polymer (MPI), and characterized in that the polymer (Cl) has a mass average molecular weight Mw of at least IO0 000g/mol and that the component c) represents at most 40wt% of the composition based on the total weight of.

[029] None of the prior art documents discloses powder composition comprising a multistage polymer combined with a (meth)acrylic polymer in form of a powder having the having a porosity expressed in total intruded volume of at last 1.2ml/g as measured by mercury intrusion or a process for preparing it.

[Brief description of the ~~invention~~disclosure]

[029a] In an aspect, there is provided a polymer composition (PC1) in form of a polymer powder 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, said polymer (C1) represents at most 40wt% of the composition based on a), b) and c) only,

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 between 10 000g/mol and 500 000g/mol and that the polymer composition (PC1) in form of a polymer powder is having a total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry.

[030] Surprisingly it has been found that a polymer composition (PC1) in form of a polymer powder 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, said polymer (C1) represents at most 40wt% of the composition based on a), b) and c) only;

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 between 10 000g/mol and 500 000g/mol and that the polymer powder is having a total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry; can be easily and rapidly dispersed in a polymeric matrix material for thermosetting polymers or thermoplastic polymers or their respective precursors as liquid resins and/or monomers.

[030a] In another aspect, there is provided a process 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,

d) coagulating the composition obtained in steps a) to c).

[031] Surprisingly it has also been found that a process for manufacturing the polymer composition (PC1) in form of a polymer powder 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, so that said polymer (C1) represents at most 40wt% of the composition based on a), b) and c) only;

d) coagulating the composition obtained in steps a) to c);

characterized in that the polymer (C1) has a mass average molecular weight Mw between 10 000g/mol and 500 000g/mol and; yields to a polymer composition in form of polymer powder having a total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry and that be easily dispersed in a polymeric matrix material for thermosetting polymers or thermoplastic polymers or their respective precursors as liquid resins and/or monomers.

[031a] In another aspect, there is provided a process 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,

d) coagulating the composition obtained in steps a) to c).

[032] Surprisingly it has also been found that a process for manufacturing the polymer composition (PC1) in form of a polymer powder 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 the multistage polymer (MP1) with a polymer (C1) having a glass transition temperature of at least 30°C said polymer (C1) represents at most 40wt% of the composition based on a), b) and c) only;

d) coagulating the composition obtained in steps a) to c);

characterized in that the polymer (C1) has a mass average molecular weight Mw between 10 000g/mol and 500 000g/mol; yields to a polymer composition in form of a polymer powder having a total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry, that be easily dispersed in a polymeric matrix material for thermosetting polymers or thermoplastic polymers or their respective precursors as liquid resins and/or monomers.

[033] Surprisingly it has also been found that that a process for manufacturing a liquid polymer composition LPC1 comprising the steps of

a) providing a polymeric composition (PC1) in form of a porous polymer powder having total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry,

b) bringing into contact the polymeric composition (PC1) with a liquid composition LC1,

yields to a liquid polymer composition where the polymeric composition POW1 is homogenously and fastly dispersed in the liquid composition LC1.

[034] Surprisingly it has also been found that a polymeric composition (PC1) in form of a porous polymer powder POW1 having total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry and can be used to prepare a liquid polymeric or prepolymeric compositions.

[035] Surprisingly it has also been found that a polymeric composition (PC1) in form of a porous polymer powder POW1 having total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry can be used to reduce the time of dispersing porous polymer powder POW1 for obtaining liquid polymeric or prepolymeric compositions.

[035a] In another aspect, there is provided the use of the polymer composition (PC1) as defined above or obtained by the process as defined above as impact modifier.

[035b] In another aspect, there is provided the use of the polymer composition (PC1) as defined above as a reduced dispersing time composition.

[035c] In another aspect, there is provided a process to reduce the dispersing time of a polymer powder in a liquid composition by using the polymeric composition (PC1) as defined above.

[035d] In another aspect, there is provided a process to reduce the time of dispersing a polymeric composition (PC1) in a liquid composition comprising the steps of:

a) providing a polymeric composition (PC1) in form of a porous polymer powder POW1 having total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry,

b) bringing into contact the polymeric composition with a liquid composition LC1.

[036] Surprisingly it has additionally been found a process to reduce the time of dispersing a polymeric composition (PC1) in a liquid composition comprising the steps of:

a) providing a polymeric composition (PC1) in form of a porous polymer powder POW1 having total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry,

b) bringing into contact the polymeric composition (PC1) with a liquid composition LC1,

which is faster than the same process using a polymeric composition in form of a polymer powder having a lower total intruded volume as measured by mercury porosimetry.

[036a] In another aspect, there is provided a polymer composition PC2 comprising the polymer composition (PC1) as impact modifier.

[Detailed description of the invention]

[037] According to a first aspect, the present invention relates to a polymer composition (PC1) in form of a polymer powder 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 said polymer (C1) represents at most 40wt% of the composition based on a), b) and c) only;

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 between 10 000g/mol and 500 000g/mol and that the polymer powder is having a total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry.

[038] According to a second aspect, the present invention relates to a process 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

Claims

1. A polymer composition (PC1) in form of a polymer powder 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, said polymer (C1) represents at most 40wt% of the composition based on a), b) and c) only,

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 between 10 000g/mol and 500 000g/mol and that the polymer composition (PC1) in form of a polymer powder is having a total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry.

~~2. The polymeric composition according to claim 1, characterized in that the total intruded volume is at least 1.35 ml/g as measured by mercury porosimetry.~~

~~3. The polymeric composition according to claim 1 or 2, characterized in that the total intruded volume of at most 10ml/g as measured by mercury porosimetry.~~

~~4.~~2. The polymer composition (PC1) according to claim 1, characterized in that the total intruded volume is between 1.2ml/g and 10ml/g, more preferably between 1.25ml/g and 8 ml/g, even more preferably between 1.3 ml/g and 7 ml/g, advantageously between 1.35 ml/g and 6 ml/g, more advantageously between 1.35 ml/g and 5ml/g and most advantageously between 1.35 ml/g and 4ml/g.

~~5.~~3. The polymeric composition (PC1) according to any of claims 1 to 4, characterized in that the relative incremental intrusion of the polymer powder for a pore size above 10µm of at most 85%.

~~6.~~4. The polymer composition (PC1) according to claim 1 or 2 characterized in that the incremental intrusion of the polymer powder between a pore size from 10µm to 1µm is at least 0.1ml/g, more preferably at least 0.12ml/g and even more preferably at least 0.15ml/g.

~~7.~~5. The polymer composition (PC1) according to claim 1 or 2 characterized in that the incremental intrusion of the polymer powder between a pore size from 10µm to 0.1µm of is at least 0.15ml/g, more preferably at least 0.2ml/g and even more preferably at least 0.25ml/g.

~~8.~~6. The polymeric composition according to claim 1 or 2 characterized in that the relative incremental intrusion between a pore size from 10µm to 1µm of at least 5%, more preferably at least 8% and even more preferably at least 10%.

~~9. The polymer composition (PC1) according to any of claims 1 to 8, characterized in that the polymer powder has a volume median particle size D50 between 1µm and 700µm.~~

~~10. The polymer composition (PC1) according to any of claims 1 to 8, characterized in that the apparent bulk density of the polymer powder is between 0.1g/cm^3 and 0.60g/cm^3.~~

~~11. The polymer composition according to any of claims 1 to 7, characterized in that the polymer composition (PC1) in form of a polymer powder of the invention or polymer powder composition POW1 comprises polymeric particles PAR that make up at least 50wt% of the polymer composition (PC1) in form of a polymer powder composition or polymer powder composition POW1.~~

~~12. The polymer composition according to claim 11 characterized in that the polymeric particle PAR has a weight average particle size (diameter) between 15nm and 900nm.~~

~~13. The polymer composition according to any of claims 1 to 12, characterized in that the stage (A) is the first stage and that stage (B) comprising polymer (B1) is grafted on stage (A) comprising polymer (A1).~~

~~14. The polymer composition according to any of claims 1 to 13 characterized in that the polymers (B1) and (C1) are acrylic or (meth)acrylic polymers.~~

~~15. The polymer composition according to any of claims 1 to 14 characterized in that the polymer (A1) comprises butadiene as monomer.~~

~~16. The polymer composition according to any of claims 1 to 14 characterized in that the polymers (A1), (B1) and (C1) are acrylic or (meth)acrylic polymers.~~

~~17. The polymer composition according to any of claims 14 or 16 characterized that at least 80wt% the acrylic or methacrylic momonomers of the polymers (A1), (B1) or (C1) are chosen from methyl acrylate, propyl acrylate, isopropyl acrylate, butyl acrylate, tert-butyl acrylate, methyl methacrylate, ethyl methacrylate, butyl methacrylate and mixtures there of.~~

~~18.~~7. A process for manufacturing the polymer composition according to any of claims 1 to 17 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,

d) coagulating the composition obtained in steps a) to c).

~~19.~~8. A process for manufacturing the polymer composition (PC1) according to any of claims 1 to 17 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,

d) coagulating the composition obtained in steps a) to c).

~~20. The process according to claim 18 or 19, characterized in that the step a) is made before step b).~~

~~21. The process according to any of claims 18 to 20, characterized in that the step b) is performed in presence of the polymer (A1) obtained in step a).~~

~~22. The process according to any of claims 18 to 19, characterized that the steps a), b), c) and d) are performed in that order.~~

~~23. The process according to any of claims 18 to 22, characterized in that the solid content before starting the coagulation is below 35wt%.~~

24.9. The process according to any of claims ~~18~~ 7 to ~~22~~8, characterized in that the solid content before starting the coagulation is below 32wt%.

25.10. The process according to any of claims ~~18~~ 7 to ~~22~~8, characterized in that the in the step d) the solid content before starting the coagulation is between 5wt% and 35wt%.

26.11. The process according to any of claims ~~18~~ 7 to ~~22~~8, characterized in that the in the step d) the solid content before starting the coagulation is between 20wt% and 35wt%.

27.12. The process according to any of claims ~~18~~ 7 to ~~22~~8, characterized in that the in the step d) the solid content before starting the coagulation is between 5wt% and 20wt%.

28.13. The process according to any of claims ~~18~~ 7 to ~~22~~8, characterized in that the in the step d) the solid content before starting the coagulation is between 10wt% and 25wt%.

29.14. The process according to any of claims ~~18~~ 7 to ~~22~~8, characterized in that the in the step d) the solid content before starting the coagulation is between 15wt% and 27wt%.

30.15. The process according to any of claims ~~18~~ 7 to ~~29~~8, characterized in that the in the step d) the coagulation is made with a salt or an inorganic acid.

~~31. The process according to any of claims 18 to 30, characterized that the process comprises additionally a drying step e).~~

32.16. Use of the polymer composition (PC1) according to any of claims 1 to ~~17~~6 or obtained by the process according to any of claims ~~18~~ 7 to ~~31~~15 as impact modifier.

~~33.~~17. Use of the polymer composition (PC1) according to any of claims 1 to ~~17~~ 6 as a reduced dispersing time composition.

~~34.~~18. A process to reduce the dispersing time of a polymer powder in a liquid composition by using the polymeric composition (PC1) according to any of claims 1 to ~~17~~6.

~~35. The process according to claim 34, characterized in that the process is comprising the steps of~~

~~- providing a precursor for a thermosetting polymer or a monomer of a thermoplastic polymer~~
~~- bringing into contact the polymeric composition (PC1) and said precursor.~~

~~36.~~19. A process to reduce the time of dispersing a polymeric composition (PC1) in a liquid composition comprising the steps of:

a) providing a polymeric composition (PC1) in form of a porous polymer powder POW1 having total intruded volume of at least 1.2 ml/g as measured by mercury porosimetry,

b) bringing into contact the polymeric composition with a liquid composition LC1.

~~37. The process according to claim 36, characterized in that the liquid composition LC1 is chosen from a compositions for preparing vinyl ester, unsaturated polyester or epoxy resin; or it can be for example a styrenic monomer or an (meth)arylic monomer, or a mixture thereof or a liquid composition comprising said monomers.~~

~~38. The process according to claim 36 or 37, characterized in that the the polymeric composition (PC1) represents between 0.5 and 50wt% of the composition comprising liquid composition LC1 and polymeric composition (PC1).~~

~~39~~20. A polymer composition PC2 comprising the polymer composition (PC1) as impact modifier.