

CLAIMS

1. A composition comprising:
 - (i) a polymer;
 - (ii) inorganic particles; and
 - (iii) aqueous medium,wherein the inorganic particles are adapted to interact with the polymer to cause an increase in glass transition temperature (T_g) during film formation of the composition.
2. The composition of claim 1, wherein the increase in T_g during film formation of the composition is due to a nanoconfinement effect.
3. The composition of claim 1, wherein the increase in T_g from T_g of the polymer to T_g of the film comprises a temperature increase in an amount of at least 10°C.
4. The composition of any one of the preceding claims, wherein the interactions involving the inorganic particles and the polymer in the aqueous medium comprise non-covalent interactions.
5. The composition of any one of the preceding claims, wherein the composition is substantially devoid of a plasticizer.
6. The composition of any one of the preceding claims, wherein the composition is substantially devoid of small organic compounds (SOC) and/or volatile organic compounds (VOC).
7. The composition of any one of the preceding claims, wherein the inorganic particles comprise inorganic nanoparticles having an average size that is no more than 200 nm.

8. The composition of claim 7, wherein the inorganic nanoparticles are selected from the group consisting of silicon dioxide, titanium dioxide, clay, nanocrystalline cellulose and lignin powders.
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9. The composition of any one of the preceding claims, wherein the polymer comprises one or more types of monomers selected from styrene; acrylic acid; methacrylic acid; maleic acid; itaconic acid; acrylonitrile; methacrylonitrile; butadiene; vinylidene chloride; vinyl acetate; and derivatives thereof.
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10. The composition of claim 9, wherein the acrylic acid derivative thereof is selected from methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethylhexyl acrylate (2EHA) and N,N-dimethylacrylamide (NNDMA); and the methacrylic acid derivative thereof is selected from methyl methacrylate (MMA) and (hydroxyethyl) methacrylate (HEMA).
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11. The composition of any one of the preceding claims, wherein the aqueous medium is in an amount of from 30 wt% to 60 wt% of the composition.
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12. The composition of any one of the preceding claims, wherein the inorganic particles are in the amount of from 0.05 wt% to 5.0 wt% of the composition.
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13. The composition of any one of the preceding claims, wherein the polymer is in an amount of from 10 wt% to 40 wt% of the composition.
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14. The composition of any one of the preceding claims, wherein the composition is a paint composition and further comprises one or more of the following: pigment, filler, wetting agent, thickening agent, base, anti-foaming agent and dispersing agent.

15. A film comprising:
a polymer that is in non-covalent interaction with inorganic particles,
wherein the inorganic particles are adapted to interact with the polymer to cause an increase in Tg during formation of the film from the composition of any one of claims 1-14.
16. The film according to claim 15, wherein the film has one or more of the following properties: odourless, non-tacky, non-sticky, excellent resistance to scrub, excellent resistance to abrasion, excellent resistance to washing, low or zero wetting, low water vapour transmission rate under dry conditions, chemically and/or physically stable, excellent resistance towards natural exposure/weathering.
17. The film according to any one of claims 15-16, wherein the film has a glass transition temperature in the range of from 15.0°C to 40.0°C.
18. A method of preparing a film, the method comprising:
mixing inorganic particles, aqueous medium and optionally one or more of pigment, filler, wetting agent, thickening agent, base, anti-foaming agent, and dispersing agent, to form a mill base;
mixing said mill base with a polymer to form a composition;
applying the composition on/over a substrate; and
optionally curing the composition to form a film on/over the substrate,
wherein the inorganic particles are adapted to interact with the polymer to cause an increase in glass transition temperature (Tg) during film formation of the composition.
19. The method according to claim 18, wherein the step of mixing to form a mill base comprises stirring the mixture until the particle size is less than 50 µm as determined by a Hegman gauge.

20. A kit comprising:

- (i) a polymer; and
- (ii) a mill base separately stored from the polymer and adapted to be mixed with the polymer, the mill base comprising inorganic particles, an aqueous medium and optionally one or more of pigment, filler, wetting agent, surfactant, thickener, thickening agent, base, defoamer, anti-foaming agent, dispersant, and dispersing agent,

wherein the inorganic particles are adapted to interact with the polymer to cause an increase/jump in glass transition temperature (T_g) during formation of the film from a composition obtained by mixing said mill base with said polymer.

21. A coated substrate comprising:

- a layer of the composition according to any one of claims 1-14 applied on/over a surface of the substrate.