[BACKGROUND OF THE INVENTION]Prior art

[016] The document WO2013/126377 discloses a structural acrylic adhesive. The adhesive can comprise toughening agents.

[017] The document WO02/076620 discloses an easy to manufacture (meth) acrylic adhesive composition. The composition comprises core shell impact modifiers that are dispersed in order to insure a high impact resistance.

[018] The document US2012/0252978 discloses a composition for a structural adhesive. The composition is based on acrylates and methacrylates and comprises as well elastomeric block copolymers and elastomeric polymeric particles.

[019] The document US2012/0302695 discloses a methacrylate-based adhesive compositions comprising core shell impact modifiers.

[020] None of the prior art documents discloses a (meth)acrylic adhesive composition comprising a multistage polymer in form of polymeric particles combined with a (meth)acrylic polymer having a specific molecular weight.

[Brief description of the disclosure]

[0020a] In an aspect, there is provided a polymer composition suitable as (meth)acrylic adhesive composition comprising

a) a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure having a weight average particle size between 25 nm and 600 nm,

a3) a polymer (C1) chosen from a (meth)acrylic polymer comprising at least 70wt% monomers chosen from C1 to C12 alkyl (meth)acrylates,

and

b) a second part composition (P2) comprising

b1) a polymerization initiator,

characterized in that the polymer (C1) is having a mass average molecular weight Mw above 12 000 g/mol and below 550 000 g/mol and that the

ratio or of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at most 40wt% and more than 5wt%.

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

a) a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure,

a3) a polymer (C1),

and

b) a second part composition (P2) comprising

b1) a polymerization initiator,

characterized in that the polymer (C1) is having a mass average molecular weight Mw between 2 000g/mol and 1 000 000g/mol, is suitable as (meth)acrylic adhesive composition.

[022] Surprisingly it has been found that a composition comprising

a) a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure,

a3) a polymer (C1),

and

b) a second part composition (P2) comprising

b1) a polymerization initiator,

characterized in that the polymer (C1) is having a mass average molecular weight Mw between 2 000g/mol and 1 000 000g/mol, yields to a (meth)acrylic adhesive composition having increase elongation at break and shear strength adhesion.

[022a] In another aspect, there is provided a method for manufacturing a polymer composition suitable as (meth)acrylic adhesive composition comprising the steps of

(a)providing a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure having a weight average particle size between 25 nm and 600 nm,

a3) a polymer (C1) chosen from a (meth)acrylic polymer comprising at least 70wt% monomers chosen from C1 to C12 alkyl (meth)acrylates ;

(b) providing a second part composition (P2) comprising

b1) a polymerization initiator

(c) polymerizing the mixture of (P1) and (P2)

characterized in that the polymer (C1) is having a mass average molecular weight Mw above 12 000 g/mol and below 550 000 g/mol and that the ratio or of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at most 40wt% and more than 5wt%.

[023] Surprisingly it has also been found that a a method for manufacturing the polymer composition suitable as (meth)acrylic adhesive composition comprising the steps of

(a)providing a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure,

a3) a polymer (C1);

(b) providing a second part composition (P2) comprising

b1) a polymerization initiator

(c) polymerizing the mixture of (P1) and (P2) characterized in that the polymer (C1) is having a mass average molecular weight Mw between 2 000g/mol and 1 000 000g/mol,yields to a (meth)acrylic adhesive composition having increase elongation at break and shear strength adhesion.

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

a) a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure,

a3) a polymer (C1),

and

b) a second part composition (P2) comprising

b1) a polymerization initiator,

Claims

1. A polymer composition suitable as (meth)acrylic adhesive composition comprising
   a) a first part composition (P1) comprising
      a1) at least one(meth)acrylic monomer (M1),
      a2) a multistage polymer (MP1) having a core-shell structure having a weight average particle size between 25 nm and 600 nm,
      a3) a polymer (C1) chosen from a (meth)acrylic polymer comprising at least 70wt% monomers chosen from C1 to C12 alkyl (meth)acrylates,
   and
   b) a second part composition (P2) comprising
      b1) a polymerization initiator,
   characterized in that the polymer (C1) is having a mass average molecular weight Mw above 12 000 g/mol and below 550 000 g/mol and that the ratio or of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at most 40wt% and more than 5wt%.

2. The composition according to claim 1, characterized in that the polymer (C1) has a mass average molecular weight Mw between 100 000g/mol and 550 000g/mol.

3. The composition according to claim 1, characterized in that the polymer (C1) has a mass average molecular weight Mw between 140 000g/mol and 500 000g/mol.

4. The composition according to claim 1, characterized in that the polymer (C1) has a mass average molecular weight Mw between 12 000g/mol and 100 000g/mol.

5. The composition according to claim 1, characterized in that the polymer (C1) has a mass average molecular weight Mw between 12 000g/mol and 50 000g/mol.

6. The polymer composition according to any of claims 1 to 5 characterized in that characterized in that the ratio r of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at most 35wt%; more preferably at most 30wt%, still more preferably less than 30wt%, advantageously less than 25wt%, more advantageously less than 24wt% and even more advantageously less than 20wt%.

7. The composition according to any of claims 1 to 5, characterized in that the ratio r of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at least 7wt% and still more preferably at least 10wt%

8. The composition according to any of claims 1 to 5, characterized in that the ratio r of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is between 5wt% and 35wt%; more preferably between 6wt% and 30wt%, still more preferably between 7wt% and less than 30wt%, advantageously between 7wt% and less than 25wt%, more advantageously between 10wt% and less than 24wt% and even more advantageously between 10wt% and less than 20wt%.

9. The polymer composition according to any of claims 1 to 8 characterized that the polymer (C1) is a (meth) acrylic polymer comprising at least 80 wt% of monomers chosen from C1 to C4 alkyl (meth)acrylates and/or C1 to C8 alkyl acrylate monomers.

10. The polymer composition according to any of claims 1 to 8 characterized in that the polymer (C1) comprises at least 80wt% of methyl methacrylate and/or C1 to C8 alkyl acrylate monomers.

11. The polymer composition according to any of claims 1 to 10 characterized in that the polymer (C1) comprises a functional comonomer.

12. The polymer composition according to claim 11 characterized in that the functional comonomer is chosen from glycidyl (meth)acrylate, acrylic or methacrylic acid, the amides derived from these acids, such as, for example, dimethylacrylamide, 2-methoxyethyl acrylate or methacrylate, 2-aminoethyl acrylates or methacrylates are optionally quaternized, polyethylene glycol (meth) acrylates.

13. The polymer composition according to any of claims 1 to 12 characterized in that the (meth)acrylic monomer (M1) is chosen from acrylic acid, methacrylic acid , alkyl acrylic monomers, alkyl methacrylic monomers and mixtures thereof, the alkyl group having from 1 to 22 carbons, either linear, branched or cyclic; preferably the alkyl group having from 1 to 12 carbons, either linear, ranched or cyclic.

14. The polymer composition according to any of claims 1 to 13 characterized in that the first part composition (P1) comprises one more additional compound: at least one monomer (M2) different from (meth)acrylic monomer (M1).

15. The polymer composition according to claim 14 characterized in that the monomer (M2) is chosen from acrylic ester monomers or methacrylic ester monomers that have at least one atom that is not a carbon or hydrogen in the group of the alcohol part of the ester.

16. The polymer composition according to any of claims 14 to 15 characterized in that the monomer (M2) is chosen from the group consisting of: 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, 2- and 3-hydroxypropyl acrylate, 2- and 3-hydroxypropyl methacrylate, 2-methoxyethyl acrylate, 2-methoxyethyl methacrylate, 2-ethoxyethyl acrylate, 2-ethoxyethyl methacrylate, 2- or 3-ethoxypropyl acrylate, 2- or 3-ethoxypropyl methacrylate, 2(2-ethoxyethoxy) ethyl acrylate, methoxy polyethylene glycol methacrylate (preferably comprising 2 to 8 repeating (EO) units), methoxy polyethylene glycol acrylate preferably comprising 2 to 8 repeating (EO)

units), polyethylene glycol methacrylate preferably comprising 2 to 8 repeating (EO) units), polyethylene glycol acrylate preferably comprising 2 to 8 repeating (EO) units), polypropylene glycol methacrylate preferably comprising 2 to 8 repeating (EO) units), polypropylene glycol acrylate preferably comprising 2 to 8 repeating (EO) units, and mixtures thereof.

17. The polymer composition according to any of claims 1 to 13 characterized in that the first part composition (P1) comprises one more additional compound: a flexibilizer.

18. The polymer composition according to claim 17 characterized in that the flexibilizer is chosen from a block copolymer or a liquid elastomer.

19. The polymer composition according to claim 17 characterized in that the flexibilizer is chosen from urethanes oligomers.

20. A method for manufacturing a polymer composition suitable as (meth)acrylic adhesive composition comprising the steps of

(a) providing a first part composition (P1) comprising

a1) at least one (meth)acrylic monomer (M1),

a2) a multistage polymer (MP1) having a core-shell structure having a weight average particle size between 25 nm and 600 nm,

a3) a polymer (C1) chosen from a (meth)acrylic polymer comprising at least 70wt% monomers chosen from C1 to C12 alkyl (meth)acrylates;

(b) providing a second part composition (P2) comprising

b1) a polymerization initiator

(c) polymerizing the mixture of (P1) and (P2)

characterized in that the polymer (C1) is having a mass average molecular weight Mw above 12 000 g/mol and below 550 000 g/mol and that the ratio or of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at most 40wt% and more than 5wt%.

21. The method according to claim 20, characterized in that the polymer (C1) has a mass average molecular weight Mw between 100 000g/mol and 550 000g/mol.

22. The method according to claim 20, characterized in that the polymer (C1) has a mass average molecular weight Mw between 140 000g/mol and 500 000g/mol.

23. The method according to claim 20, characterized in that the polymer (C1) has a mass average molecular weight Mw between 12 000g/mol and 100 000g/mol.

24. The method according to claim 20, characterized in that the polymer (C1) has a mass average molecular weight Mw between 12 000g/mol and 50 000g/mol.

25. The method according to any of claims 20 to 24, characterized in that the multistage polymer (MP1) having a core-shell structure and a3) the polymer (C1) of the first part composition (P1) form together a polymer composition (PC1) are made by a method for manufacturing 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 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 30wt%.

26. The method according to any of claims 20 to 24, characterized in that the multistage polymer (MP1) having a core-shell structure and a3) the polymer (C1) of the first part composition (P1) form together a polymer composition (PC1) are made by a method for manufacturing comprising the steps of

a) mixing of the polymer (C1) and the multi stage polymer (MP1),

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

wherein the polymer (C1) and the multi stage polymer (MP1) in step a) are in form of a dispersion in aqueous phase.

27. The method according to any of claims 20 to 24, characterized in that the ratio r of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at most 35wt%; more preferably at most 30wt%, still more preferably less than 30wt%, advantageously less than 25wt%, more advantageously less than 24wt% and even more advantageously less than 20wt%.

28. The method according to any of claims 20 to 24, characterized in that the ratio r of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is at least 7wt% and still more preferably at least 10wt%

29. The method according to any of claims 20 to 24, characterized in that the ratio r of the polymer (C1) in a composition comprising only the multistage polymer (MP1) and the polymer (C1) is between 5wt% and 35wt%; more preferably between 6wt% and 30wt%, still more preferably between 7wt% and less than 30wt%, advantageously between 7wt% and less than 25wt%, more advantageously between 10wt% and less than 24wt% and even more advantageously between 10wt% and less than 20wt%.

30. The method according to any of claims 20 to 29, characterized in that the first part composition (P1) comprises one more

additional compound: at least one monomer (M2) different from (meth)acrylic monomer (M1).

31. The method according to claim 30 characterized in that the monomer (M2) is chosen from acrylic ester monomers or methacrylic ester monomers that have at least one atom that is not a carbon or hydrogen in the group of the alcohol part of the ester.

32. The method according to any of claims 30 to 31 characterized in that the monomer (M2) is chosen from the group consisting of: 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, 2- and 3-hydroxypropyl acrylate, 2- and 3-hydroxypropyl methacrylate, 2-methoxyethyl acrylate, 2-methoxyethyl methacrylate, 2-ethoxyethyl acrylate, 2-ethoxyethyl methacrylate, 2- or 3-ethoxypropyl acrylate, 2- or 3-ethoxypropyl methacrylate,2(2-ethoxyethoxy) ethyl acrylate, methoxy polyethylene glycol methacrylate (preferably comprising 2 to 8 repeating (EO) units), methoxy polyethylene glycol acrylate preferably comprising 2 to 8 repeating (EO) units), polyethylene glycol methacrylate preferably comprising 2 to 8 repeating (EO) units), polyethylene glycol acrylate preferably comprising 2 to 8 repeating (EO) units), polypropylene glycol methacrylate preferably comprising 2 to 8 repeating (EO) units), polypropylene glycol acrylate preferably comprising 2 to 8 repeating (EO) units, and mixtures thereof.

33. The method according to any of claims 20 to 29, characterized in that the first part composition (P1) comprises one more additional compound: a flexibilizer.

34. The method according to claim 33 characterized in that the flexibilizer is chosen from a block copolymer or a liquid elastomer.

35. The method according to claim 33 characterized in that the flexibilizer is chosen from urethanes oligomers.

36. The method according to any of claims 20 to 35 characterized that the polymer (C1) is a (meth) acrylic polymer comprising at least 80 wt% monomers chosen from C1 to C4 alkyl (meth)acrylates and/or C1 to C8 alkyl acrylate monomers.

37. A structural adhesive polymer composition comprising a composition according to any of claims 1 to 19, or made according the method of any of claims 20 to 36.

38. Use a composition according to any of claims 1 to 19 for making a structural (meth)acrylic adhesive.