the organic medium comprises a polymer;

the filler comprises one or more of graphene, functionalised graphene, graphene oxide, polyhedral oligomeric silsesquioxane, graphite, a 2D material, aluminium oxide, zinc oxide, aluminium nitride, boron nitride, silver, nano fibres, carbon fibres, diamond, carbon nanotubes, silicon dioxide and metal-coated particles, and

the composition comprises from 0.001 to 40 wt.% of the filler based on the total weight of the composition.

In one aspect, there is provided a composition for use in an electronic assembly process, the composition comprising a filler dispersed in an organic medium, wherein:

the organic medium comprises a curable polymer;

the filler comprises one or more of graphene, functionalized graphene, graphene oxide, a polyhedral oligomeric silsesquioxane, graphite, a 2D material, aluminum oxide, zinc oxide, aluminum nitride, boron nitride, silver, nano fibers, carbon fibers, diamond, carbon nanotubes, silicon dioxide and metal-coated particles, and

wherein the composition comprises from 0.001 to 40 wt.% of the filler based on the total weight of the composition, further wherein the organic medium comprises:

from 30 to 40 wt.% of an organic solvent having a boiling point of at least 280 °C;

from 5 to10 wt.% of different functionality epoxy resins;

from 15 to 30 wt.% of solid bifunctional epoxy resins;

from 3 to 10 wt.% of an activator comprising a dicarboxylic acid;

from 2 to 8 wt.% of a catalyst comprising substituted aromatic amine;

from 1 to 5 wt.% of a catalyst comprising a phosphine-based salt;

from 1 to 5 wt.% of a liquid anhydride type hardener;

from 0.1 to 4 wt.% of a liquid type stress modifier; and

from 0.1 to 3 wt.% of an adhesion promoter.

Each aspect or embodiment as defined herein may be combined with any other aspect(s) or embodiment(s) unless clearly indicated to the contrary. In particular, any features indicated as being preferred or advantageous may be combined with any other feature indicated as being preferred or advantageous.

The term "graphene" used herein encompasses a single atomic plane of graphite (referred to as monolayer graphene), or a few layers graphene, or multilayers of graphene or graphene platelets.

The term "2D materials" used herein encompasses material having two dimensions that are proportionally much larger than a third dimension. Examples of such materials are boron nitride, molybdenum disulphide, tungsten diselenide, transition metals di-chalcogenides, nickel HITP (2,3,6,7,10,11-hexaiminotriphenylene), germanane, graphane, phosphorene, stanene, silicine, borophene, graphyne, fluorinated graphene and 2D synthesized metals such as Palladium and Rhodium.

The term "graphene oxide" used herein encompasses the molecular sheets obtained when graphite oxide is dispersed in a basic medium. Graphene oxide comprises graphene sheets with oxygen-containing functional groups on the surface thereof.

The term "functionalised graphene" used herein encompasses graphene having one or more functional groups on the surface thereof.

Claims:

1. A composition for use in an electronic assembly process, the composition comprising a filler dispersed in an organic medium, wherein:

the organic medium comprises a curable polymer;

the filler comprises one or more of graphene, functionalized graphene, graphene oxide, a polyhedral oligomeric silsesquioxane, graphite, a 2D material, aluminum oxide, zinc oxide, aluminum nitride, boron nitride, silver, nano fibers, carbon fibers, diamond, carbon nanotubes, silicon dioxide and metal-coated particles, and

wherein the composition comprises from 0.001 to 40 wt.% of the filler based on the total weight of the composition, further wherein the organic medium comprises:

from 30 to 40 wt.% of an organic solvent having a boiling point of at least 280 °C;

from 5 to10 wt.% of different functionality epoxy resins;

from 15 to 30 wt.% of solid bifunctional epoxy resins;

from 3 to 10 wt.% of an activator comprising a dicarboxylic acid;

from 2 to 8 wt.% of a catalyst comprising substituted aromatic amine;

from 1 to 5 wt.% of a catalyst comprising a phosphine-based salt;

from 1 to 5 wt.% of a liquid anhydride type hardener;

from 0.1 to 4 wt.% of a liquid type stress modifier; and

from 0.1 to 3 wt.% of an adhesion promoter.

2. The composition of claim 1 comprising from 0.01 to 10 wt.% of the filler based on the total weight of the composition, preferably from 0.02 to 5 wt.% of the filler based on the total weight of the composition, more preferably from 0.03 to 4 wt.% of the filler based on the total weight of the composition, even more preferably from 0.04 to 1 wt.% of the filler based of the total weight of the composition, still even more preferably from 0.04 to 0.8 wt.% of the filler based of the total weight of the composition.

3. The composition of claim 1, comprising from 0.05 to 0.4 wt.% of the filler based of the total weight of the composition.

4. The composition of any preceding claim, wherein the composition is a curable composition, and/or the polymer is a curable polymer.

5. The composition of any preceding claim, wherein the filler comprises one or more of: graphene, graphene oxide, functionalised graphene and a polyhedral oligomeric silsesquioxane.

6. The composition of any preceding claim, wherein the filler comprises:

a polyhedral oligomeric silsesquioxane; and
one or more of graphene, and functionalised graphene.

7. The composition of any preceding claim wherein the filler comprises funtionalised graphene and the functionalised graphene comprises graphene oxide.

8. The composition of any preceding claim, wherein the filler comprises functionalised graphene, the functionalised graphene being functionalised with an organic and/or inorganic group, preferably one or more of: an amine group, a silane and/or titanate group, an epoxy group, an ester group and a polyhedral oligomeric silsesquioxane.

9. The composition of any preceding claim, wherein the filler comprises functionalised graphene, the functionalised graphene comprising graphene functionalised with a polyhedral oligomeric silsesquioxane.

10. The composition of any claim 1, wherein the curable polymer comprises an epoxy resin.

11. The composition of any of claims 1 to 5, wherein:
the filler comprises graphene oxide, and
the composition comprises from 0.1 to 4 wt.% of the graphene oxide.

12. The composition of any preceding claim, wherein the organic medium further comprises one or more organic solvents.

13. The polymer composition of claim 12, wherein the organic solvent has a boiling point of at least 280 °C.

14. The composition of any preceding claim, wherein the organic medium further comprises an activator, preferably wherein the activator comprises a dicarboxylic acid.

15. The composition of any preceding claim, wherein the organic medium further comprises a catalyst, preferably wherein the catalyst comprises a substituted aromatic amine and/or a phosphine-based salt.

16. The composition of any preceding claim, wherein the organic medium further comprises a hardener, preferably wherein the hardener comprises a liquid anhydride type hardener.

17. The composition of any preceding claim, wherein the organic medium further comprises a stress modifier, preferably a liquid type stress modifier.

18. The composition of any preceding claim, wherein the organic medium further comprises an adhesion promoter.

19. The composition of claim 8, wherein the organic medium comprises:
about 39 wt.% of an organic solvent having a boiling point of at least 280 °C;
about 8 wt.% of different functionality epoxy resins;
about 29 wt.% of solid bifunctional epoxy resins;
about 9 wt.% of an activator comprising a dicarboxylic acid;
about 3 wt.% of a catalyst comprising substituted aromatic amine;
about 4 wt.% of a catalyst comprising a phosphene-based salt;
about 2 wt.% of a liquid anhydride type hardener;
about 4 wt.% of a liquid type stress modifier; and
about 2 wt.% of an adhesion promoter.

20. The composition of any preceding claim, wherein the composition may be applied to a device using one or more of: film transfer, pin transfer, component dipping, dispensing, jetting, printing, spraying, casting, and doctor-blading.

21. The composition of any preceding claim, wherein the composition is flow-able at high temperatures using capillary additives.

22. The composition of any preceding claim, wherein the collar height of the cured composition may be varied up to 100 % by varying the dipping height and/or dipping time.

23. The composition of any preceding claim, wherein the filler comprises graphene, graphene oxide, graphite flakes, graphene platelets, reduced graphene oxide or a combination of two of more thereof.

24. The composition of any preceding claim, wherein the composition comprises colour pigments.

25. The composition of any preceding claim, in the form of a film.

26. An underfill comprising the composition of any preceding claim.

27. The underfill of claim 26, wherein the underfill can be applied in one or more steps, preferably wherein the one or more steps comprises dipping and/or dispensing.

28. A solder flux comprising the composition of any of claims 1 to 25.

29. A single or dual-side reinforcement material comprising the composition of any of claims 1 to 25.

30. An electronic material comprising:
solder alloy; and
the composition of any of claims 1 to 25.

31. A conductive adhesive comprising:
conductive particles; and
the composition of any of claims 1 to 25.

32. A non-conductive adhesive comprising:
non-conductive particles; and
the composition of any of claims 1 to 25.

33. A solder paste comprising:
solder particles; and
the composition of any of claims 1 to 25.

34. The composition of any of claims 1 to 25 once cured.

35. A solder joint at least partially encapsulated with a cured polymer composition, the polymer composition being the polymer composition of any of claims 1 to 25.

36. A method of forming a solder joint, the method comprising:
providing the solder paste of claim 33 between two or more work pieces to be joined; and
heating the solder paste to form a solder joint.

37. The method of claim 36, wherein the step of providing the solder paste between two or more work pieces to be joined comprises applying the solder paste to at least one of the work pieces, wherein the paste is in the form of a film, and wherein heating the solder paste comprises hot stamping.

38. A method of manufacturing the composition of any of claims 1 to 25, the method comprising:
providing an organic medium comprising a polymer; and
dispersing a filler in the organic medium,
wherein:
the filler comprises one or more of graphene, graphene oxide, 2D materials, functionalised graphene, graphene oxide, a polyhedral oligomeric silsesquioxane, graphite, aluminium oxide, zinc oxide, aluminium nitride, boron nitride, silver, nano

fibres, carbon fibres, diamond, carbon nanotubes, silicon dioxide and metal-coated particles, and

the composition comprises from 0.001 to 40 wt.% of the filler based on the total weight of the composition.

39. Use of the composition of any of claims 1 to 25 in a method selected from: an electronic assembly method, a die attachment method, a reflow soldering method, a circuit board manufacturing method and a solar cell manufacturing method.

40. Use of the composition of any of claims 1 to 25 in electronic packaging, flip chips, LED assembly and hermetic sealing.

41. Use of the composition of any of claims 1 to 25 in an electronic assembly application such as printing, pin transfer and no flow adhesive composition, the composition having a viscosity of greater than 20 Pa.s.