[011] Another way for impregnating the fibrous substrate is to dissolve the thermoplastic polymer in an organic solvent or using a syrup based on monomers or a mixture or monomers and polymers.

[012] In order to guarantee and obtain a satisfying mechanical performance over a large temperature range, the impact performance of the thermoplastic polymer matrix has to be increased.

[013] Usually impact modifiers in form of core-shell particles are made by a multistage process, with at least stage comprising a rubber like polymer. Afterwards the particles are incorporated in the brittle polymers for composite material or the one of the phases for the structural adhesives, in order to increase the impact resistance of the finished product.

[014] However these kind of multistage polymers are not easy to disperse in all kind of resins or polymers, especially in a homogenous distribution and/or in important quantities; for example in epoxy resins or meth acrylic resins, but also other precursors of polymeric phases or monomers for composites and structural adhesives.

[015] A good homogenous dispersion is necessary for having satisfying impact performance.

[016] The objective of the present disclosure is to propose a multistage polymer composition which is rapidly and easily dispersible in reactive epoxy resins, polyester resins or (meth)acrylic resins/polymers or liquid monomers or resins while having a suitable viscosity for the required application.

[017] An objective of the present disclosure is also to propose a multistage polymer composition which is easily dispersible in reactive epoxy resins, polyester resins or (meth)acrylic resins/polymers or liquid monomers or resins in form of a polymer powder.

[018] An additional objective of the present disclosure is to propose a multistage polymer composition in form of a dry polymer powder which is easily dispersible in reactive epoxy resins,

polyester resins or (meth)acrylic resins/polymers or liquid monomers or resins.

[019] Another objective of the present disclosure is to propose a method for making a multistage polymer composition which is easily dispersible in in reactive epoxy resins, polyester resins or (meth)acrylic resins/polymers or liquid monomers or resins.

[020] Still another objective of the present disclosure is a method for manufacturing a dry multistage polymer composition which is easily dispersible in in reactive epoxy resins, polyester resins or (meth)acrylic resins/polymers or liquid monomers or resins.

[021] Still an additional objective is to propose an impact modified cured resin or adhesive composition, with satisfying impact properties.

[BACKGROUND OF THE INVENTION]Prior art

[022] The document WO2016/102666 discloses a composition comprising a multistage polymer and its method of preparation. The composition comprises as well a (meth) acrylic polymer that has a mass average molecular weight of less than 100 000g/mol.

[023] The document WO2016/102682 discloses a multistage polymer composition and its method of preparation. The multistage polymer comprises a last stage that comprises a (meth) acrylic polymer that has a mass average molecular weight of less than 100 000g/mol

[024] The document FR 2934866 discloses polymer preparation of a specific core shell polymers with functional shell comprising hydrophilic monomers. The core shell polymers are used as impact modifier in thermoset polymers.

[025] The document EP 1 632 533 describes a process for producing modified epoxy resin. The epoxy resin composition is having rubber like polymer particles dispersed in it by a process that brings

the particles in contact with an organic medium that disperses the rubber particles.

[026] The document EP 1 666 519 discloses a process for producing rubbery polymer particle and process for resin composition containing the same.

[027] The document EP 2 123 711 discloses a thermosetting resin composition having a rubbery polymer particles dispersed therein and process for production thereof.

[028] The document EP 0066382A1 discloses a bulk flowable impact modifier particles. The coagulated impact modifier particles are coated or agglomerated with hard non-elastomeric high molecular weight polymer. The hard non-elastomeric high molecular weight polymer has a viscosity average molecular weight preferably above 800 000 and its weight ratio is between 0.1 and 10wt%.

[029] None of the prior art documents discloses a multistage polymer combined with a (meth)acrylic polymer having a medium molecular weight in selective weight ratio.

[Brief description]

[030] Surprisingly it has been found that a polymer composition (PC1) comprising

a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less than 10°C

b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C and

c) and a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that at least the component a) and the component b) of composition (PC1) are part of a multistage polymer (MP1), and characterized in that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c); can be easily dispersed in a polymeric matrix

material for thermosetting polymers or thermoplastic polymers or its precursors.

[0030a] In an aspect, there is provided a polymer composition (PC1) comprising

a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less than 10°C

b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C and

c) and a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that at least the component a) and the component b) of composition (PC1) are part of a multistage polymer (MP1), and characterized in that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a) b) and c).

[031] Surprisingly it has also been found that a method for manufacturing the polymer composition (PC1) comprising the steps of

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 10°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 60°C

c) polymerizing by emulsion polymerization of a monomer or monomer mixture (Cm) to obtain a layer in a stage (C) comprising a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c); yields to a polymer composition in form of polymer

particles that be easily dispersed in a polymeric matrix material for thermosetting polymers or thermoplastic polymers or its precursors.

[0031a] In another aspect, there is provided a method for manufacturing the polymer composition as defined above comprising the steps of

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 10°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 60°C

c) polymerizing by emulsion polymerization of a monomer or monomer mixture (Cm) to obtain a layer in stage (C) comprising a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c).

[032] Surprisingly it has also been found that a method for manufacturing the polymer composition (PC1) comprising the steps of

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 10°C,

b) polymerizing by emulsion polymerization of a monomer or monomer mixture (B_m) to obtain a layer in stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C,

both together steps a) and b) giving a multistage polymer (MP1) and step

c) blending multistage polymer (MP1) with a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition obtained in steps a), b) and c); yields to a polymer composition in form of polymer particles that be easily dispersed in a polymeric matrix material for thermosetting polymers or thermoplastic polymers or its precursors.

[0032a] In another aspect, there is provided a method for manufacturing the polymer composition (PC1) as defined above comprising the steps of

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 10°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 60°C,

both together steps a) and b) giving a multistage polymer (MP1) and step

c) blending multistage polymer (MP1) with a polymer (C1) having a glass transition temperature of at least 30°C

characterized that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition obtained in steps a), b) and c).

[033] Surprisingly it has also been found that a polymeric composition (PC2) comprising

i) a polymer (P2) and

ii) a polymer composition (PC1) comprising

a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less than 10°C
b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C and
c) and a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that at least the component a) and the component b) of composition (PC1) are part of a multistage polymer (MP1), and characterized that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c); possesses satisfying impact properties.

[0033a] In another aspect, there is provided the use of the polymer composition as defined above or obtained by the method as defined above as an impact modifier.

[0033b] In another aspect, there is provided a polymer composition (PC2) comprising

i)a polymer (P2) and

ii)a polymer composition (PC1) comprising

a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less then 10°C
b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C and
c) a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c).

[Detailed description of the invention]

[034] The present disclosure relates to a polymer composition (PC1) comprising

a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less than 10°C
b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C and

c) and a polymer (C1) having a glass transition temperature of at least 30°C

characterized in that at least the component a) and the component b) of composition (PC1) are part of a multistage polymer (MP1), characterized that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c).

[035] The present disclosure relates to a method for manufacturing the polymer composition (PC1) comprising the steps of

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 10°C

b) polymerizing by emulsion polymerization of a monomer or monomer mixture (B_m) to obtain a layer in stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C

c) polymerizing by emulsion polymerization of a monomer or monomer mixture (Cm) to obtain a layer in stage (C) comprising a polymer (C1) having a glass transition temperature of at least 30°C

characterized that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c).

[036] The present disclosure relates to a method for manufacturing the polymer composition (PC1) comprising the steps of

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 10°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 60°C,

both together steps a) and b) giving a multistage polymer (MP1) and step

c) blending multistage polymer (MP1) with a polymer (C1) having a glass transition temperature of at least 30°C

characterized that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition obtained in steps a), b) and c).

[037] The present disclosure relates to a polymeric composition (PC2) comprising

i) a polymer (P2) and

ii) a polymer composition (PC1) comprising

a) one stage (A) comprising a polymer (A1) having a glass transition temperature of less than 10°C

b), one stage (B) comprising a polymer (B1) having a glass transition temperature of at least 60°C and

c) and a polymer (C1) having a glass transition temperature of at least 30°

characterized that the polymer (C1) has a mass average molecular weight Mw of at least 100 000g/mol and that the component c) represents at most 40wt% of the composition based on a), b) and c).

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

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