 3 000 g/mol and 90 000 g/mol and more preferably between 4 000g/mol and 80 000g/mol advantageously between 5000g/mol and 70 000g/mol, more advantageously between 6 000g/mol and 50 000g/mol and most advantageously between 10 000g/mol and 40 000g/mol.

[048] Preferably the (meth)acrylic polymer (P1) is a copolymer comprising (meth)acrylic monomers. More preferably the (meth)acrylic polymer (P1) is a (meth) acrylic polymer. Still more preferably the (meth)acrylic polymer (P1) comprises at least 50wt% monomers chosen from C1 to C12 alkyl (meth)acrylates. Advantageously preferably the (meth)acrylic polymer (P1) comprises at least 50 wt% of monomers chosen from C1 to C4 alkyl

methacrylate and C1 to C8 alkyl acrylate monomers and mixtures thereof. The other optional monomers are copolymerized. More advantageously the (meth)acrylic polymer (P1) comprises at least 50 wt% of polymerized methyl methacrylate, and even more advantageously at least 60wt% and still even more advantageously at least 65wt%.

[049] In a first most advantageously embodiment the (meth)acrylic polymer (P1) comprises at least 70wt% of polymerized methyl methacrylate.

10 **[050]** In a second most advantageously embodiment the (meth)acrylic polymer (P1) comprises at least 80wt% of polymerized methyl methacrylate.

[051] In a third most advantageously embodiment the (meth)acrylic polymer (P1) comprises at least 90wt% of polymerized methyl methacrylate.

15 **[052]** Preferably the glass transition temperature T_g of the (meth)acrylic polymer (P1) is between 30°C and 150°C. The glass transition temperature of the (meth)acrylic polymer (P1) is more preferably between 40°C and 150°C, advantageously between 45°C and 150°C and more advantageously between 50°C and 150°C. The other optional monomers that are copolymerized are chosen so that the T_g is within these limits.

[053] Preferably the (meth)acrylic polymer (P1) is not crosslinked.

25 **[054]** Preferably the (meth)acrylic polymer (P1) is not grafted on any other polymer or polymers.

[055] Preferably the (meth)acrylic polymer (P1) has a melt flow index (MFI) according to ISO 1133 (230°C/3.8kg) of at least 5g/10min, preferably at least 6g/10min, more preferably at least 7g/10min and most preferably at least 8g/10min.

30 **[056]** More preferably the (meth)acrylic polymer (P1) has a melt flow index (MFI) according to ISO 1133 (230°C/3.8kg) according to between 5g/10min and 100g/10min, preferably melt flow index is between 6g/10min and 90g/10min, more preferably between 7g/10min and 80g/10min, advantageously between 8g/10min and 70g/10min.

35 **[057]** Preferably the (meth)acrylic polymer (P1) does not comprise any aromatic groups, coming from copolymerization of aromatic group containing monomers.

[058] In a fourth preferred embodiment the (meth)acrylic polymer (P1) comprises from 50wt% to 100wt% methyl methacrylate, preferably from 80wt% to 100wt% methyl methacrylate, still more preferably from 80wt% to 99.8wt% methyl methacrylate and from 0.2wt% to 20wt% of an C1 to C8 alkyl acrylate monomer. Advantageously the C1 to C8 alkyl acrylate monomer is chosen from methyl acrylate, ethyl acrylate or butyl acrylate.

[059] In a fifth preferred embodiment the (meth)acrylic polymer (P1) comprises between 0wt% and 50wt% of a functional monomer. Preferably the (meth)acrylic polymer (P1) comprises between 0wt% and 30wt% of the functional monomer, more preferably between 1wt% and 30wt%, still more preferably between 2wt% and 30wt%, advantageously between 3wt% and 30wt%, more advantageously between 5wt% and 30wt% and most advantageously between 5wt% and 30wt%.

[060] Preferably the functional monomer of the second preferred embodiment is a (meth)acrylic monomer. The functional monomer has the formula (1) or (2):



[061] wherein in both formulas (1) and (2) R₁ is chosen from H or CH₃; and in formula (1) Y is O, R₅ is H or an aliphatic or aromatic radical having at least one atom that is not C or H; and in formula (2) Y is N and R₄ and/or R₃ is H or an aliphatic or aromatic radical.

[062] Preferably the functional monomer (1) or (2) is chosen from glycidyl (meth)acrylate, acrylic or methacrylic acid, the amides derived from these acids, such as, for example, dimethylacrylamide, 2-methoxyethyl acrylate or methacrylate, 2-aminoethyl acrylates or methacrylates are optionally quaternized,

acrylate or methacrylate monomers comprising a phosphonate or phosphate group, alkyl imidazolidinone (meth) acrylates, polyethylene glycol (meth) acrylates. Preferably the polyethylene glycol group of polyethylene glycol (meth) acrylates has a
5 molecular weight ranging from 400g/mol to 10 000 g/mol.

[063] The multistage polymer according to the invention has at least two stages that are different in its polymer composition.

[064] The multistage polymer is preferably in form of spherical
10 polymer particles. These particles are also called core shell particles. The first stage forms the core, the second or all following stages the respective shells. Such a multistage polymer which is also called core/shell particle is preferred.

[065] With regard to the spherical polymer particle, it has a weight average particle diameter between 20nm and 800nm. Preferably the weight average particle diameter of the polymer particle is between 25nm and 600nm, more preferably between 30nm and 550nm, still more preferably between 35nm and 500nm,
20 advantageously between 40nm and 400nm, more advantageously between 50nm and 400nm, still more advantageously between 75nm and 350nm and most advantageously between 80nm and 300nm.

[066] The primary polymer particles can be agglomerated giving a polymer powder comprising either the multi stage polymer or the
25 (meth) acrylic polymer (P1) and the multi stage polymer

[067] The polymer particle is obtained by a multistage process such as a process comprising two, three or more stages.

[068] The polymer particle has a multilayer structure comprising at
30 least one layer (A) comprising a polymer (A1) having a glass transition temperature below 0°C and another layer (B) comprising a polymer (B1) having a glass transition temperature over 30°C.

[069] In a first preferred embodiment the polymer (B1) having a glass transition temperature of at least 30°C is the external
35 layer of the polymer particle having the multilayer structure.

[070] In a second preferred embodiment the polymer (B1) having a glass transition temperature of at least 30°C is an intermediate layer of the polymer particle having the multilayer structure.

[071] Preferably the stage (A) is the first stage and the stage (B) comprising polymer (B1) is grafted on stage (A) comprising polymer (A1) or another intermediate layer. By first stage is meant that the stage (A) comprising polymer (A1) is made before the stage (B) comprising polymer (B1).

[072] The polymer (A1) having a glass transition temperature below 0°C in the layer (A) is never made during the last stage of the multistage process. This means that the polymer (A1) is never in the external layer of the particle with the multilayer structure. The polymer (A1) having a glass transition temperature below 0°C in the layer (A) is either in the core of the polymer particle or one of the inner layers.

[073] Preferably the polymer (A1) having a glass transition temperature below 0°C in the layer (A) is made in the first stage of the multistage process forming the core for the polymer particle having the multilayer structure and/or before the polymer (B1) having a glass transition temperature over 60°C. Preferably the polymer (A1) is having a glass transition temperature below -5°C, more preferably below -15°C, advantageously below -25°C.

[074] In a first preferred embodiment the polymer (B1) having a glass transition temperature over 60°C is made in the last stage of the multistage process forming the external layer of the polymer particle having the multilayer structure.

[075] In a second preferred embodiment the polymer (B1) having a glass transition temperature of at least 30°C is an intermediate layer of the polymer particle having the multilayer structure, is made in a stage after the stage for forming the polymer (A1) of the multistage process.

[076] There could be additional intermediate layer or layers obtained by an intermediate stage or intermediate stages.

[077] Preferably at least a part of the polymer (B1) of layer (B) is grafted on the polymer made in the previous layer. If there are only two stages (A) and (B) comprising polymer (A1) and (B1)

respectively, a part of polymer (B1) is grafted on polymer (A1). More preferably at least 50wt% of polymer (B1) is grafted. The ratio of grafting can be determined by extraction with a solvent for the polymer (B1) and gravimetric measurement before and after
5 extraction to determine the non-grafted quantity.

[078] The glass transition temperature T_g of the respective polymers can be estimated for example by dynamic methods as thermo
10 mechanical analysis.

[079] In order to obtain a sample of the respective polymers (A1) and (B1) they can be prepared alone, and not by a multistage process, for estimating and measuring more easily the glass transition temperature T_g individually of the respective polymers
15 of the respective stages.

[080] With regard to the polymer (A1), in a first embodiment it is a (meth) acrylic polymer comprising at least 50wt% of monomers from alkyl acrylates.

[081] More preferably the polymer (A1) comprises a comonomer or comonomers which are copolymerizable with alkyl acrylate, as long as polymer (A1) is having a glass transition temperature of less than 0°C.

[082] The comonomer or comonomers in polymer (A1) are preferably
25 chosen from (meth)acrylic monomers and/or vinyl monomers.

[083] The (meth)acrylic comonomer in polymer (A1) comprises monomers chosen from C1 to C12 alkyl (meth)acrylates. Still more preferably (meth)acrylic comonomer in polymer (A1) comprises monomers of C1 to C4 alkyl methacrylate and/or C1 to C8 alkyl
30 acrylate monomers.

[084] Most preferably the acrylic or methacrylic comonomers of the polymer (A1) are chosen from methyl acrylate, propyl acrylate, isopropyl acrylate, butyl acrylate, tert-butyl acrylate, methyl methacrylate, ethyl methacrylate, butyl methacrylate and mixtures
35 thereof, as long as polymer (A1) is having a glass transition temperature of less than 0°C.

[085] Preferably the polymer (A1) is crosslinked. This means that a crosslinker is added to the other monomer or monomers. A crosslinker comprises at least two groups that can be polymerized.

[086] In one specific embodiment polymer (A1) is a homopolymer of butyl acrylate.

[087] In another specific embodiment polymer (A1) is a copolymer of butyl acrylate and at least one crosslinker. The crosslinker presents less than 5wt% of this copolymer.

[088] More preferably the glass transition temperature T_g of the polymer (A1) of the first embodiment is between -100°C and 0°C , even more preferably between -100°C and -5°C , advantageously between -90°C and -15°C and more advantageously between -90°C and -25°C .

[089] With regard to the polymer (A1), in a second embodiment the polymer (A1) is a silicone rubber based polymer. The silicone rubber for example is polydimethyl siloxane. More preferably the glass transition temperature T_g of the polymer (A1) of the second embodiment is between -150°C and 0°C , even more preferably between -145°C and -5°C , advantageously between -140°C and -15°C and more advantageously between -135°C and -25°C .

[090] With regard to the polymer (A1), in a third embodiment the polymer (A1) having a glass transition temperature below 0°C comprises at least 50wt% of polymeric units coming from isoprene or butadiene and the stage (A) is the most inner layer of the polymer particle having the multilayer structure. In other words the stage (A) comprising the polymer (A1) is the core of the polymer particle.

[091] By way of example, the polymer (A1) of the core of the second embodiment, mention may be made of isoprene homopolymers or butadiene homopolymers, isoprene-butadiene copolymers, copolymers of isoprene with at most 98 wt% of a vinyl monomer and copolymers of butadiene with at most 98 wt% of a vinyl monomer. The vinyl monomer may be styrene, an alkylstyrene, acrylonitrile, an alkyl (meth)acrylate, or butadiene or isoprene. In one embodiment the core is a butadiene homopolymer.

[092] More preferably the glass transition temperature T_g of the polymer (A1) of the third embodiment comprising at least 50wt% of polymeric units coming from isoprene or butadiene is between -100°C and 0°C , even more preferably between -100°C and -5°C ,
5 advantageously between -90°C and -15°C and even more advantageously between -90°C and -25°C .

[093] With regard to the polymer (B1), mention may be made of homopolymers and copolymers comprising monomers with double bonds
10 and/or vinyl monomers. Preferably the polymer (B1) is a (meth) acrylic polymer.

[094] Preferably the polymer (B1) comprises at least 70wt% monomers chosen from C1 to C12 alkyl (meth)acrylates. Still more preferably the polymer (B1) comprises at least 80 wt% of monomers C1 to C4
15 alkyl methacrylate and/or C1 to C8 alkyl acrylate monomers.

[095] The polymer (B1) can be crosslinked.

[096] Most preferably the acrylic or methacrylic monomers of the polymer (B1) are chosen from methyl acrylate, ethyl acrylate, butyl acrylate, methyl methacrylate, ethyl methacrylate, butyl
20 methacrylate and mixtures thereof, as long as polymer (B1) is having a glass transition temperature of at least 30°C .

[097] Advantageously the polymer (B1) comprises at least 50wt%, more advantageously at least 60wt% and even more advantageously at least 70wt% of monomer units coming from methyl methacrylate.
25

[098] Preferably the glass transition temperature T_g of the polymer (B1) is between 30°C and 150°C . The glass transition temperature of the polymer (B1) is more preferably between 50°C and 150°C , still more preferably between 70°C and 150°C ,
30 advantageously between 90°C and 150°C and more advantageously between 90°C and 130°C .

[099] In another embodiment the multi stage polymer as described previously, has an additional stage, which is the (meth)acrylic
35 polymer (P1). The primary polymer particle according to this embodiment of the invention has a multilayer structure comprising at least one stage (A) comprising a polymer (A1) having a glass

transition temperature below 0°C, at least one stage (B) comprising a polymer (B1) having a glass transition temperature over 30°C and at least one stage (P) comprising the (meth)acrylic polymer (P1) having a glass transition temperature between 30°C and 150°C.

[0100] Preferably the (meth)acrylic polymer (P1) is not grafted on any of the polymers (A1) or (B1).

[0101] The (meth)acrylic polymer (P1) and the polymer (B1) are not the same polymer, even if their composition could be very close and some of their characteristics are overlapping. The essential difference is that the polymer (B1) is always part of the multistage polymer.

[0102] This is more explained in the process for preparing the composition according to the invention comprising the fibrous material, the (meth) acrylic polymer (P1) and the multi stage polymer.

[0103] With regard to the process for manufacturing the multistage polymer according to the invention it comprises the steps of

a) polymerizing by emulsion polymerization of a monomer or monomer mixture (A_m) to obtain at least one layer (A) comprising polymer (A1) having a glass transition temperature of less than 0°C

b) polymerizing by emulsion polymerization of a monomer or monomer mixture (B_m) to obtain layer (B) comprising a polymer (B1) having a glass transition temperature of at least 30°C

the monomer or monomer mixture (A_m) and the monomer or monomer mixture (B_m) are chosen from monomers according to the composition for polymer (A1) and polymer (B1) given earlier.

[0104] Preferably the step a) is made before step b). More preferably step b) is performed in presence of the polymer (A1) obtained in step a), if there are only two stages.

[0105] Still more preferably a graftlinking compound is used in order to graft at least a part of the polymer (B1) of step b) on the polymer (A1) of step a).

[0106] Advantageously the process for manufacturing the multistage polymer composition according to the invention is a multistep process comprises the steps one after the other of

- 5 a) polymerizing by emulsion polymerization of a monomer or monomer mixture (A_m) to obtain one layer (A) comprising polymer (A1) having a glass transition temperature of less than 0°C
- 10 b) polymerizing by emulsion polymerization of a monomer or monomer mixture (B_m) to obtain layer (B) comprising a polymer (B1) having a glass transition temperature of at least 30°C.

[0107] The respective monomers or monomer mixtures (A_m) and (B_m) for forming the layers (A) and (B) respectively comprising the polymers (A1) and (B1) respectively and the characteristics of the respective polymers (A1) and (B1) are the same as defined before.

[0108] Still more advantageously a graftlinking compound is used in order to graft at least a part of the polymer (B1) of step b) on the polymer (A1) of step a).

[0109] The process for manufacturing the multistage polymer can comprise additional steps for additional stages between the steps a) and b).

25 **[0110] The process for** manufacturing the multistage polymer can also comprise additional steps for additional stages before the steps a) and b). A seed could be used for polymerizing by emulsion polymerization the monomer or monomers mixture (A_m) to obtain the layer (A) comprising polymer (A1) having a glass transition temperature of less than 0°C. The seed is preferably a thermoplastic polymer having a glass transition temperature of at least 20°C.

30 **[0111]** The multistage polymer is obtained as an aqueous dispersion of the polymer particles. The solid content of the dispersion is between 10wt% and 65wt%.

[0112] With regard to the process for manufacturing the (meth)acrylic polymer (P1) according to the invention is comprises the step of polymerizing the respective (meth)acrylic monomers (Pl_m) and the other optional comonomers. The respective (meth)acrylic monomers (Pl_m) are the same as defined before for the the (meth)acrylic polymer (P1) and two preferred embodiments the (meth)acrylic polymer (P1).

[0113] The (meth)acrylic homo or copolymer (P1) could be made in batch or semi-continuous process:

10 for the batch process, the mixture of monomers is introduced in one shot just before or after introduction of one or part of the initiator system
for the semi-continuous process, the monomer mixture is added in multiple shots or continuously in parallel to the
15 initiator addition (the initiator is also added in multiple shots or continuously) during a defined period of addition which could be in the range 30 to 500min.

[0114] The process for preparing the polymeric composition according to the invention comprising the thermoplastic polymer (TP1), the (meth) acrylic polymer (P1) and the multi stage polymer has two preferred embodiments.

[0115] In both cases concerning the preferred embodiments of the process, the thermoplastic polymer (TP1) is blended with the (meth) acrylic polymer (P1) and the multi stage polymer. The (meth) acrylic polymer (P1) and the multi stage polymer are added together in a polymeric composition (PC1), which is also called the impact modifier composition. The polymeric composition (PC1) can be obtained by two preferred processes.

30 **[0116]** In a first preferred embodiment of the process, the (meth) acrylic polymer (P1) is polymerized in the presence of the multistage polymer. The (meth) acrylic polymer (P1) is made as an additional stage of the multistage polymer for giving polymeric composition (PC1). The (meth) acrylic polymer (P1) is a layer on
35 the multistage polymer and as it is an additional layer it is the outer layer on top of the multistage polymer. The (meth) acrylic polymer (P1) is not grafted on the multistage polymer.

[0117] In a second preferred embodiment of the process, the (meth) acrylic polymer (P1) is polymerized apart and mixed or blended with the multistage polymer for giving polymeric composition (PC1).

5

[0118] With regard to the process according to the first preferred embodiment for preparing the polymeric composition (PC1) comprising the (meth) acrylic polymer (P1) and the multi stage polymer, it comprises the steps of

- 10 a) polymerizing by emulsion polymerization of a monomer or monomer mixture (A_m) to obtain one layer in stage (A) comprising polymer (A1) having a glass transition temperature of less than 0°C
- 15 b) polymerizing by emulsion polymerization of a monomer or monomer mixture (B_m) to obtain layer in stage (B) comprising a polymer (B1) having a glass transition temperature of at least 30°C
- 20 c) polymerizing by emulsion polymerization of a monomer or monomer mixture ($P1_m$) to obtain a layer in this additional stage comprising the (meth) acrylic polymer (P1) having a glass transition temperature of at least 30°C

characterized that the (meth) acrylic polymer (P1) has a mass average molecular weight M_w of less than 100 000g/mol.

25 [0119] Preferably the step a) is made before step b).

[0120] More preferably step b) is performed in presence of the polymer (A1) obtained in step a). Still more preferably a graftlinking compound is used in order to graft at least a part of the polymer (B1) of step b) on the polymer (A1) of step a).

30 [0121] Advantageously the method for manufacturing the polymeric composition (PC1) comprising the (meth) acrylic polymer (P1) and the multi stage polymer is a multistep process and comprises the steps one after the other of

- 35 a) polymerizing by emulsion polymerization of a monomer or monomer mixture (A_m) to obtain one layer in stage (A)

comprising polymer (A1) having a glass transition temperature of less than 0°C

b) polymerizing by emulsion polymerization of a monomer or monomer mixture (B_m) to obtain layer in stage (B) comprising a polymer (B1) having a glass transition temperature of at least 30°C

c) polymerizing by emulsion polymerization of a monomer or monomer mixture (Pl_m) to obtain a layer in this additional stage comprising the (meth) acrylic polymer (P1) having a glass transition temperature of at least 30°C

characterized that the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol.

[0122] Preferably the (meth) acrylic polymer (P1) is not grafted on any of the polymers prepared in the previous steps.

[0123] Still more advantageously a graftlinking compound is used in order to graft at least a part of the polymer (B1) of step b) on the polymer (A1) of step a).

[0124] The respective monomers or monomer mixtures (A_m), (B_m) and (Pl_m) for forming the layers (A), (B) and additional stage respectively comprising the polymers (A1), (B1) and (P1) respectively, are the same as defined before. The characteristics of the polymers (A1), (B1) and (P1) respectively, are the same as defined before.

[0125] The polymer composition (PC1) is obtained as an aqueous dispersion of the polymer particles. The solid content of the dispersion is between 10wt% and 65wt%.

[0126] Optionally the method for manufacturing the polymer composition comprising the (meth) acrylic polymer (P1) and the multi stage polymer comprises the additional step d) of recovering of this polymer composition.

[0127] By recovering is meant partial or separation between the aqueous and solid phase, latter comprises the polymer composition.

[0128] More preferably according to the invention the recovering of the polymer composition is made by coagulation or by spray-drying.

[0129] Spray drying is the preferred method for the recovering and/or drying for the manufacturing method for a polymer powder

composition of (PC1) if the polymer (A1) having a glass transition temperature below 0°C comprises at least 50wt% of polymeric units coming from alkyl acrylate and the stage (A) is the most inner layer of the polymer particle having the multilayer structure.

5 [0130] Coagulation is the preferred method for the recovering and/or drying for the manufacturing method for a polymer powder composition of (PC1) if the polymer (A1) having a glass transition temperature below 0°C comprises at least 50wt% of polymeric units coming from isoprene or butadiene and the stage (A) is the most
10 inner layer of the polymer particle having the multilayer structure.

[0131] The method for manufacturing the polymeric composition (PC1) can comprise optionally the additional step e) of drying of the polymeric composition (PC1).

15 [0132] Preferably the drying step e) is made if the step d) of recovering of the polymeric composition (PC1) is made by coagulation.

[0133] Preferably after the drying step an e) the polymeric composition (PC1) comprises less than 3wt%, more preferably less
20 than 1.5wt% advantageously less than 1% of humidity or water.

[0134] The humidity of a polymeric composition can be measure with a thermo balance.

[0135] The drying of the polymer can be made in an oven or vacuum oven with heating of the composition for 48hours at 50°C.

25

[0136] With regard to the process according to the second preferred embodiment for preparing the polymeric composition (PC1) comprising the (meth) acrylic polymer (P1) and the multi stage polymer, it comprises the steps of

30 a) mixing of the (meth) acrylic polymer (P1) and the multi stage polymer,

b) optionally recovering the obtained mixture of previous step in form of a polymer powder,

wherein the (meth) acrylic polymer (P1) and the multi stage
35 polymer in step a) are in form of a dispersion in aqueous phase.

[0137] The quantities of the aqueous dispersion of the (meth) acrylic polymer (P1) and the aqueous dispersion of the multi stage

polymer are chosen in a way that the weight ratio of the multi stage polymer based on solid part only in the obtained mixture is at least 5wt%, preferably at least 10wt%, more preferably at least 20wt% and advantageously at least 50wt%.

5 **[0138]** The quantities of the aqueous dispersion of the (meth) acrylic polymer (P1) and the aqueous dispersion of the multi stage polymer are chosen in a way that the weight ratio of the multi stage polymer based on solid part only in the obtained mixture is at most 99wt%, preferably at most 95wt% and more preferably at
10 most 90wt%.

[0139] The quantities of the aqueous dispersion of the (meth) acrylic polymer (P1) and the aqueous dispersion of the multi stage polymer are chosen in a way that the weight ratio of the multi stage polymer based on solid part only in the obtained mixture is
15 between 5wt% and 99wt%, preferably between 10wt% and 95wt% and more preferably between 20wt% and 90wt%.

[0140] The polymer composition (PC1) is obtained as an aqueous dispersion of the polymer particles, if recovering step b) takes not place. The solid content of the dispersion is between 10wt%
20 and 65wt%.

[0141] In one embodiment the recovering step b) of the process for manufacturing the polymer composition comprising the (meth) acrylic polymer (P1) and the multi stage polymer, is not optional and is preferably made by coagulation or by spray drying.

25 **[0142]** The process for manufacturing the polymer composition (PC1) comprising the (meth) acrylic polymer (P1) and the multi stage polymer can optionally comprise the additional step c) for drying the polymer composition.

[0143] By dry is meant that the polymer composition according to
30 the present invention comprises less than 3wt% humidity and preferably less than 1.5wt% humidity and more preferably less than 1.2wt% humidity.

[0144] The humidity can be measured by a thermo balance that heats the polymer composition and measures the weight loss.

35 **[0145]** The process for manufacturing the polymer composition comprising the (meth) acrylic polymer (P1) and the multi stage polymer yields preferably to a polymer powder. The polymer powder

of the invention is in form of particles. A polymer powder particle comprises agglomerated primary polymer particles made by multistage process and the (meth) acrylic polymer (P1).

5 **[0146] With regard to the polymer powder** comprising the (meth) acrylic polymer (P1) and the multi stage polymer according to the two embodiments of the process of preparation of polymeric composition (PC1), it has a volume median particle size D50 between 1µm and 500µm. Preferably the volume median particle size
10 of the polymer powder is between 10µm and 400µm, more preferably between 15µm and 350µm and advantageously between 20µm and 300µm.

[0147] The D10 of the particle size distribution in volume is at least 7µm and preferably 10µm.

[0148] The D90 of the particle size distribution in volume is at
15 most 950µm and preferably 500µm, more preferably at most 400µm.

[0149] The weight ratio r of the (meth) acrylic polymer (P1) in relation to the multi stage polymer is at least 5wt%, more preferably at least 7wt% and still more preferably at least 10wt%.

20 **[0150]** According to the invention the ratio r of the (meth) acrylic polymer (P1) in relation to the multi stage polymer is at most 95w%.

[0151] Preferably the weight ratio of the (meth) acrylic polymer (P1) in relation to the multi stage polymer is between 5wt% and
25 95wt% and preferably between 10wt% and 90wt%.

[0152] With regard to the thermoplastic polymer (TP1) that is part of the thermoplastic composition according to the invention it can
30 be chosen among but not limited to, poly(vinyl chloride) (PVC), polyesters as for example poly (ethylene terephthalate) (PET) or poly(butylene terephthalate) (PBT) or polylactic acid (PLA), polystyrene (PS), polycarbonates (PC), polyethylene, thermoplastic
35 poly(methyl methacrylate-co-ethylacrylates), poly(alkylene-terephthalates), poly vinylidene fluoride, les poly(vinylidenechloride), polyoxymethylene (POM),

semi-crystalline polyamides, amorphous polyamides, semi-crystalline copolyamides, amorphous copolyamides, polyetheramides, polyesteramides, copolymers of styrene and acrylonitrile (SAN), and their respective mixtures.

5 According to a preferred embodiment the thermoplastic resin composition comprises polycarbonate (PC) and/or polyester (PET or PBT) or PC or polyester alloys. The alloys for example may be PC/ABS (poly(Acrylonitrile-co-butadiene-co-styrene), PC/polyester or PC/PLA just to mention a few.

10 **[0153]** The thermoplastic polymer that is part of the thermoplastic composition according to the invention, it can also be chosen also among polyurethanes; poly(aromatic ketones) such as polyether ketone, polyether ether ketone, polyether ketone ketone, polyketone; poly(phenylene ethers); poly(phenylene sulfides);
15 phenoxy resins; polysulfones such as poly(ether sulfone), poly(aryl sulfone), polysulfone; poly(ether imides); poly(ether imide esters); copoly(ether imide esters); poly(ester carbonates); polyarylates such as poly(bisphenol A isophthalate); polyimides such as poly(glutarimides); aromatic polyimides; acrylate-styrene-
20 acrylonitrile resins; acrylonitrile-butadiene-styrene resins; poly(amide imides); nitrile resins; poly(methyl pentene); olefin modified styrene-acrylonitrile; styrene-butadiene resins; acrylonitrile-chlorinated polyethylene-styrene resins; thermoplastic elastomers such as poly(ether esters), poly(ether
25 amides), poly(styrene butadiene styrenes) and poly(styrene ethylene-butylene styrenes); and copolymers and blends of the above.

[0154] The thermoplastic polymer (TP1) has a meltflow index (at 300°C/1.2kg) between 3 and 65g/10min, preferably between 4 and
30 50g/10min.

[0155] In a first preferred embodiment the thermoplastic polymer (TP1) is chosen from polycarbonate and mixtures therewith. Advantageously the thermoplastic polymer (TP1) is chosen from polycarbonate, mixtures of polycarbonate with polyester or
35 polycarbonate alloys. Preferably the polyester is PET or PBT.

[0156] In a second preferred embodiment the thermoplastic polymer (TP1) is chosen from polyester and mixtures comprising polyesters.

Preferably the polyester is chosen from polylactid acid, polyethylene terephthalate or polybutylene terephthalate and mixtures thereof.

5 **[0157] With regard to the constituents of the composition,** the weight proportions between the part of stage (A) comprising a polymer (A1) having a glass transition temperature of less than 0°C of the multistage polymer (core-shell polymer) and the thermoplastic polymer are between 0.5/99.5 and 30/70, preferably
10 between 1/99 and 25/75.

[0158] With regard to the process for manufacturing the composition according to the invention, it comprises the step of

15 a) blending the thermoplastic polymer (TP1) and the a multistage polymer and a (meth) acrylic polymer (P1), wherein the quantity of the multistage polymer is between 0.5wt% and 50wt% of the composition and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol.

20 **[0159]** Preferably the multistage polymer and a (meth) acrylic polymer (P1) are in form of the polymeric composition (PC1) as described before.

[0160] Preferably the blending is made by compounding. The compounding is made in an extruder.

25 **[0161]** The invention relates also to the use of the thermoplastic composition according to the invention to produce molded bodies.

[0162] The invention relates as well to molded bodies comprising the thermoplastic composition according to the invention.

30

[0163] [Methods of evaluation]

[0164] Particle size analysis

The particle size of the primary particles after the multistage polymerization is measured with a Zetasizer Nano S90 from MALVERN.

35 The particle size of the polymer powder is measured with Malvern Mastersizer 3000 from MALVERN. For the estimation of volume median

particle size D50 a Malvern Mastersizer 3000 apparatus with a 300mm lenses, measuring a range from 0,5-880µm is used.

[0165] Glass transition Temperature

The glass transitions (T_g) of the multistage polymers is measured
5 with equipment able to realize a thermo mechanical analysis. A
RDAII "RHEOMETRICS DYNAMIC ANALYSER" proposed by the Rheometrics
Company has been used. The thermo mechanical analysis measures
precisely the visco-elastics changes of a sample in function of
the temperature, the strain or the deformation applied. The
10 apparatus records continuously, the sample deformation, keeping
the stain fixed, during a controlled program of temperature
variation. The results are obtained by drawing, in function of the
temperature, the elastic modulus (G'), the loss modulus (G'')
and the tan delta. The T_g is higher temperature value read in
15 the tan delta curve, when the derived of tan delta is equal to
zero.

[0166] Molecular Weight

The mass average molecular weight (M_w) of the polymers is measured
with by size exclusion chromatography (SEC).

20 **[0167] Impact strength**

The impact strength is IZOD standard ISO180 type 1eA notch
pendulum 5.5J.

[0168] Melt flow index (MFI)

The melt flow index (MFI) for the compositions of the invention is
25 measured according to ISO 1133 at 300°C/1.2kg.

[Examples]

[0169] Following materials are used or prepared:

30 **[0170]** As thermoplastic polymer (TP1) polycarbonate is used,
Calibre 300-10 from the company TRINSEO.

[0171] As multistage polymer for a composition outside of the
invention, a polymeric impact modifier (IM1) is prepared according
to the technique described in EP 1 844 086, which employs a
standard emulsion polymerization technique. This multistage
35 polymer is used in comparative example 2.

[0172] As multistage polymer for the composition according to the
invention in the polymeric composition (PC1) an impact modifier

composition (IM2) is prepared. According to the example of sample 1 of WO2012/038441 a multistage polymer is obtained. It comprises a stage (A) comprising a polymer (A1) having a glass transition temperature of less than 0° (essentially made of butyl acrylate) and a stage (B) comprising a polymer (B1) having a glass transition temperature of at least 30°C (essentially made of methyl methacrylate). The multistage polymer CS1 is kept as an aqueous dispersion for further use.

[0173] Synthesis of a (meth)acrylic polymer type (P1) can be made according to two embodiments: first the (meth) acrylic polymer (P1) is polymerized in the presence of the multistage polymer CS1. The (meth) acrylic polymer (P1) is made as an additional stage of the multistage polymer CS. And in a second embodiment the (meth) acrylic polymer (P1) is polymerized apart and mixed or blended with the multistage polymer after the end of polymerization of the (meth) acrylic polymer (P1).

[0174] For example 1: The (meth) acrylic polymer (P1) is made as an additional stage on the multistage polymer CS1. A semi continuous process is used: charged into a reactor, with stirring, were 6 400g of multi stage polymer (CS1) in de-ionized water, 0.01g of FeSO4 and 0.032g of ethylenediaminetetraacetic acid, sodium salt (dissolved in 10g of de-ionized water), 3.15g of sodium formaldehydesulfoxylate dissolved in 110g of de-ionized water and 21.33 g of emulsifier potassium salt of beef tallow fatty acid (dissolved in 139.44g of water), and the mixture was stirred until complete dissolution of added raw materials except core-shell polymer. Three vacuum-nitrogen purges were carried out in succession and the reactor left under a slight vacuum. The reactor was then heated. At the same time, a mixture comprising 960.03 g of methyl methacrylate, 106.67 g of dimethylacrylamide and 10.67 g of n-octyl mercaptan was nitrogen-degassed for 30 minutes. The reactor is heated at 63°C and maintained at that temperature. Next, the monomers mixture was introduced into the reactor in 180min using a pump. In parallel, a solution of 5.33g of ter-butyl hydroperoxide (dissolved in 100g of de-ionized water) is introduced (same addition time). The lines were rinsed with 50g and 20g of water. Then the reaction mixture was heated at a

temperature of 80°C and the polymerization was then left to completion for 60 minutes after the end of the monomers addition. The reactor was cooled down to 30°C. The mass average molecular weight of the (meth)arylic polymer P1 is $M_w = 28\,000\text{g/mol}$.

5 **[0175]** The final polymer composition was then recovered, the polymer composition being dried by spray drying.

[0176] The two impact modifiers IM1 and IM2 are blended with the polycarbonate according to the rations given in table 1.

10

[0177] Table 1 Prepared Compositions

	Multistage polymer in thermoplastic polymer (TP1) [wt%]	Stage (A) comprising polymer (A1) in thermoplastic polymer (TP1) [wt%]
Comparative example 1 without any impact modifier	0	0
Comparative exemple 2 with IM1	4.35	3.35
Exemple 1 with IM2	5.00	3.35

15 **[0178]** The prepared compositions of comparative examples and examples of table 1 are compared on same wt% of rubber phase (stage (A) comprising a polymer (A1) having a glass transition temperature of less than 0°C of the impact modifier relatively to the thermoplastic polymer (TP1).

[0179] Table 2 - Evaluation of impact properties and melt flow index of the respective examples and comparative examples of table 1

	Impact strength at 23°C [kJ/m ²]	MFI ^{a)} (300°C/1.2kg) [g/10min]
Comparative example 1 without any impact modifier	-	12.2
Comparative example 2 with IM1	63.0	9.6
Example 1 with IM2	61.6	12.5

5 a) The MFI is measured after 7min of residence time

[0180] The example 1 shows a comparative level in impact strength as comparative example 2 and keeps at the same time the same fluidity (expressed as MFI) as the neat non-impact modified thermoplastic polymer.

[0181] Comparative example 2 has a decrease in MFI which signifies a higher viscosity.

Claims

1. A polymeric composition comprising
 - a) a thermoplastic polymer (TP1) and
 - 5 b) a multi stage polymer and
 - c) a (meth) acrylic polymer (P1),wherein the quantity of multi stage polymer is between 0.1wt% and 50wt% of the composition comprising a), b), c) and the (meth) acrylic polymer (P1) has a mass average molecular weight Mw of less than 100 000g/mol.
10
2. The composition according to claim 1 characterized in that the (meth) acrylic polymer (P1) has a mass average molecular weight Mw between 5000g/mol and 70 000g/mol.
15
3. The composition according to claim 1 characterized in that the (meth) acrylic polymer (P1) has a mass average molecular weight Mw between 6 000g/mol and 50 000g/mol.
- 20 4. The composition according to any of claims 1 to 3 characterized in that the quantity of (meth) acrylic polymer (P1) is between 0.005wt% and 47.5wt%.
- 25 5. The composition according to any of claims 1 or 4 characterized in that the (meth) acrylic polymer (P1) comprises at least 50wt% of polymerized methyl methacrylate.
- 30 6. The composition according to any of claims 1 or 4 characterized in that the (meth) acrylic polymer (P1) comprises at least 70wt% of polymerized methyl methacrylate.
- 35 7. The composition according to any of claims 1 or 4 characterized in that the (meth) acrylic polymer (P1) comprises at least 90wt% of polymerized methyl methacrylate.
8. The composition according to any of claims 1 or 4 characterized in that the (meth) acrylic polymer (P1) comprises from 80wt% to

100wt% methyl methacrylate and from 0.2wt% to 20wt% of an C1 to C8 alkyl acrylate monomer

9. The composition according to any of claims 1 or 4 characterized in that the (meth)acrylic polymer (P1) comprises between 1wt% and 30wt% of a functional monomer.

10. The composition according to any of claims 1 or 4 characterized in that the (meth)acrylic polymer (P1) has a melt flow index (MFI) according to ISO 1133 (230°C/3.8kg) of at least 5g/10min.

11. The composition according to any of claims 1 or 4 characterized in that the (meth)acrylic polymer (P1) has a melt flow index (MFI) according to ISO 1133 (230°C/3.8kg) between 8g/10min and 70g/10min.

12. The composition according to any of claims 1 to 11 characterized in that the thermoplastic polymer (TP1) is chosen from poly(vinyl chloride) (PVC), polyesters as for example poly(ethylene terephthalate) (PET) or poly(butylene terephthalate) (PBT) or polylactic acid (PLA), polystyrene (PS), polycarbonates (PC), polyethylene, thermoplastic poly(methyl methacrylate-co-ethylacrylates), poly(alkylene-terephthalates), polyvinylidene fluoride, poly(vinylidenechloride), polyoxymethylene (POM), semicrystalline polyamides, amorphous polyamides, semicrystalline copolyamides, amorphous copolyamides, polyetheramides, polyesteramides, copolymers of styrene and acrylonitrile (SAN), and their respective mixtures.

13. The composition according to any of claims 1 to 12 characterized in that the thermoplastic polymer (TP1) is chosen from polycarbonate and mixtures of polycarbonate.

14. The composition according to any of claims 1 to 12 characterized in that the thermoplastic polymer (TP1) is chosen from polycarbonate, mixtures of polycarbonate with polyester or polycarbonate alloys.

15. The composition according to any of claims 1 to 12 characterized in that the thermoplastic polymer (TP1) is chosen from polyester and mixtures comprising polyesters.

16. The composition according to any of claims 1 to 15 characterized in that the thermoplastic polymer (TP1) has a meltflow index (at 300°C/1.2kg) between 3 and 65g/10min.

17. The composition according to any of claims 1 to 16 characterized in that the multistage polymer is preferably in form of spherical polymer particles having a weight average particle size between 20nm and 800nm.

18. The composition according to any of claims 1 to 17 characterized in that the multi stage polymer comprises

- a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less than 0°C
- b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 30°C.

19. The composition according to claim 18 characterized in that the polymers (A1) and (B1) are acrylic or methacrylic polymers.

20. The composition according to claim 19 characterized in that the polymer (A1) is a silicone rubber based polymer

21. The composition according to claim 19 characterized in that the polymers (A1) comprises at least 50wt% of polymeric units coming from isoprene or butadiene.

22. The composition according to any of claims 19 to 21 characterized that the stage (A) is the first stage and that

stage (B) comprising polymer (B1) is grafted on stage (A) comprising polymer (A1).

- 5 23. A process for manufacturing the composition according to any of claims 1 to 22, said process comprising the step of
- a) blending the thermoplastic polymer (TP1) with a multistage polymer and a (meth) acrylic polymer (P1).
- 10 24. The process according to claim 23, characterized that the multistage polymer and the (meth) acrylic polymer (P1) are in form of a polymeric composition (PC1) comprising the multistage polymer and the (meth) acrylic polymer (P1) .
- 15 25. The process according to claim 24, characterized that the polymeric composition (PC1) is a polymer powder having a volume median particle size D50 between 1µm and 500µm.
- 20 26. Use of the composition according to any of claims 1 to 21 or obtained by a process according to any of claims 23 to 25 for transforming or processing the polymeric composition without significant increase of the viscosity.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/066217

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08L69/00 C08L51/00 C08L33/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C08K C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016/168376 A1 (KWON KEE-HAE [KR] ET AL) 16 June 2016 (2016-06-16)	1-14, 16-19, 21-23
Y	example 6; table 1 paragraph [0121] - paragraph [0138] -----	15,20
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Further documents are listed in the continuation of Box C.



See patent family annex.

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28 July 2017

Date of mailing of the international search report

08/08/2017

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