Claims:

1. A composition for use in the manufacture of an in-mould electronic (IME) component, the composition containing a binder comprising:

a cross-linking agent comprising melamine formaldehyde,

a thermoplastic resin comprising a hydroxyl group, and

a solvent,

wherein the thermoplastic resin comprises:

from 20 to 60 wt.% polyurethane resin,

from 5 to 30 wt.% polyester resin, and

from 20 to 60 wt.% phenoxy resin,

based on the total weight of the thermoplastic resin.

2. The composition of claim 1, wherein the melamine formaldehyde comprises hexamethoxymethyl melamine.

3. The composition of claim 1 or claim 2, wherein the cross-linking agent further comprises isocyanate and/or polyisocyanate and/or blocked polyisocyanate.

4. The composition of any preceding claim, wherein the thermoplastic resin comprises one or more of polyurethane resin, polyester resin, polyacrylate resin, polyvinyl ester resin, phenoxy resin and ketonic resin.

5. The composition of claim 4, wherein the thermoplastic resin comprises polyurethane resin, polyester resin and phenoxy resin.

6. The composition of claim 5, wherein the thermoplastic resin comprises:

from 35 to 47 wt.% polyurethane resin,

from 13 to 19 wt.% polyester resin, and

from 34 to 51 wt.% phenoxy resin,

based on the total weight of the thermoplastic resin.

7. The composition of any preceding claim, wherein the thermoplastic resin:

comprises a homo-polymer, and co-polymer and/or a ter-polymer; and/or

has a glass transition temperature of less than 100 °C; and/or

has a weight average molecular weight of from 1000 to 100000 g/mol; and/or

has a softening point of less than 100 °C; and/or

has a hydroxyl content (OH number) of greater than 20 mgKOH/g.

8. The composition of any preceding claim comprising:

from 1 to 40 wt% of the cross-linking agent, preferably from 7 to 24 wt.% of the cross-linking agent, and

from 60 to 99 wt% of the thermoplastic resin, preferably 76 to 93 wt.% of the thermoplastic resin,

based on the total amount of cross-linking agent and thermoplastic resin.

9. The composition of any preceding claim, wherein the solvent comprises one or more of a glycol ether acetate, a glycol ether, an ester, a ketone, an alcohol and a hydrocarbon.

10. The composition of claim 9, wherein the solvent comprises:

up to 95 wt% glycol ether acetate, preferably up to 85 wt.% glycol ether acetate, and/or

up to 95 wt% glycol ether, preferably up to 85 wt.% glycol ether, and/or

up to 15% ester, preferably up to 5 wt.% ester, and/or

up to 40 wt% ketone, preferably up to 32 wt.% ketone, and/or

up to 80 wt% alcohol, preferably up to 70 wt.% alcohol, and/or

up to 30 wt% hydrocarbon, preferably up to 22 wt.% hydrocarbon,

based on the total weight of the solvent.

11. The composition of any preceding claim, wherein the binder further comprises:

a thermosetting resin, preferably comprising one or both of acrylic resin and epoxy resin; and

a curing catalyst for curing the thermosetting resin, preferably for thermally curing the thermosetting resin and/or for UV curing the thermosetting resin.

12. The composition of any preceding claim, wherein the binder further comprises one of more functional additives, preferably selected from one or more of surfactants, rheology modifiers, dispersants, de-foamers, de-tackifiers, slip additives, anti-sag agents, levelling agents, surface active agents, surface tension reducing agents, adhesion promoters, anti-skinning agents, matting agents, coloring agents, dyes, pigments and wetting agents.

13. The composition of any preceding claim, wherein the binder comprises:

from 0.5 to 12 wt.% of the cross-linking agent, preferably from 1.5 to 7.7 wt.% of the cross-linking agent;

from 10 to 40 wt.% of the thermoplastic resin, preferably from 11 to 30.4 wt.% of the thermoplastic resin; and

from 40 to 85 wt.% solvent, preferably from 46.7 to 78.8 wt.% solvent; optionally:

from 0.1 to 30 wt.% thermosetting resin and from 0.1 to 3 wt.% curing catalyst for curing the thermosetting resin, preferably from 1 to 10 wt.% thermosetting resin and from 0.1 to 1 wt.% curing catalyst for curing the thermosetting resin; and/or

from 0.1 to 20 wt% functional additives, preferably from 1.7 to 17 wt.% functional additives.

14. The composition of any preceding claim, further comprising conductive particles.

15. The composition of claim 14, wherein the conductive particles:

comprise one or more of metal particles, preferably selected from one or more of silver particles, copper particles, brass particles, nickel particles, gold particles, platinum particles, palladium particles, metal alloy particles, silver-coated copper particles, silver-coated brass particles, silver-nickel alloy particles and silver-copper alloy particles; and/or

comprise carbon particles, preferably selected from one or more of graphite particles, graphite flakes, carbon black particles, graphene flakes, graphene particles and carbon nanotubes; and/or

exhibit one or more of a mean particle size (d50) of from 1.25 to 7 µm, a tap density of from 2 to 4 g/cc, a surface area of from 0.3 to 2.1 m^2/g, and an organic content of from 0.06 to 1.3 wt.%; and/or

are in the form of one or more of flakes, spheres, irregularly shaped particles, nano-powders and nanowire.

16. The composition of claim 14 or claim 15, comprising:

from 30 to 85 wt% binder, preferably from 40.1 to 80.9 wt.% binder, and

from 15 to 70 wt% conductive particles, preferably from 19.1 to 59.9 wt.% conductive particles.

17. The composition of any of claims 14 to 16 comprising:

from 30 to 85 wt% binder, preferably from 40.1 to 80.9 wt. % binder, and

from 15 to 70 wt% conductive particles, preferably from 19.1 to 59.9 wt.% conductive particles,

and wherein the binder comprises:

from 0.2 to 6 wt.% cross-linking agent, preferably from 0.7 to 3.3 wt.% cross-linking agent,

from 1 to 7.5 wt.% polyurethane resin, preferably from 1.7 to 4.5 wt.% polyurethane resin,

from 0.1 to 5.5 wt.% polyester resin, preferably from 0.7 to 1.8 wt.% polyester resin,

from 1 to 7.5 wt.% phenoxy resin, preferably from 2.5 to 6.6 wt.% phenoxy resin,

from 0 to 10 wt.% thermosetting resin, preferably from 0 to 5.7 wt.% thermosetting resin,

from 0 to 1 wt.% curing catalyst, preferably from 0 to 0.6 wt.% curing catalyst,

from 0.2 to 10 wt% functional additives, preferably from 2.6 to 7.4 wt.% functional additives,

from 0 to 60 wt% glycol ether acetate, preferably from 4.3 to 43.2 wt.% glycol ether acetate,

from 0 to 40 wt% glycol ether, preferably from 0 to 24.1 wt.% glycol ether,

from 0 to 5 wt.% ester, preferably from 0 to 1.7 wt.% ester, and

from 0 to 30 wt% ketone, preferably from 0 to 20.5 wt.% ketone.

18. The composition of any of claims 14 to 17 in the form of a conductive ink.

19. The composition of any of claims 14 to 17 in the form of a conductive adhesive.

20. The composition of any of claims 1 to 13, further comprising non-conductive particles.

21. The composition of claim 20, wherein the non-conductive particles:

comprise organic non-conductive particles, preferably selected from one or more of cellulose, wax, polymer microparticles, non-conductive carbon particles and graphene oxide; and/or

comprise inorganic non-conductive particles, preferably selected from one or more of mica, silica (SiO_2), fumed silica, talc, titanium dioxide (TiO_2), alumina, barium titanate ($BaTiO_3$), zinc oxide (ZnO) and boron nitride (BN), optionally wherein the inorganic non-conductive particles are sub-micron and micron sized; and/or

exhibit a mean particle size (d50) of less than or equal to 10 µm.

22. The composition of claim 20 or claim 21, comprising:

from 2 to 45 wt.% non-conductive particles, and

from 55 to 98 wt.% binder.

23. The composition of any of claims 20 to 22 comprising:

from 50 to 98 wt.% binder, and

from 2 to 50 wt.% non-conductive particles,

and wherein the binder comprises:

from 0.5 to 10 wt% cross-linking agent, preferably from 1.9 to 6.1 wt.% cross-linking agent,

from 2 to 12 wt% polyurethane resin, preferably from 4.8 to 8.4 wt.% polyurethane resin,

from 0.5 to 10 wt.% polyester resin, preferably from 1.9 to 5.3 wt.% polyester resin,

from 2 to 18 wt% phenoxy resin, preferably from 4.5 to 12.4 wt.% phenoxy resin,

from 0 to 30 wt.% thermosetting resin, preferably from 0 to 19.6 wt.% thermosetting resin,

from 0 to 3 wt.% curing catalyst, preferably from 0 to 2 wt.% curing catalyst,

from 0.3 to 17 wt.% functional additives, preferably from 1.4 to 12.5 wt.% functional additives,

from 0 to 41.7 wt.% glycol ether acetate, preferably from 4.9 to 41.7 wt.% glycol,

from 0 to 60 wt.% glycol ether, preferably from 0 to 43.8 wt.% glycol ether,

from 0 to 30 wt.% ketone, preferably from 0 to 19.9 wt.% ketone,

from 0 to 50 wt.% alcohol, preferably from 0 to 35.5 wt.% alcohol, and

from 0 to 20 wt.% hydrocarbon, preferably from 0 to 13.3 wt.% hydrocarbon.

24. The composition of any of claims 1 to 13 or 20 to 23 in the form of a dielectric ink.

25. The composition of any of claims 1 to 13 or 20 to 23 in the form of a non-conductive adhesive.

26. The composition of any of claims 1 to 13 or 20 to 23 in the form of an encapsulant.

27. The composition of any of claim 1 to 13 further comprising a colorant and/or dye and/or pigment, the composition in the form of a graphic ink.

28. A method of manufacturing an in-mould electronic (IME) component, the method comprising:

preparing a blank; and

thermoforming the blank,

wherein preparing the blank comprises forming one or more structures on a thermoformable substrate, each structure formed by a method comprising:

disposing the composition of any of claims 1 to 27 on a thermoformable substrate, and

drying the composition at a temperature of from 20 to 150 °C for from 0.5 to 0 minutes.

29. The method of claim 28, wherein the one or more structures are selected from a conductive layer, a conducting track layer, an adhesive attachment layer, a dielectric layer, an encapsulant layer, a graphic layer and a barrier layer.

30. The method of claim 28 or claim 29, wherein the one or more structures comprises a multilayer stack.

31. The method of any of claims 28 to 30, wherein the one or more structures comprises a printed circuit board.

32. The method of any of claims 28 to 31, wherein disposing the composition comprises printing the composition, preferably screen-printing the composition.

33. The method of any of claims 28 to 32, wherein the substrate comprises polycarbonate (PC) and/or polyethylene terephthalate (PET).

34. The method of any of claims 28 to 33, wherein the thermoforming is carried out at a temperature of from 140 °C to 210 °C and/or at a pressure of from 0.25 MPa to 0.4 MPa and/or at a pressure ranging from 6 MPa to 12 MPa.

35. The method of any of claims 28 to 34, further comprising attaching one or more electronic devices to the blank using a conductive adhesive or a non-conductive adhesive, the conductive adhesive being the composition according to claim 19 and the non-conductive adhesive being the composition according to claim 25, wherein the attaching takes place before and/or after thermoforming.

36. The method of any of claims 28 to 35, further comprising, after thermoforming, applying a layer of resin to the substrate using injection moulding, preferably wherein the resin comprises one or more of polycarbonate (PC), polyethylene terephthalate (PET), acrylonitrile butadiene styrene (ABS), polypropylene (PP), polyester, poly(methyl methacrylate) (PMMA), low density polyethylene (LDPE), high-density polyethylene (HDPE), polystyrene (PS) and thermoplastic polyurethane (TPU)..

37. The method of any of claims 28 to 36, wherein the injection moulding is carried out at a temperature of from 170 to 330 °C.

38. The method of any of claims 28 to 37, wherein the in-mould electronic (IME) component comprises a capacitive touch switch, a resistive touch switch or a capacitive touch sensor.

39. The method of any of claims 28 to 37, wherein the in-mould electronic (IME) component comprises one or more of a display, a light/lamp, a sensor, an indicator and a haptic/touch feedback device.

40. An in-mould electronic (IME) component comprising the composition of any of claims 1 to 27.

41. The in-mould electronic (IME) component of claim 40 comprising a capacitive touch switch or a resistive touch switch.

42. The in-mould electronic (IME) component of claim 40 or claim 41 comprising one or more of a display, a light/lamp, a sensor, an indicator and a haptic/touch feedback device.