Claims:

1. A sintering composition, consisting essentially of:

a solvent; and

a metal complex dissolved in the solvent,

wherein:

the sintering composition contains at least 60 wt.% of the metal complex, based on the total weight of the sintering composition; and

the sintering composition contains at least 20 wt.% of the metal of the metal complex, based on the total weight of the sintering composition; and the viscosity of the sintering composition is from 60,000 to 120,000 cP.

2. The sintering composition of claim 1, consisting of the solvent and the metal complex dissolved in the solvent.

3. The sintering composition of claim 1 or claim 2, wherein the metal complex substantially decomposes over a temperature range of less than 20 °C, preferably less than 15 °C, more preferably less than or equal to 10 °C.

4. The sintering composition of any preceding claim, wherein the sintering composition contains the metal complex in an amount of at least 70 wt.% based on the total weight of the sintering composition, preferably at least 75 wt.% based on the total weight of the sintering composition.

5. The sintering composition of any preceding claim, wherein the solvent is supersaturated with the metal complex.

6. The sintering composition of any of preceding claim, wherein the sintering composition contains at least 25 wt.% metal based on the total weight of the sintering composition, preferably at least 30 wt.% metal based on the

total weight of the sintering composition, more preferably at least 35 wt.% metal based on the total weight of the sintering composition.

7. The sintering composition of any preceding claim, wherein the metal complex substantially decomposes at a temperature of less than 200°C, preferably less than 190 °C.

8. The sintering composition of any of preceding claim, wherein the solvent and/or the ligand of the metal complex has a boiling point of less than 300°C, preferably less than 250°C and more preferably less than 200°C.

9. The sintering composition of any preceding claim, wherein the metal of the metal complex is selected from one or more of silver, gold, platinum, palladium, nickel, copper and molybdenum, preferably copper and/or silver.

10. The sintering composition of any preceding claim, wherein the solvent comprises an organic solvent, preferably wherein the solvent is selected from one or more of propane-1-2-diol, terpineol, triethylene glycol, glycerol and 2-methyl-1,3-propanediol, more preferably terpineol or glycerol.

11. The sintering composition of any preceding claim, wherein the metal complex is a metal carboxylate, preferably wherein the carboxylate has the structure $RCOO^-$ wherein R is a branched or unbranched hydrocarbon chain having 14 carbon atoms or less, preferably 12 carbon atoms or less and more preferably 10 carbon atoms or less.

12. The sintering composition of any preceding claim, wherein the metal complex is selected from one or more of silver neodecanoate, silver 2-ethyl hexanoate, silver oxalate, silver lactate, silver hexafluoroacetylacetonate cyclooctadiene, copper formate tetrahydrate

and copper acetate, preferably silver neodecanoate or copper formate tetrahydrate.

~~13. The sintering composition of any preceding claim, wherein the viscosity of the sintering composition is from 60,000 to 120,000 cP, preferably from 70,000 to 80,000 cP.~~

~~14~~13. The sintering composition of any preceding claim, in the form of:

a gel, preferably a metallic gel; or

a free-standing film or foil; or

applied, deposited, printed or laminated on a wafer; or

applied, deposited, printed or laminated on a substrate fabricated from glass and/or ceramic and/or a metal and/or a polymeric film and/or a composite material used as a printed circuit board.

~~15~~14. A method of manufacturing the sintering composition of any preceding claim, the method comprising:

providing a solvent;

providing a metal complex; and

dissolving the metal complex in the solvent at a temperature of from 100 °C to 180 °C to form a solution.

~~16~~15. The method of claim ~~15~~14, wherein the solution is supersaturated.

~~17~~16. The method of claim ~~15~~ 14 or claim ~~16~~15, wherein the method further comprises cooling the solution to a temperature of from 30 to 60 °C, preferably to a temperature of from 40 to 50 °C.

~~18~~17. The method of any of claims ~~15~~ 14 to ~~17~~16, wherein the method further comprises milling the solution.

~~19~~18. The method of any of claims ~~15~~ 14 to ~~18~~17, wherein dissolving the metal complex in the solvent is carried out at a temperature of from 110 °C to 150 °C, preferably from 120 °C to 140°C, even more preferably about 130 °C.

~~20~~19. The method of any of claims ~~15~~ 14 to ~~19~~18, wherein the sintering composition is free of any metal particles and/or free of any particles of the metal complex.

~~21~~20. A method of forming a sintered metal deposit on a substrate, the method comprising:

providing a substrate;

disposing the sintering composition of any of claims 1 to ~~14~~ 13 onto the substrate;

drying the composition at a temperature of from 140 to 200 °C to form a dried composition; and

sintering the dried composition at a temperature of from 150 °C to 300 °C, wherein the sintering is carried out at a temperature higher than the temperature of the drying.

~~22~~21. The method of claim ~~21~~20, wherein the substrate is a flexible substrate, preferably comprising one of more of PET, PC, PI, TPU, PEN and PEEK.

~~23~~22. The method of claim ~~21~~20, wherein the substrate is a rigid substrate, preferably comprising FR4, glass, ceramic, such as Al_2O_3, SiC or SiO_2, a semiconductor material, such as Si, SiC, Ge or GaN, or a metal foil, such as a metal foil formed of Cu, Ag, Au, Al, Ni or an alloy.

~~24~~23. The method of any of claims ~~21~~ 20 to ~~23~~22, wherein disposing the sintering composition onto the substrate comprises stencil printing and/or screen printing the sintering composition onto the substrate.

~~25~~24. The method of any of claim ~~21~~ 20 to ~~24~~23, wherein:

the metal complex of the sintering composition comprises silver, and the drying is carried out at a temperature of from 170 °C to 190 °C for from 30 to 90 minutes; or

the metal complex of the sintering composition comprises copper, and the drying is carried out at a temperature of from 150 °C to 170 °C for from 15 to 60 minutes under a nitrogen atmosphere.

~~26~~25. The method of any of claim ~~21~~ 20 to ~~25~~24, wherein the sintering is carried out at a temperature of from 180 °C to 295 °C, preferably from 200 °C to 290 °C, more preferably from 210 °C to 285 °C, even more preferably from 240 °C to 280 °C, still even more preferably from 250 °C to 270 °C.

~~27~~26. The method of any of claims ~~21~~ 20 to ~~26~~25, wherein the sintering step is performed at a pressure of from 2 MPa to 15 MPa, preferably from 4 MPa to 12 MPa.

~~28~~27. The method of any of claims ~~21~~ 20 to ~~27~~26, wherein the sintered metal deposit comprises a joint between a die and a substrate.

~~29~~28. The method of any of claims ~~21~~ 20 to ~~27~~26, wherein the sintered metal deposit comprises an electrical circuit or an interconnect.

~~30~~29. The method of any of claims ~~21~~ 20 to ~~27~~26, wherein the sintered metal deposit comprises a coating.

~~31~~30. The method of any of claim ~~21~~ 20 to ~~30~~29, wherein the sintered metal deposit is substantially free of metal complex and/or substantially free of organic ligand and/or substantially free of organic material and/or substantially free of carbon.

~~32~~31. The method of any of claims ~~21~~ 20 to ~~31~~30, wherein the sintered metal deposit has a die shear strength of greater than or equal to 30 MPa, preferably

greater than or equal to 40 MPa, and more preferably greater than or equal to 50 MPa.

~~33~~32. The method of any of claims ~~21~~ 20 to ~~32~~31, wherein:

after a thermal shock test for 1000 cycles, from +150°C to -50°C with a dwell time of 3 minutes, the percentage void in the sintered metal deposit is 0.5% or less, preferably 0.3% or less; and/or

after a thermal shock test for 3000 cycles, from +150°C to -50°C with a dwell time of 3 minutes, the percentage void in the sintered metal deposit is 1.5% or less, preferably 1.0% or less.

~~34~~33. The method of any of claims ~~21~~ 20 to ~~33~~32, wherein the peel strength of the sintered metal deposit is greater than or equal to 10 N/mm, preferably greater than or equal to 15 N/mm, and more preferably greater than or equal to 20 N/mm.

~~35~~34. The method of any of claims ~~21~~ 20 to ~~34~~33, wherein the sintered metal deposit is solderable and/or high-current capable.

~~36~~35. The method of any of claims ~~21~~ 20 to ~~35~~34, wherein the sintered metal deposit is flexible.

~~37~~36. The method of any of claims ~~21~~ 20 to ~~36~~35, wherein the sintered metal deposit, preferably a silver deposit, exhibits a sheet resistance of less than 12 mΩ/sq/mil.

~~38~~37. A sintered metal deposit formed using the sintering composition of any of claims 1 to ~~14~~13, preferably wherein the sintered metal deposit is formed using the method of any of claims ~~21~~ 20 to ~~37~~36.

~~39~~38. The sintered metal deposit of claim ~~38~~37, wherein the sintered metal deposit comprises a joint between a die and a substrate.

~~40~~39. The sintered metal deposit of claim ~~38~~37, wherein the sintered metal deposit comprises an electrical circuit or an interconnect.

~~41~~40. The sintered metal deposit of claim ~~38~~37, wherein the sintered metal deposit comprises a coating.

~~42~~41. A method of die attachment, the method comprising:

providing a substrate and a die;

disposing the sintering composition of any of claims 1 to ~~14~~ 13 between the substrate and the die;

drying the composition at a temperature of from 140 to 200 °C to form a dried composition; and

sintering the dried composition at a temperature of from greater than 150 °C to 300 °C at a pressure of from 2 MPa to 15 MPa to attach the die to the substrate,

wherein the sintering is carried out at a temperature higher than the temperature of the drying.

~~43~~42. The method of claim ~~42~~41, wherein the sintering is carried out at a pressure of from 4 MPa to 12 MPa.

~~44~~43. A method of forming an electrical circuit or an interconnect on a substrate, the method comprising:

providing a substrate;

disposing the sintering composition of any of claims 1 to ~~14~~ 13 onto the substrate in the form a circuit or interconnect;

drying the composition at a temperature of from 140 to 200 °C to form a dried composition; and

sintering the dried composition at a temperature of from 150 °C to 300 °C to form the circuit or interconnect,

wherein the sintering is carried out at a temperature higher than the temperature of the drying.

~~45~~44. The method of claim ~~44~~43, wherein the substrate is either rigid or flexible.

~~46~~45. A method of manufacturing a soldered assembly, the method comprising:

forming a sintered metal deposit on a substrate according to the method of any of claims ~~21~~ 20 to ~~37~~36;

depositing a solder paste on the sintered metal;

contacting a component with the deposited solder paste; and

reflowing the solder paste to provide a soldered assembly.

~~47~~46. The method of claim ~~46~~45, wherein the component is selected from an electronic component, an LED, a metallized printed circuit board and heat sink.

~~48~~47. The method of claim ~~46~~ 45 or ~~47~~46, wherein the substrate is selected from a carrier film, an interposer or a circuit board or a heat sink.

~~49~~48. Use of the sintering composition of any of claims 1 to ~~14~~ 13 in a method selected from: die attachment, wafer-to-wafer bonding, hermetic and near hermetic sealing, dispensing and the production of circuitry or interconnect lines.

~~50~~49. Use of the sintering composition of any of claims 1 to ~~14~~ 13 in the method of any of claims ~~21~~ 20 to ~~37~~ 36 or ~~41~~ 40 to ~~48~~ 47 to produce electrical/electronic devices, interconnects, assemblies, circuits, or printed cables and wire harnesses.

~~51~~50. Use according to claim ~~50~~49, wherein the assemblies and/or circuits are flexible or thermoformed and/or injection molded 3D electronic structures.

~~52~~51. Use according to claim ~~50~~ 49 or claim ~~51~~50, wherein the assemblies and/or circuits are solderable and can carry high current density.