

Polymer Composition, its process of preparation and its use

[Field of the invention]

[001] The present invention relates to a polymeric composition comprising an impact modifier, a processing aid and a mineral filler and its process of preparation and its use.

[002] In particular the present invention relates to a polymeric composition comprising an impact modifier, a processing aid and a mineral filler and its use for thermoplastic polymers.

[003] More particularly the present invention relates to the process of preparation of polymeric composition comprising an impact modifier, a processing aid and a mineral filler and its use for the transformation and/or processing of thermoplastic polymers.

[Technical problem]

[004] Many kind of additives and fillers are used in thermoplastic polymer compositions in general and in halogenated polymer compositions in particular for a large variety of reasons. They can extend the composition, increase stiffness and strength, and shorten cycle times. They prevent hang-up in dies and neutralize the products of degradation. Fillers can also be used to add color, opacity and conductivity or they can be used as a low cost material that lowers the cost of the composition as the filler is less expensive than the other ingredients of the formulation.

[005] However the addition of additives and filler to thermoplastic polymers, especially when several are added at the same time or mixtures of them, can also change characteristics of that thermoplastic polymer composition in a negative direction, meaning loss or important decrease of certain characteristic or behavior.

[006] Polymer compositions comprising polymers with specific characteristic (such as polymer composition, glass transition temperature or specific molecular weight range just for naming some characteristics) are used as additives for thermoplastic polymer compositions in general and in halogenated polymer compositions in particular in order to enhance the processing behavior of these various polymers compositions or plastic resin

or to improve their transformation and/or processing performance. Therefor these additives are also called processing aids.

[007] Processing aids in small quantities in thermoplastic polymer compositions in general and in halogenated polymer compositions in particular can improve the processing characteristics through an acceleration of the fusion process of said thermoplastic polymer compositions in general and of halogenated polymer compositions in particular.

[008] Again other polymer compositions comprising polymers with specific characteristic (such as polymer composition, glass transition temperature or structure for naming some characteristics) are also used as additives for thermoplastic polymer compositions in general and in halogenated polymer compositions in particular in order to improve the impact resistance of the composition or object made out of these various polymers or plastic resin. Therefor these additives are also called impact modifiers.

[009] The additive polymer composition is compatible with thermoplastic polymer compositions in general and in halogenated polymer compositions in particular.

[010] The objective of the present disclosure is to propose a polymeric composition which can be added to thermoplastic polymers as an additive.

[011] The objective of the present disclosure is as well to propose a polymeric composition which acts as impact modifier and processing aid at the same time.

[012] An objective of the present disclosure is also to have a polymer composition that can be used to increase the melt fracture resistance of thermoplastic polymers.

[013] Another objective of the present disclosure is also to have a polymer composition that can be used to increase the productivity of extrusion of thermoplastic polymers.

[014] An additional objective of the present disclosure is the reduction of the price of a polymer composition which acts as processing aid and impact modifier at the same time for thermoplastic polymer compositions by addition of low cost components without negatively influencing the performance of the thermoplastic polymer compositions.

[015] Still another objective of the present disclosure is a method for manufacturing a polymer composition which acts as impact modifier and processing aid at the same time and increase the productivity of extrusion of thermoplastic polymers.

[016] Still an additional objective is having a process for preparing a polymer composition that can be used to increase the productivity of transformation of polymer compositions and to increase the impact strength.

[BACKGROUND]Prior art

[017] The document US 2009/0111915 discloses acrylic copolymers for use in highly filled compositions. In particular the document disclosed filled polyvinylchloride (PVC) materials as a composition for flooring comprising 70wt% to 95wt% filler, 1wt% to 15wt%PVC and 0.5wt% to 4wt% of acrylic copolymer or a composition for siding or pipe comprising 15wt% to 35wt% filler, 50wt% to 95wt%PVC and 0.25 to 6wt% of acrylic copolymer.

[018] The document WO 2010/099160 discloses composite polymer modifiers. The document discloses a composite polymer modifier consisting of 99wt% to 1wt% of inorganic filler and from 1wt% to 99wt% of a polymeric processing aid and 0wt% to 80% of an impact modifier. The impact modifier is optional, however used in some examples. This document discloses no specific advantages about certain impact modifier compositions.

[019] The document US 3,373,229 discloses vinyl polymer compositions. The compositions comprises polyvinyl chloride and

high molecular weight polymers of methyl methacrylate or copolymers of methyl methacrylate with a small amount of an alkyl acrylate as processing aid. The composition might comprise a filler.

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[020] None of the prior art documents discloses such a specific polymer composition comprising an inorganic compound, a (meth)acrylic copolymer and a polymeric impact modifier, neither its process of preparation or its use.

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[Brief description]

[020a] In an aspect, there is provided a polymer composition P1 comprising:

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a) from 30wt% to 60wt% of an inorganic mineral compound (F) ,
b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) or a mixture of (meth)acrylic copolymers

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c) a polymeric impact modifier (IM1) or a mixture of polymeric impact modifiers, said polymeric impact modifier (IM1) being a polymer particle having a multilayer structure comprising at least one layer (IM1L1) comprising a polymer (L1) having a glass transition temperature below 0 °C and at least another layer (IM1L2) comprising a polymer (L2) having a glass transition temperature over 45 °C

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characterized that the three components of a), b) and c) add up to 100wt%;
wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is at least 85/15.

[020b] In another aspect, there is provided a process for preparing a polymeric composition P1 comprising

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a) from 30wt% to 60wt% of an inorganic mineral compound (F)

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) or a mixture of (meth)acrylic copolymers

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c) a polymeric impact modifier (IM1) or a mixture of polymeric impact modifiers, said polymeric impact modifier (IM1) being a polymer particle having a multilayer structure comprising at least one layer (IM1L1) comprising

a polymer (L1) having a glass transition temperature below 0 °C and at least another layer (IM1L2) comprising a polymer (L2) having a glass transition temperature over 45 °C

5 characterized that the three components a), b) and c) add up to 100wt%,

wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is at least 85/15,

said process comprises the step of

10 blending the three components of a), b) and c), while the two components b) and c) and at least 83.33wt% of compound a) are in form of a dispersion in aqueous phase during the blending step

[020c] In another aspect, there is provided a process for
15 preparing a composition P1 as defined above, wherein said inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1.

[020d] In another aspect, there is provided a process for preparing a polymeric composition P2 comprising polymer
20 composition P1 as defined above or obtained by a process as defined above,

the said polymeric composition P2 comprises also

d) a thermoplastic polymer TP1

said process comprises the step of

25 blending the compositions P1 and the thermoplastic polymer TP1.

[020e] In another aspect, there is provided the use of a composition as defined above or obtained by a process as defined above, for increasing the melt fracture resistance of a
30 thermoplastic polymer TP1.

[020f] In another aspect, there is provided the use of a composition as defined above or obtained by a process as defined above, for transforming a polymeric composition P2 that comprises said polymeric composition P1 and a thermoplastic polymer TP1.

35 **[020g]** In another aspect, there is provided an article comprising polymer composition P2 obtained by a process as

defined above, characterized that the article is a profile, a pipe, a siding, a flooring film, sheet or foamed article.

[021] Surprisingly it has been found that a polymer composition P1 comprising

- 5 a) from 30wt% to 60wt% of an inorganic compound (F),
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) and
- c) a polymeric impact modifier (IM1);

characterized that the three components of a), b) and c) add up to 100wt%, increases the melt fracture resistance of thermoplastic
10 polymers while giving good impact properties.

[022] Surprisingly it has also been found that a process for preparing a polymer composition P1 comprising

- a) from 30wt% to 60wt% of an inorganic compound (F)
- 15 b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
- c) a polymeric impact modifier (IM1);

characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of

- blending the three components a), b) and c), while the two
- 20 components of b) and c) and at least 83.33wt% of compound of
- a) are in form of a dispersion in aqueous phase during the
- blending step;

yields to a polymer composition that increases the melt fracture resistance of thermoplastic polymers while giving good impact
25 properties.

[023] Surprisingly it has also been found that a process for preparing a polymer composition P1 comprising

- a) from 30wt% to 60wt% of an inorganic compound (F)
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
- c) a polymeric impact modifier (IM1);

characterized that the three components of a), b) and c) add up to
5 100wt%, said process comprises the step of

- i) blending the three components of a), b) and c), while the two components of b) and c) and at least 83.33wt% of compound a) are in form of a dispersion in aqueous phase during the blending step,

- 10 ii) drying the blend obtained in step i);

yields to a polymer composition that increases the melt fracture resistance of thermoplastic polymers while giving good impact properties.

15 **[024]** Surprisingly it has also been found that a polymer composition P1 comprising

- a) from 30wt% to 60wt% of an inorganic compound (F)
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
- c) a polymeric impact modifier (IM1);

20 characterized that the three components of a), b) and c) add up to 100wt%, can be used to increase the productivity of the extrusion of thermoplastic polymers.

[Detailed description of the invention]

25 **[025]** According to a first aspect, the present invention relates to a polymer composition P1 comprising

- a) from 30wt% to 60wt% of an inorganic compound (F),
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) and
- c) a polymeric impact modifier (IM1);

30 characterized that the three components of a), b) and c) add up to 100wt%.

[026] According to a second aspect, the present invention relates to a polymer composition P1 comprising

- 35 a) from 30wt% to 60wt% of an inorganic compound (F),

said inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1,

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) and

5 c) a polymeric impact modifier (IM1);

characterized that the three components of a), b) and c) add up to 100wt%.

[027] In a third aspect the present invention relates to a process
10 for preparing a polymeric composition P1 comprising

a) from 30wt% to 60wt% of an inorganic compound (F)

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)

c) a polymeric impact modifier (IM1)

characterized that the three components a), b) and c) add up to
15 100wt%, said process comprises the step of

blending the three components of a), b) and c), while the two components of b) and c) and at least 83.33wt% of compound a) are in form of a dispersion in aqueous phase during the blending step.

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[028] In a fourth aspect the present invention relates to a process for preparing a polymeric composition P1 comprising

a) from 30wt% to 60wt% of an inorganic compound (F)

said inorganic compound (F) consists of a mineral
25 filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1,

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) and

c) a polymeric impact modifier (IM1);

characterized that the three components of a), b) and c) add up to
30 100wt%, said process comprises the step of

blending the three components a), b) and c), while the three components of b), c) and mineral filler (F1) are in form of a dispersion in aqueous phase during the blending step.

[029] In a fifth aspect the present invention relates to a process
35 for preparing a polymeric composition P1 comprising

a) from 30wt% to 60wt% of an inorganic compound (F)

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)

c) a polymeric impact modifier (IM1)

characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of

5 i) blending the three components of a), b) and c), while the two components of b) and c) and at least 83.33wt% of compound a) are in form of a dispersion in aqueous phase during the blending step,

ii) drying the blend obtained in step i).

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[030] In a sixth aspect the present invention relates to a process for preparing a polymeric composition P1 comprising

a) from 30wt% to 60wt% of an inorganic compound (F)

15 said inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1,

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1) and

c) a polymeric impact modifier (IM1);

20 characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of

i) blending the three components a), b) and c), while the three components of b), c) and mineral filler (F1) are in form of a dispersion in aqueous phase during the blending step

25 ii) drying the blend obtained in step i).

[031] In a seventh aspect the present invention relates to a process for preparing a polymeric composition P2 comprising polymer composition P1, said polymer composition P1 comprises

30 a) from 30wt% to 60wt% of an inorganic compound (F)

b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)

c) a polymeric impact modifier (IM1),

characterized that the three components of a), b) and c) add up to 100wt%, and the said polymeric composition P2 comprises also

35 d) a thermoplastic polymer TP1

said process comprises the step of

blending the compositions P1 and the thermoplastic polymer TP1.

[032] In a eighth aspect the present invention relates to the use
5 of a polymeric composition P1 comprising
a) from 30wt% to 60wt% of an inorganic compound (F)
b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
c) a polymeric impact modifier (IM1),
characterized that the three components of a), b) and c) add up to
10 100wt%, for increasing the melt fracture resistance of a
thermoplastic polymer TP1.

[033] In a ninth aspect the present invention relates to the use of
a polymeric composition P1 comprising
15 a) from 30wt% to 60wt% of an inorganic compound (F)
b) from 5wt% 15wt% a (meth)acrylic copolymer (A1)
c) a polymeric impact modifier (IM1),
characterized that the three components of a), b) and c) add up to
100wt%, for transforming a polymeric composition P2 that comprises
20 said polymeric composition P1 and a thermoplastic polymer TP1 .

[034] By the term "polymeric composition" as used is denoted that
the composition consists of polymers of at least 40wt%.

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

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

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

[038] By the term "polymer powder" as used is denoted a polymer
comprising powder grain in the range of at least 1 micrometer (μm)
obtained by agglomeration of primary polymer comprising particles
35 in the nanometer range.

[039] By the term "primary particle" as used is denoted a spherical
shape polymer comprising particle in the nanometer range.

Preferably the primary particle has a weight average particle size between 20nm and 500nm.

[040] By "multistage polymer" as used is denoted a polymer formed in sequential fashion by a multi-stage polymerization process.

5 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.

10 **[041]** By the term "dispersion" as used is denoted a colloidal system with a continuous liquid phase and a discontinuous solid phase that is distributed throughout the continuous phase.

[042] By the term "emulsion" as used is denoted a liquid/liquid mixture of a liquid discontinuous phase in a liquid continuous
15 phase.

[043] By the term "PVC" as used is understood polyvinyl chloride in form of homopolymer or copolymer comprising at least 50wt% of vinyl chloride.

[044] By the term "filler" as used is understood a solid extender
20 added to a polymer in order to enhance properties and/or reduce costs.

[045] By the term "flow aid" as used is understood an anti caking agent, that allows a good flow ability of the powder and avoids caking.

25 **[046]** By the abbreviation "phr" is meant parts per hundred parts of resin. For example 15phr of filler in a PVC formulation means that 15kg of filler are added to 100kg of PVC.

[047] By "that the three components of a), b) and c) add up to 100wt%" as used, is meant that the ratio of the three components
30 of a), b) and c) is only calculated from the sum of these three components. If there are other additional components outside of a), b) and c), they are not taken into account for the calculation of the weight ratio between the three of them.

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

[049] 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.

5 [050] With regard to the polymeric composition P1 of the present invention, it comprises at least three components a) from 30wt% to 60wt% of an inorganic compound (F), b) from 2wt% to 15wt% a (meth)acrylic copolymer (A1) and c) a polymeric impact modifier (IM1) latter chosen in a relative quantity so that the three
10 components add up to 100wt%. The component c) the polymeric impact modifier (IM1) in the polymeric composition P1 is between 25wt% and 68wt%.

[051] The component b) could also be a mixture of several (meth)acrylic copolymers (A1) to (Ax). Each (meth)acrylic
15 copolymer having a specific different characteristic.

[052] The component c) could also be a mixture of several polymeric impact modifiers (IM1) to (IMx). Each polymeric impact modifier having a specific different characteristic.

[053] Preferably the polymeric composition P1 comprises a) between
20 30wt% and 60wt% of an inorganic compound (F), b) between 2wt% and 15wt% a (meth)acrylic copolymer (A1) and c) a polymeric impact modifier (IM1) latter chosen in a relative quantity so that the three components add up to 100wt%.

[054] The inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at
25 least 5/1.

[055] More preferably the composition P1, of the present invention comprises a) between 30wt% and 60wt% of an inorganic compound (F), b) between 2wt% and 12wt% a (meth)acrylic copolymer (A1) and c) a
30 polymeric impact modifier (IM1) latter chosen in a relative quantity so that the three components add up to 100wt%. Still more preferably the composition P1 comprises a) between 30wt% and 50wt% of an inorganic compound (F), b) between 3wt% and 10wt% a (meth)acrylic copolymer (A1) and c) a polymeric impact modifier
35 (IM1) latter chosen in a relative quantity so that the three components add up to 100wt%.

[056] Advantageously the composition P1, of the present invention comprises a) between 40wt% and 50wt% of an inorganic compound (F), b) between 4wt% and 10wt% a (meth)acrylic copolymer (A1) and c) a polymeric impact modifier (IM1) latter chosen in a relative quantity so that the three components add up to 100wt%.

[057] The polymeric composition P1 according to the invention is preferably in form of a powder comprising the three components. The powder is composed of grains of aggregated particles of the three components. These particles are the primary particles.

[058] With regard to the polymer powder of the invention, it has a volume median particle size D50 between 1µm and 500µm. Preferably the volume median particle size of the polymer powder is between 10µm and 450µm, more preferably between 15µm and 400µm and advantageously between 20µm and 300µm.

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

[060] The D90 of the particle size distribution in volume is at most 800µm and preferably at most 500µm.

[061] The powder according to the invention is homogenous in view of the composition concerning the three components.

[062] Homogeneous in the present invention signifies no important variation throughout the composition. If one or several small samples (1g or less comprising several powder grain particles) is/are taken from a larger quantity (1kg) of the composition there is no important variation of the composition concerning the weight ratio of the three respective components in the small sample in comparison to other small samples and the global composition. By no important variation is meant that the variation is less than 30% relative to the global composition. As an example, if the global composition P1 comprises 40wt% of the inorganic compound (F), 10wt% of the (meth)acrylic copolymer (A1) and 50wt% of the polymeric impact modifier (IM1), a small first sample taken from the global composition that would comprise 35wt of the inorganic compound (F), 11% of the (meth)acrylic copolymer (A1) and 54wt% of the polymeric impact modifier (IM1) or small second sample taken from the global composition that would comprise 42wt of the inorganic compound (F), 10% of the (meth)acrylic copolymer (A1)

and 48wt% of the polymeric impact modifier (IM1), would signify a homogenous composition as the variation of ratio of the respective components throughout the small samples is within the 30% variation in view of the global composition of the sample.

5 **[063]** Preferably the variation of the components within the composition is less than 25%, more preferably less than 20%.

[064] In an ideal case each powder particle or grain comprises all three components a), b) and c) and is composed of aggregated particles of the three components.

10 **[065]** The polymer composition P1 according to the present invention which is preferably in form of a powder, is more preferably a dry powder. By dry is meant that the powder has a certain maximum level of humidity.

15 **[066]** The dry polymer composition P1 in form of a powder according to the present invention comprises less than 3wt% humidity and preferably less than 1.5wt% humidity and more preferably less than 1.2wt% humidity.

20 **[067]** The dry polymer composition P1 in form of a powder according to the present invention can comprise additionally a flow aid (F2). The flow aid (F2) is preferably an inorganic compound. Therefor the flow aid (F2) is part of the inorganic compound (F) of the composition P1. The inorganic compound (F) is consisting of the flow aid (F2) and an inorganic filler (F1): $(F) = (F1) + (F2)$ The quantity of the flow aid (F2) is much less important in the
25 polymer composition P1 than the inorganic filler (F1). The quantity of (F1) is at least 5 times more important than the quantity of (F2)

30 **[068]** The density of the polymer composition P1 is at least 1.25g/cm³, preferably at least 1.3g/cm³ and more preferably at least 1.33g/cm³.

[069] The density of the polymer composition P1 is at most 1.75g/cm³, preferably at most 1.7g/cm³ and more preferably at most 1.67g/cm³.

35 **[070]** Advantageously the density of the polymer composition P1 is between 1.25g/cm³ and 1.75g/cm³, and more advantageously between 1.3g/cm³ and 1.7g/cm³.

[071] With regard to the inorganic compound (F) it is either an inorganic filler or mineral filler (F1) or it comprises both an inorganic filler or mineral filler (F1) and a flow aid (F2).

5 [072] Preferably the inorganic compound (F) comprises a mineral filler (F1) and a flow aid (F2). More preferably the weight ratio (F1)/(F2) is at least 5/1.

[073] With regard to the mineral filler (F1), mention may be made of glass fibers, hollow glass microspheres, inorganic compounds, such as minerals and salts including calcium carbonate (CaCO_3),
10 silica, silicates such as calcium silicate or metasilicate, clay such as bentonite, mica, talc, alumina trihydrate, magnesium hydroxide, metal oxides, or combinations of two or more thereof.

[074] Preferably the mineral filler (F1) is chosen from calcium carbonate, titanium dioxide or calcinated clay, silica (fumed or
15 precipitated), clay, Montmorillonite (nano-clay), zeolite, perlite or any other type of inorganic material that can be obtained as a slurry.

[075] More preferably the mineral filler (F1) is chosen from calcium carbonate, calcinated clay, silica (fumed or
20 precipitated), clay, Montmorillonite (nano-clay), zeolite or perlite.

[076] The mineral filler (F1) of the inorganic compound (F) could also be a mixture of several mineral fillers (F1a) to (F1x).

[077] In a still more preferred embodiment the mineral filler (F1)
25 is calcium carbonate (CaCO_3).

[078] Advantageously the calcium carbonate is chosen from precipitated calcium carbonate (PCC), grinded natural calcium carbonate (GCC) or nanosized particles of precipitated calcium carbonate (NPCC).

30 [079] The mineral filler (F1) or at least a part of the mineral filler (F1) could also be in form of a slurry for the process for preparing the polymeric composition P1.

[080] Preferably the filler (F1) or at least a part of the mineral filler (F1), that is blended with the (meth)acrylic copolymer (A1)
35 and the polymeric impact modifier (IM1), is in form of a slurry.

[081] As regards the slurry of the mineral filler, it is a water dispersion of a mineral filler with solid content preferably

between 5wt% and 90wt% and advantageously between 50wt% and 80wt%. This water dispersion can contain any specific surfactant, dispersing agent, additive or filler surface treatment that can advantageously improve the quality of the slurry (stability, viscosity or compatibility with the host polymer matrix).

[082] With regard to the flow aid (F2) it is an inorganic powder.

[083] The flow aid (F2) could also be a mixture of several flow aid (F2a) to (F2x).

[084] Advantageously the flow aid (F2) is chosen from calcium carbonate (CaCO₃).

[085] With regard to the (meth)acrylic copolymer (A1), it is a (meth) acrylic copolymer comprising at least 50wt% of polymeric units coming from methyl methacrylate.

[086] Preferably the (meth)acrylic copolymer (A1) has a glass transition temperature of less than 106°C.

[087] More preferably the polymer (A1) comprises a comonomer or comonomers which are copolymerizable with methyl methacrylate, as long as polymer (A1) is having a glass transition temperature of less than 106°C.

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

[089] The (meth)acrylic comonomer in (meth)acrylic copolymer (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 acrylate monomers.

[090] Most preferably the acrylic or methacrylic comonomers of the (meth)acrylic copolymer (A1) or the two (meth)acrylic copolymers (A1a) and (A1b) are chosen from methyl acrylate, propyl acrylate, isopropyl acrylate, butyl acrylate, tert-butyl acrylate, methyl methacrylate, ethyl methacrylate, butyl methacrylate and mixtures thereof, as long as (meth)acrylic copolymer (A1) or the mixture of two (meth)acrylic copolymers (A1a) and (A1b) is having a glass transition temperature of less than 106°C.

[091] Preferably the (meth)acrylic copolymer (A1) comprises at most 90wt%, more preferably at most 85wt% and advantageously at most 81wt% of polymeric units coming from methyl methacrylate.

5 [092] In a specific embodiment the (meth)acrylic copolymer (A1) is a copolymer of methyl methacrylate with ethyl acrylate and/or butyl acrylate.

[093] More preferably the glass transition temperature T_g of the (meth)acrylic polymer (A1) comprising at least 50wt% of polymeric units coming from methyl methacrylate is between 60°C and 106°C,
10 even more preferably between 65°C and 100°C and advantageously between 70°C and 100°C.

[094] The glass transition temperature T_g can be estimated for example by dynamic methods as thermo mechanical analysis.

[095] Preferably the mass average molecular weight M_w of the
15 (meth)acrylic copolymer (A1) or the two (meth)acrylic copolymers (A1a) and (A1b) comprising at least 50wt% of polymeric units coming from methyl methacrylate is at least 1 000 000g/mol, preferably at least 1 500 000g/mol, more preferably at least 2 000 000g/mol, advantageously at least 2 500 000 g/mol and most
20 advantageously at least 3 000 000g/mol.

[096] Preferably the mass average molecular weight M_w of the (meth)acrylic copolymer (A1) or the two (meth)acrylic copolymers (A1a) and (A1b) comprising at least 50wt% of polymeric units coming from methyl methacrylate is less than 10 000 000g/mol,
25 preferably less than 9 000 000g/mol, more preferably less than 8 000 000g/mol, advantageously less than 8 500 000 g/mol and most advantageously at 7 000 000g/mol.

[097] The (meth)acrylic copolymer (A1) comprising at least 50wt% of polymeric units coming from methyl methacrylate is preferably
30 prepared by an emulsion polymerisation, yielding to an aqueous dispersion of spherical shape polymer particles of the (meth)acrylic copolymer (A1).

[098] A possible variation of the method for preparing an aqueous dispersion of spherical shape polymer particles comprising the
35 (meth)acrylic copolymer (A1) is by using a multistage process.

[099] During one stage of the multistage process the (meth)acrylic copolymer (A1) is prepared.

[0100] With regard to the spherical shaped polymer particle comprising the (meth)acrylic copolymer (A1), it has a weight average particle size between 20nm and 500nm. Preferably the weight average particle size of the polymer is between 50nm and 400nm, more preferably between 75nm and 350nm and advantageously between 80nm and 300nm.

[0101] With regard to the polymeric impact modifier (IM1), it is preferably a polymer particle having a multilayer structure.

[0102] The polymer particle having a multilayer structure is more or less spherical shape. The polymer particle has a weight average particle size (diameter) between 20nm and 500nm. Preferably the weight average particle size of the polymer particle is between 50nm and 400nm, more preferably between 75nm and 350nm and advantageously between 80nm and 300nm.

[0103] The polymer particle according to the invention is obtained by a multistage process such as two or three stages or more stages, each stage yield to a layer, the whole process yields to a particle with a multilayer structure

[0104] The polymeric impact modifier (IM1) in form of the polymeric particle having a multilayer structure comprising at least one layer (IM1L1) comprising a polymer (L1) having a glass transition temperature below 0°C and at least another layer (IM1L2) comprising a polymer (L2) having a glass transition temperature over 45°C.

[0105] More preferably the glass transition temperature Tg of the polymer (L1) is between -100°C and 0°C, even more preferably between -80°C and 0°C and advantageously between -80°C and -20°C and more advantageously between -70°C and -20°C.

[0106] Preferably the glass transition temperature Tg of the polymer (L2) is between 60°C and 150°C. The glass transition temperature of the polymer (L2) is more preferably between 80°C and 140°C, advantageously between 90°C and 135°C and more advantageously between 90°C and 130°C.

[0107] In order to obtain a sample of the respective polymers (L1) and (L2) they can be prepared alone, and not by a multistage process, for estimating and measuring more easily the glass

transition temperature Tg individually of the respective polymers of the respective stages.

[0108] The weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is preferably at least 70/30, more preferably at least 80/20, even more preferably at least 85/15, advantageously at least 86/14, more advantageously 87/13, even more advantageously 88/12 and most advantageously 89/11.

[0109] The weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is preferably in a range by weight between 70/30 and 99/1, more preferably 80/20 and 98/2, even more preferably 85/15 and 97/3, advantageously 86/14 and 97/3, more advantageously 87/13 and 97/3, even more advantageously 88/12 and 97/3 and most advantageously 89/11 to 96/4.

[0110] Preferably the polymer L1 presents more than 85wt% of the polymeric impact modifier (IM1) and more preferably more than 86wt% and advantageously more than 87wt%.

[0111] The multi-layer structure of IM1 can have different structures. The layer (IM1L1) comprising a polymer (L1) having a glass transition temperature below 0°C, can be the core of the polymeric impact modifier (IM1) or an intermediate layer, but never the most outer layer. The layer (IM1L2) comprising a polymer (L2) having a glass transition temperature over 45°C can be the most outermost layer.

[0112] The layer (IM1L2) comprising a polymer (L2) is preferably a (meth) acrylic copolymer comprising at least 50wt% of polymeric units coming from methyl methacrylate. Preferably the polymer (L2) or the majority of the polymer (L2) of the layer (IM1L2) is grafted on the layer situated below.

[0113] In a first preferred embodiment of (IM1), the polymer (L1) having a glass transition temperature below 0°C is a (meth) acrylic polymer comprising at least 50wt% of monomers from alkyl acrylates.

[0114] More preferably the polymer (L1) 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.

[0115] The comonomer or comonomers in polymer (L1) are preferably chosen from (meth)acrylic monomers and/or vinyl monomers.

[0116] The (meth)acrylic comonomer in polymer (L1) comprises monomers chosen from C1 to C12 alkyl (meth)acrylates. Still more preferably (meth)acrylic comonomer in polymer (L1) comprises monomers of C1 to C4 alkyl methacrylate and/or C1 to C8 alkyl acrylate monomers.

[0117] Most preferably the acrylic or methacrylic comonomers of the polymer (L1) are chosen from methyl acrylate, propyl acrylate, isopropyl acrylate, butyl acrylate, tert-butyl acrylate, methyl methacrylate, ethyl methacrylate, butyl methacrylate and mixtures thereof, as long as polymer (L1) is having a glass transition temperature of less than 0°C.

[0118] Preferably the polymer (L1) 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.

[0119] In one specific embodiment polymer (L1) is a homopolymer of butyl acrylate.

[0120] In another specific embodiment polymer (L1) is a copolymer of butyl acrylate and at least one crosslinker. The crosslinker presents less than 5wt% of this copolymer.

[0121] More preferably the glass transition temperature Tg of the polymer (L1) 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.

[0122] In a second preferred embodiment the polymer (L1) having a glass transition temperature below 0°C comprises at least 50wt% of polymeric units coming from isoprene or butadiene and the stage or layer (IML1) is the most inner layer of the polymer particle having the multilayer structure. In other words the stage for making the layer (IM1L1) comprising a polymer (L1) is the core of the polymer particle.

[0123] By way of example, the polymer (L1) 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.

5 **[0124]** More preferably the glass transition temperature T_g of the polymer (L1) of the second 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 , advantageously between -90°C and -15°C and even more
10 advantageously between -90°C and -25°C .

[0125] With regard to the thermoplastic polymer TP1 it is chosen from halogen containing polymers, such as for example polyvinyl
15 chloride, polyamide, polymethyl methacrylate, polystyrene, polycarbonate, polyesters such as polyethylene terephthalate, polybutylene terephthalate, polycyclohexanedimethanol terephthalate, and polyolefins.

[0126] In a first preferred embodiment the thermoplastic polymer
20 TP1 is a halogen containing polymer.

[0127] With regard to the halogen containing polymer, mention may be made of:

[0128] homopolymers and copolymers of vinyl chloride (PVC) and of
25 vinylidene chloride (PVDC), vinyl resins comprising vinyl chloride units in their structure, such as copolymers of vinyl chloride, and vinyl esters of aliphatic acids, especially vinyl acetate, copolymers of vinyl chloride with esters of acrylic and methacrylic acid and with
30 acrylonitrile, copolymers of vinyl chloride with diene compounds and unsaturated dicarboxylic acids or their anhydrides, such as copolymers of vinyl chloride with diethyl maleate, diethyl fumarate or maleic anhydride, post-chlorinated polymers and copolymers of vinyl chloride,
35 copolymers of vinyl chloride and vinylidene chloride with unsaturated aldehydes, ketones and others, such as acrolein, crotonaldehyde, vinyl methyl ketone, vinyl methyl

ether, vinyl isobutyl ether and the like; polymers of vinylidene chloride and its copolymers with vinyl chloride and other polymerizable compounds;

[0129] polymers of vinyl chloroacetate and dichlorodivinyl ether;

5 chlorinated polymers of vinyl carboxylate, such as vinyl acetate, vinyl propionate, vinyl butyrate, chlorinated polymeric esters of acrylic acid and of α -substituted acrylic acid, such as methacrylic acid, of nitriles, amides, alkyl esters such as acrylonitrile, 10 (meth)acrylamide, methyl (meth)acrylate, butyl acrylate, ethyl acrylate, 2-ethylhexyl acrylate;

[0130] polymers of vinyl aromatic derivatives, such as styrene, dichlorostyrene; chlorinated rubbers;

[0131] chlorinated polymers of olefins, such as ethylene, propene, 15 1-butene, (2.2.1)bicyclo heptene-2, (2.2.1)bicyclo heptadiene-2,5;

[0132] polymers and post-chlorinated polymers of chlorobutadiene and copolymers thereof with vinyl chloride, chlorinated natural and synthetic rubbers, and also mixtures of these 20 polymers with one another or with other polymerizable compounds.

[0133] grafted halogen containing copolymers, where the halogen containing polymer part is grafted on an (meth)acrylic homo or copolymer, in form of a particles, which could be 25 crosslinked or not.

[0134] Preferably the halogen containing polymer is a thermoplastic polymer and not an elastomeric polymer. The glass transition temperature of the thermoplastic polymer is at least 40°C, preferably 50°C.

30 [0135] Preferably the halogen in the halogen containing polymer is chosen from fluorine or chlorine and advantageously the halogen is chlorine.

[0136] The chlorine containing polymer is chosen from among polymers or mixtures of polymers chosen from among homopolymer 35 vinyl chlorides such as polyvinyl chloride, polyvinylidene chloride, chlorinated polyvinyl chloride, post-chlorinated polyvinyl chloride and copolymers formed by the polymerisation of

a vinyl chloride monomer with up to 40% of a comonomer such as vinyl acetate, vinyl butyrate, vinylidene chloride, propylene, methyl methacrylate and the like, as well as chlorine-containing polymers containing other polymers such as chlorinated polyethylene, terpolymers of acrylonitrile, butadiene, styrene, terpolymers of methyl methacrylate, butadiene, styrene; polyacrylate resins, poly methyl methacrylate resins and terpolymer of alkyl acrylate, methyl methacrylate, butadiene, preferably the chlorine-containing polymer is polyvinyl chloride or post-chlorinated polyvinyl chloride.

[0137] Preferably the chlorine containing polymer is chosen from homo- and copolymers of vinyl chloride (VC); comprising at least 50wt% of VC units, preferably at least 70 wt% of VC units, more preferably at least 80 wt% of VC units, advantageously at least 85 wt% of VC units; or mixtures thereof.

[0138] With regard to the process for preparing a polymeric composition P1 according to the present invention comprising

- a) from 30wt% to 60wt% of an inorganic compound(F)
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
- c) a polymeric impact modifier (IM1)

characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of

blending the three components of a), b) and c), while the two components of b) and c) and at least 83.33wt% of compound of a) are in form of a dispersion in aqueous phase during the blending step.

[0139] With regard to a first preferred process for preparing a polymeric composition P1 according to the present invention comprising

- a) from 30wt% to 60wt% of an inorganic compound(F)
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
- c) a polymeric impact modifier (IM1)

characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of

i) blending the three components of a), b) and c), while the two components of b) and c) and at least 83.33wt% of compound of a) are in form of a dispersion in aqueous phase during the blending step

5 ii) drying the blend obtained in step i).

[0140] With regard to a second preferred process for preparing a polymeric composition P1 according to the present invention comprising

10 a) from 30wt% to 60wt% of an inorganic compound (F),
said inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1,
b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
15 c) a polymeric impact modifier (IM1)
characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of
blending the three components of a), b) and c), while the three components b), c) and (F1) are in form of a dispersion
20 in aqueous phase during the blending step.

[0141] More preferably the process for preparing a polymeric composition P1 comprising

25 a) from 30wt% to 60wt% of an inorganic compound (F)
said inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1,
b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
30 c) a polymeric impact modifier (IM1)
characterized that the three components of a), b) and c) add up to 100wt%, said process comprises the step of
i) blending the three components a), b) and c), while the three components b), c) and (F1) are in form of a dispersion
35 in aqueous phase during the blending step,
ii) drying the blend obtained in step i).

[0142] Additionally the process can include additionally the step of recovering the obtained blend of previous step in order to form a polymer powder or as a polymer powder.

[0143] The quantities of the aqueous dispersion of the three components of a), b) and c) or (F1) are chosen on the solid content of each respective dispersion, in order to obtain the composition of polymeric composition P1 on the solid part.

[0144] The recovering step of the process for manufacturing the polymer composition according to the invention, is preferably made by coagulation or by spray drying. It is obvious that the spray drying combines the recovering and drying in one process step.

[0145] In the case of spray drying it is possible to blend or mix the respective dispersions of the components of a), b) and c) before adding the liquid mixture to the spray drying apparatus. It is also possible to blend or mix the dispersion inside the spray drying apparatus during the recovering step.

[0146] Spray drying is the preferred method for the recovering and/or drying for the process of preparing polymeric composition P1.

[0147] The polymeric composition P1 after drying comprises less than 3wt% humidity and preferably less than 1.5wt% humidity and more preferably less than 1.2wt% humidity.

[0148] The present invention relates also to a process for preparing a polymeric composition P2 comprising polymer composition P1, said polymer composition P1 comprises

- a) from 30wt% to 60wt% of an inorganic compound (F)
- b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
- c) a polymeric impact modifier (IM1),

characterized that the three components of a), b) and c) add up to 100wt%, and the said polymeric composition P2 comprises also

- d) a thermoplastic polymer TP1

said process comprises the step of

blending the compositions P1 and the thermoplastic polymer TP1.

[0149] Preferably in the process for preparing a polymeric composition P2, the polymer composition P1 is prepared according to the process described earlier.

5 [0150] The inorganic compound (F), the (meth)acrylic copolymer (A1), polymeric impact modifier (IM1), polymer composition P1 and thermoplastic polymer TP1 are the same as defined before.

[0151] Preferably blending the compositions P1 and the thermoplastic polymer TP1 is made by means known by one skilled in the art of blending polymeric compositions as dry blending or
10 compounding of components then melt processed.

[0152] The ratio of the polymer composition P1 in the polymeric composition P2 is between 1 and 20phr, preferably between 2 and 15phr, more preferably between 3 and 12 phr and advantageously between 3 and 10phr.

15 [0153] The present invention relates to the use of a polymeric composition P1 comprising

a) from 30wt% to 60wt% of an inorganic compound (F)
b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
20 c) a polymeric impact modifier (IM1),
characterized that the three components of a), b) and c) add up to 100wt%, for increasing the melt fracture resistance of a thermoplastic polymer TP1.

[0154] After the use, the thermoplastic polymer TP1 comprises the
25 polymeric composition P1 and gives polymeric composition P2.

[0155] Preferably in the process for preparing a polymeric composition P2, and the polymer composition P1 is prepared according to the processes described earlier.

[0156] The inorganic compound (F), the (meth)acrylic copolymer (A1), polymeric impact modifier (IM1), polymer composition P1 and
30 thermoplastic polymer TP1 are the same as defined before.

[0157] The present invention relates to the use of a polymeric composition P1 comprising

35 a) from 30wt% to 60wt% of an inorganic compound (F)
b) from 2wt% 15wt% a (meth)acrylic copolymer (A1)
c) a polymeric impact modifier (IM1),

characterized that the three components of a), b) and c) add up to 100wt%, for transforming a polymeric composition P2 that comprises said polymeric composition P1 and a thermoplastic polymer TP1.

5 [0158] Preferably in the process for preparing a polymeric composition P2, the polymer composition P1 is prepared according to the process described earlier.

[0159] The inorganic mineral filler (F), the (meth)acrylic copolymer (A1), polymeric impact modifier (IM1), polymer composition P1 and thermoplastic polymer TP1 are the same as
10 defined before.

[0160] Preferably the transformation of polymeric composition P2 that comprises said polymeric composition P1 and a thermoplastic polymer TP1 is made by extrusion.

[0161] The polymer composition P1 is used in the polymeric
15 composition P2 in a ratio of between 1 and 20phr, preferably between 2 and 15phr, more preferably between 3 and 12phr and advantageously between 3 and 10phr.

[0162] The present invention relates also to an article comprising
20 the polymeric composition P2 as described above. This article can be a profile, a pipe, a siding, a flooring film, a sheet or a foamed article.

[0163] The present invention relates also to an article comprising
25 the polymeric composition P2 as described above, as a coextruded layer or as layer of a laminated structure or as at least one layer of an multilayer structure.

[Methods of evaluation]

30 [0164] Glass transition Temperature

The glass transitions (Tg) of the polymers or mixture of polymers are measured 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
35 measures precisely the visco-elastics changes of a sample in function of the temperature, the strain or the deformation

applied. The used frequency is 1Hz. The 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 and the tan delta. The T_g is higher temperature value read in the tan delta curve, when the derived of tan delta is equal to zero.

[0165] For the estimation of volume average powder particle size, particle size distribution and ratio of fine particles a Malvern Mastersizer 300 apparatus with a 300mm lenses, measuring a range from 0.5-880 μ m is used. The $D(v, 0.5)$ is the particle size at which 50% of the sample has size less then and 50% of the sample have a size larger then that size, or in other words the equivalent volume diameter at 50% cumulative volume. This size is also known as volume medium diameter (abbreviated D50) that is related to the mass or weight median diameter by the density of the particles assuming a size independent density for the particles.

[0166] Molecular Weight

[0167] The mass average molecular weight (M_w) of the polymers is measured with by size exclusion chromatography (SEC).

[0168] Fusion efficiency

[0169] The fusion efficiency of the polymer composition is estimated by measuring the fusion time with a torque rheometer based on ASTM D2538-02 (reapproved 2010). A shorter fusion time signifies a better fusion efficiency and interpreted as a more efficient process.

[0170] Melt strength

[0171] The melt strength was evaluated with a RHEOTENS GOTTFERT equipment which was used to compare the different melt strength of the respective PVC composition. Roll speed at break (mm/s) and strength at break (N) were reported to evaluate the melt fracture resistance of the different composition.

[0172] Impact strength

[0173] ASTM D5420 standard was used to evaluate the dart drop impact resistance of the compositions. Normalized Mean Failure Energy (in*lbs/mil) was reported for comparison.

[0174] The DIN 53753 method was used to evaluate the double V-notch impact strength. 0.1mm notch radius was used. Impact test were evaluated at controlled room temperature. Pendulum energy was 1J. 10 samples were used to evaluate an average impact energy with its standard deviation. Information on the type of failure (Ductile or Fragile) is also given.

[0175] Microscopy

[0176] Microscopy on the powder is performed with Scanning Electron Microscopy (SEM). With the detection of back scattered electrons the inorganic filler for example calcium carbonate can be easily detected in each powder grain.

[0177] Atomic Force Microscopy is performed in tapping mode in order to obtain about the dissipated energy of the cantilever information about the varying stiffness of the sample, due to different glass transition temperature of polymers and the inorganic filler.

[Examples]

[0178] Following materials are used or prepared:

[0179] The (meth)acrylic copolymer (A1) is prepared in this way:

[0180] A first (meth)acrylic copolymer (A1a): Charged into a reactor, with stirring, were 8600 g of water, 5.23 g of Na₂CO₃ and 38.20 g of sodium lauryl sulfate, and the mixture was stirred until complete dissolution. 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 4166.4 g of methyl methacrylate and 1041.6 g of n-butyl acrylate was nitrogen-degassed for 30 minutes. Next, the mixture was rapidly introduced into the reactor using a pump. When the temperature of the reaction mixture reached 55 degrees centigrade, 7.81 g of potassium persulfate dissolved in 98.08 g of water were introduced. The line was rinsed with 50 g of water. The reaction mixture was left to rise in temperature to the exothermal peak. The polymerization was then left to completion for 60 minutes

after the exothermal peak. The reactor was cooled down to 30 degrees centigrade and the latex dispersion removed. The solid content is 38.2%.

[0181] A second (meth)acrylic copolymer (Alb): Charged into a reactor, with stirring, were 8140 g of water, 5.23 g of Na_2CO_3 and 38.20 g of sodium lauryl sulfate, and the mixture was stirred until complete dissolution. 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 3645.6 g of methyl methacrylate and 1562.4 g of n-butyl acrylate was nitrogen-degassed for 30 minutes. Next, the mixture was rapidly introduced into the reactor using a pump. When the temperature of the reaction mixture reached 55 degrees centigrade, 7.81 g of potassium persulfate dissolved in 98.08 g of water were introduced. The line was rinsed with 50 g of water. The reaction mixture was left to rise in temperature to the exothermal peak. The polymerization was then left to completion for 60 minutes after the exothermal peak. The reactor was cooled down to 30 degrees centigrade and the latex dispersion removed. The solid content is 39.5%.

[0182] A polymeric impact modifier (IM1) is prepared according to the technique described in U.S. Pat. No. 4,278,576, which employs a standard emulsion polymerization technique.

[0183] A first polymeric impact modifier (IM1a) namely a core/shell acrylic polymer impact modifier is prepared employing 89.2 parts of butyl acrylate, 0.4 parts of butylene glycol diacrylate and 0.4 parts of diallylmaleate as elastomeric core, followed by a polymerization of 10 parts of methyl methacrylate. The solid content is 40% of the aqueous dispersion.

[0184] A second polymeric impact modifier (IM1b) namely also a core/shell acrylic polymer is prepared employing 84.2 parts of butyl acrylate, 0.4 parts of butylene glycol diacrylate and 0.4 parts of diallylmaleate as elastomeric core, followed by a polymerization of 15 parts of methyl methacrylate. The solid content is 40%.

[0185] The inorganic mineral filler (F1) is calcium carbonate (CaCO_3). Slurry or dispersion of CaCO_3 is prepared according to the technique described in J.P. Pat. No. 59057913. Namely the slurry is obtained by mixing 270 parts of water, 0.72 parts of sodium polyacrylate and 729.3 parts of CaCO_3 of diam. 0.2 - 0.6 μm and 0.6% moisture and stirring for 20 min at shear rate 5 times 102/s. The obtained solid content is 73wt%.

[0186] As thermoplastic polymer TP1, polyvinylchloride PVC S110P from Kemone is used.

[0187] As flow aid (F2) calcium carbonate (PCC, 0.07 micron) is used.

[0188] The sample compositions according to table 1 are prepared as polymer composition P1 or as compositions for comparative examples in form of powders.

[0189] Comparative example 1: The impact modifier dispersion (IM1a) and the slurry of mineral filler (F1) are mixed for with the following ratio, 7.902 kg (7902 parts) of latex and 1.587 kg (1587 parts) of slurry, and spray dried in the conditions classically used for the dispersion alone. The obtained powder as a particle size ~ 150 μm . 3 weight percent calcium carbonate (PCC, 0.07 micron) is added to the recovered powder as a flow aid (F2). The resulting powder has a ratio of 70/30 acrylic impact modifier/inorganic compound CaCO_3 .

[0190] Comparative example 2: The impact modifier dispersion (IM1a) and the slurry of mineral filler (F1) are mixed for with the following ratio, 5.895 kg (5895 parts) of latex and 2.469 kg (2469 parts) of slurry, and spray dried in the conditions classically used for the dispersion alone. The obtained powder as a particle size ~ 150 μm . 3 weight percent calcium carbonate (PCC, 0.07 micron) is added to the recovered powder as a flow aid (F2). The resulting powder has a ratio of 55/45 impact modifier/inorganic compound CaCO_3 .

[0191] Comparative example 3: For this comparative example each components is spray dried alone and then the obtained powders are

mixed together with 3 weight percent calcium carbonate (PCC, 0.07 micron) as flow aid. Thus enough impact modifier dispersion (IM1a) is spray dried in order to obtain 2122g of powder. Enough process aid (meth)acrylic copolymer (Ala) dispersion is spray dried in order to obtain 235.8 g of powder. Enough calcium carbonate slurry is spray dried in order to obtain 1800g of calcium carbonate. These 3 amounts of powder are dry blended with 128.6g of Calcium carbonate (PCC, 0.07 micron) in order to obtain a dry blend composite.

10

[0192] Example 1: The two acrylic dispersions and the inorganic slurry are mixed for with the following ratio, 5.305 kg (5305 parts) of impact modifier dispersion (IM1a), 0.617 kg (617 parts) of process aid (meth)acrylic copolymer (Ala) and 2.469 kg (2469 parts) of slurry of inorganic mineral filler (F1), and spray dried in the conditions classically used for the dispersion alone. The obtained powder as a particle size ~ 150µm. 3 weight percent calcium carbonate (PCC, 0.07 micron) is added to the recovered powder as a flow aid (F2). The resulting powder has a ratio of 55/45 polymer/inorganic compound CaCO₃.

20

[0193] Example 2: Example 1 is repeated but impact modifier dispersion (IM1b) is used instead of impact modifier dispersion (IM1a).

[0194] Example 3: Example 1 is repeated but (meth)acrylic copolymer (Alb) is used instead of (meth)acrylic copolymer (Ala).

25

[0195] Table 1 Composition of powder samples

	A1 [wt%]	IM1 [wt%]	(F1) [wt%]	Flow aid (F2) [wt%]	F=F1+F2 [wt%]
Comparative example 1	0	70	27	3	30
Comparative example 2	0	55	42	3	45
Comparative example 3	5.5	49.5	42	3	45
Example 1	5.5	49.5	42	3	45
Example 2	5.5	49.5	42	3	45
Example 3	5.5	49.5	42	3	45

[0196] The prepared powder samples of comparative examples and examples of table 1 are formulated at 5.5phr in a PVC composition with PVC as thermoplastic polymer TP1. The compositions are dry blended in a Papenmeyer equipment while increasing the temperature. PVC compositions are prepared according to quantities given in table 2.

[0197] Table 2 - PVC compositions

components	Composition with quantities in phr	
PVC (TP1)	100	100*
1pack CaZn	4	4
CaCo3 filler	8	22
TiO2	8	0
Added polymeric composition from respective comparative examples and examples (P1)	5.5	4

*Composition for GARDNER falling weight impact strength

[0198] The different compositions of table 2 where process extruded in a Haake PolyLab extruder. During the extrusion the average torque and fusion pressure were followed.

[0199] The results are summarized in table 2.

[0200] Table 3 - Evaluation of the respective examples and comparative examples of table 1 during transformation and extrusion of composition of table 2

	Torque	Fusion Pressure	Fusion time	Roll speed at break	Stength at break
	[%]	[bar]	[s]	[mm/s]	[N]
Comparative example 1	66	134	185	67	0.92
Comparitive	66	131	192	52	0.90

example 2					
Comparative example 3	67	132	185	-	-
Example 1	63	125	175	82	1.01
Example 2	62	124	186	-	-
Example 3	64	128	148	87	1.00

[0201] The examples 1 to 3 show a lower torque and fusion pressure, while having better or acceptable fusion time, and especially a much higher roll speed at break and strength at break, allowing a faster extrusion due to better melt fracture resistance.

[0202] Comparative examples 1 and 2, have a higher fusion pressure and torque and lower higher roll speed at break and strength at break, while comparative example 3 has a higher fusion pressure and torque.

[0203] Specimen were prepared from extruded samples according to composition of table 2, while using examples and comparative examples of powder sample compositions of table 1. Impact properties were measure of specimens and results are given in table 4.

[0204] Table 4 - Evaluation of impact properties of the respective examples and comparative examples of table 1 after transformation and extrusion of composition of table 2.

	GARDNER falling weight impact strength ASTM D5420 [in*lbs/mil]	Double V-notch impact strength DIN 53753 [kJ/m2]	% of ductile break
Comparative example 1	2.2	n.m.	n.m.
Comparative example 2	1.6	n.m.	n.m.
Example 1	2.4	47.4	100%
Example 2	2.2	36.0	30%
Example 3	n.m.	n.m.	n.m.

n.m. - not measured

[0205] The examples 1 and 2 show the same level or even higher of falling weight impact strength, while the composition comprises less impact modifier than comparative examples.

Claims

1. A polymer composition P1 comprising:
 - 5 a) from 30wt% to 60wt% of an inorganic mineral compound (F) ,
 - b) from 2wt% to 15wt% of a (meth)acrylic copolymer (A1) or a mixture of (meth)acrylic copolymers
 - c) a polymeric impact modifier (IM1) or a mixture of polymeric impact modifiers, said polymeric impact modifier
 - 10 (IM1) being a polymer particle having a multilayer structure comprising at least one layer (IM1L1) comprising a polymer (L1) having a glass transition temperature below 0 °C and at least another layer (IM1L2) comprising a polymer (L2) having a glass transition temperature over 45 °C
 - 15 characterized that the three components of a), b) and c) add up to 100wt%;
 - wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is at least 85/15.
- 20 2. Composition according to claim 1, wherein the inorganic compound (F) consists of a mineral filler (F1) and a flow aid (F2), wherein the weight ratio (F1)/(F2) is at least 5/1.
3. Composition according to claim 1 or 2 comprising
 - 25 a) between 30wt% and 60wt% of an inorganic compound (F),
 - b) between 2wt% and 15wt% a (meth)acrylic copolymer (A1) and
 - c) a polymeric impact modifier (IM1).
4. Composition according to any of claims 1 to 3, wherein the
 - 30 composition is in form of a powder having volume median particle size D50 between 1µm and 500µm
5. Composition according to claim 4, wherein each powder particle comprises the compounds of a), b) and c).
- 35 6. Composition according to any of claims 1 to 5, wherein the polymer (L1) has a glass transition temperature between -100°C

and 0 °C and the polymer (L2) has a glass transition temperature between 60°C and 150 °C.

7. Composition according to any of claims 1 to 6, wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is at least 86/14.
8. Composition according to any of claims 1 to 7, wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is at least 87/13, even more preferably at least 88/12 and most preferably at least 89/11.
9. Composition according to any of claims 1 to 6, wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is preferably in a range by weight between 85/15 and 97/3, preferably 89/11 to 96/4 and most preferably between 90/10 and 96/4.
10. Composition according to any of claims 1 to 7, wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is preferably in a range by weight between 86/14 and 97/3, more preferably between 87/13 and 97/3, even more preferably between 88/12 and 97/3.
11. Composition according to any of claims 1 to 10, wherein the polymer L1 presents more than 85wt% of the polymeric impact modifier (IM1).
12. Composition according to claims 1 to 11, wherein the polymer L1 presents more preferably more than 86wt% and preferably more than 87wt%.
13. Composition according to any of claims 1 to 12, wherein the the polymer (L1) having a glass transition temperature below 0°C is a (meth) acrylic polymer comprising at least 50wt% of monomers from alkyl acrylates.
14. Composition according to any of claims 1 to 13 wherein at least a part of the inorganic mineral filler (F) is a mineral

filler chosen from calcium carbonate, calcinated clay, silica (fumed or precipitated), clay, Montmorillonite (nano-clay), zeolite or perlite, titanium dioxide.

- 5 15. Composition according to any of claims 1 to 14 wherein the inorganic mineral filler (F) or the mixture of it is chosen from calcium carbonate.
- 10 16. Composition according to any of claims 1 to 15 wherein the (meth)acrylic copolymer (A1) is chosen from a copolymer comprising at least 50wt% of methyl methacrylate.
- 15 17. Composition according to any of claims 1 to 16 wherein the (meth)acrylic copolymer (A1) has a weight average molecular weight of at least 1 000 000g/mol.
18. A process for preparing a polymeric composition P1 comprising
- 20 a) from 30wt% to 60wt% of an inorganic mineral compound (F)
- b) from 2wt% to 15wt% of a (meth)acrylic copolymer (A1) or a mixture of (meth)acrylic copolymers
- c) a polymeric impact modifier (IM1) or a mixture of polymeric impact modifiers, said polymeric impact modifier
- 25 (IM1) being a polymer particle having a multilayer structure comprising at least one layer (IM1L1) comprising a polymer (L1) having a glass transition temperature below 0 °C and at least another layer (IM1L2) comprising a polymer (L2) having a glass transition temperature over
- 30 45 °C
- characterized that the three components a), b) and c) add up to 100wt%,
- wherein the weight ratio of layer (IM1L1)/layer (IM1L2) in the multistage polymer is at least 85/15,
- 35 said process comprises the step of
- blending the three components of a), b) and c), while the two components b) and c) and at least 83.33wt% of compound a) are

in form of a dispersion in aqueous phase during the blending step.

19. A process for preparing a composition P1 according to claim
5 18, wherein said inorganic compound (F) consists of a mineral
filler (F1) and a flow aid (F2), wherein the weight ratio
(F1)/(F2) is at least 5/1.
20. The process according to claim 18 or 19, characterized
10 that said process comprises the step of
i) blending the three components of a), b) and c), while the
three components are in form of a dispersion in aqueous phase
during the blending step,
ii) drying the blend obtained in step i).
- 15 21. A process for preparing a polymeric composition P2 comprising
polymer composition P1 according to any of claims 1 to 17 or
obtained by a process according to any of claims 18 to 20,
the said polymeric composition P2 comprises also
20 d) a thermoplastic polymer TP1
said process comprises the step of
blending the compositions P1 and the thermoplastic polymer
TP1.
- 25 22. Use of a composition according to any of claims 1 to 17 or
obtained by a process according to any of claims 18 to 20, for
increasing the melt fracture resistance of a thermoplastic
polymer TP1.
- 30 23. Use of a composition according to any of claims for 1 to 17 or
obtained by a process according to any of claims 18 to 20, for
transforming a polymeric composition P2 that comprises said
polymeric composition P1 and a thermoplastic polymer TP1.
- 35 24. Article comprising polymer composition P2 obtained by a
process according to claim 21, characterized that the article

is a profile, a pipe, a siding, a flooring film, sheet or foamed article.