Claims~~:~~

1. A sintering powder comprising copper particles~~,~~ and up to 1 wt.% capping agent, wherein:

the particles are at least partially coated with ~~a~~the capping agent, and

the particles exhibit a D10 of greater than or equal to 100 nm and a D90 of less than or equal to 2000 nm, wherein the D10 describes the equivalent spherical diameter that 10% of the volume distribution are lower than and the D90 describes the equivalent spherical diameter that 90% of the volume distribution are lower than.

2. The sintering powder of claim 1, for die attach.

3. The sintering powder of claim 1 ~~or claim 2~~, wherein the capping agent comprises triethanol amine.

4. The sintering powder of ~~any preceding~~ claim ~~comprising up to 1 wt.% capping agent, preferably from 0.1 to 0.5 wt.% capping agent, more preferably from 0.2 to 0.4 wt.% capping agent.~~

~~5. The sintering powder of any preceding claim~~, wherein the particles exhibit a D90 of less than or equal to 1000 nm~~, preferably less than or equal to 500 nm, more preferably less than or equal to 450 nm.~~.

~~6~~5. The sintering powder of ~~any preceding~~ claim 1, wherein the particles exhibit a D10 of greater than or equal to 125 nm and a D90 of less than or equal to 450 nm.

~~7~~6. The sintering powder of ~~any preceding~~ claim 1, wherein the particles exhibit a D10 of greater than or equal to 150 nm and a D90 of less than or equal to 400 nm.

~~8~~7. The sintering powder of ~~any preceding~~ claim 1, in the form of a powder compact.

~~9~~8. A sintering paste comprising the sintering powder of any ~~preceding claim~~of claims 1 to 3 and 5 to 8.

~~10~~9. The sintering paste of claim ~~9~~8, wherein the paste comprises 70 to 90 wt.% of the sintering powder.

~~11~~10. The sintering paste of claim ~~9 or claim 10~~8, wherein the paste comprises 1 to 5 wt.% of a binder.

~~12~~11. The sintering paste of ~~any of claims 9 to 11~~claim 10, wherein the binder comprises epoxy methacrylate urethane.

~~13~~12. The sintering paste of ~~any of claims 9 to 12~~claim 8, wherein the paste comprises 0.5 to 3 wt.% of an activator, ~~preferably from 1 to 3 wt.%.~~

~~14. The sintering paste of claim 13,~~ wherein the activator comprises a dicarboxylic acid.

~~15~~13. The sintering paste of claim ~~14~~12, wherein the dicarboxylic acid comprises malonic acid.

~~16~~14. The sintering paste of ~~any of claims 9 to 15~~claim 8, wherein the paste comprises 0.5 to 2 wt.% of a dispersing agent.

~~17~~15. The sintering paste of claim ~~16~~14, wherein the dispersing agent comprises a surfactant.

~~18~~16. The sintering paste of ~~any of claims 9 to 17~~claim 8, wherein the paste comprises 10 to 15 wt.% of an organic solvent.

~~19~~17. The sintering paste of claim ~~18~~16, wherein the organic solvent comprises terpineol.

~~20~~18. The sintering paste of ~~any of claims 9 to 19~~claim 8, wherein the paste comprises:

70 to 90 wt.% of the sintering powder,

1 to 3 wt.% of an activator,

0.5 to 2 wt.% of a dispersing agent,

10 to 15 wt.% of an organic solvent, and

optionally, 1 to 5 wt.% of a binder,

wherein the activator comprises a dicarboxylic acid.

~~21~~19. The sintering paste of ~~any of claims 9 to 20~~claim 8, wherein the paste is printable ~~and/or~~, dispensable ~~and/or~~, jettable ~~and/or~~, pin transferable ~~and/~~,or screen printable.

~~22~~20. A sintering film comprising the sintering paste of ~~any of claims 9 to 21~~claim 8.

~~23~~21. The sintering film of claim ~~22~~20, wherein the film is pre-applied to a wafer.

~~24~~22. The sintering film of claim ~~22~~20, wherein the film is on a polymer substrate.

~~25~~23. The sintering film of claim ~~22~~20, wherein the film is free standing.

~~26~~24. A method of manufacturing a sintering powder~~, preferably the sintering powder~~ of any of claims 1 to ~~8~~3 and 4 to 7, the method comprising:

providing a solution comprising copper ions and a capping agent,

contacting the solution with a reducing agent to provide the sintering powder, and

recovering the sintering powder.

~~27~~25. The method of claim ~~26~~24, wherein the molar ratio of copper ions : capping agent in the solution is from 1:1 to 10:1~~, preferably from 2:1 to 7:1, more preferably from 4:1 to 6:1.~~ .

~~28~~26. The method of claim ~~26 or claim 27~~24, wherein the copper ions in the solution are provided in the form of a copper salt, and the copper salt comprises copper acetate.

~~29~~27. The method of ~~any of claims 26 to 28~~claim 24, wherein the capping agent comprises triethanolamine.

~~30~~28. The method of ~~any of claims 26 to 29~~claim 24, wherein the solution has a pH greater than 7.

~~31~~29. The method of ~~any of claims 26 to 30~~claim 24, wherein the molar ratio of reducing agent to copper ions is greater than 1:1.

~~32~~30. The method of ~~any of claims 26 to 31~~claim 24, wherein the reducing agent comprises hydrazine.

~~33~~31. The method of ~~any of claims 26 to 32~~claim 24, wherein the solution comprising copper ions and a capping agent is contacted with the reducing agent for from 5 to 30 hours~~, preferably from 10 to 20 hours.~~.

~~34~~32. The method of ~~any of claims 26 to 33~~claim 24, wherein recovering comprises one or more of decanting the resulting solution from the sintering powder, washing the sintering powder and drying the sintering powder.

~~35~~33. The method of ~~any of claims 26 to 34~~claim 24, wherein the method is carried out in a non-inert atmosphere~~, preferably air~~.

~~36~~34. A method of manufacturing the sintering paste comprising the sintering powder of any of claims ~~9~~1 to 3 and 4 to ~~21~~7, the method comprising:

providing the sintering powder according to any of claims claims 1 to ~~8~~3 and 4 to 7, and

mixing the sintering powder with an organic solvent and optionally one or more of an activator, a dispersing agent, a capping agent and a binder, wherein the activator comprises a dicarboxylic acid.

~~37~~35. The method of claim ~~36~~34, further comprising milling the sintering paste.

~~38~~36. The method of claim ~~36 or claim 37~~34, further comprising casting the sintering paste into a film.

~~39~~37. A method of forming a joint between two or more work pieces, the method comprising:

providing two or more work pieces to be joined,

providing the sintering ~~powder of any of claims 1 to 8 and/or the sintering~~ paste of any of ~~claims 9 to 21 and/or the sintering film of any of claims 22 to 25~~claim 8 in the vicinity of the two or more work pieces,

drying the ~~sintering powder and/or~~ sintering paste ~~and/or sintering film~~, and

heating the sintering ~~powder and/or sintering~~ paste ~~and/or sintering film~~ to at least partially sinter the metal.

~~40~~38. The method of claim ~~39~~37, wherein the two or more work pieces comprise a die and a substrate.

~~41~~39. The method of claim ~~39 or 40~~37, wherein the drying is carried out at a temperature of from 30 to 100 °C~~, preferably from 40 to 80 °C, more preferably from 50 to 70 °C.~~.

~~42~~40. The method of claim ~~41~~39, wherein the drying is carried out for from 1 to 60 minutes~~, preferably from 5 to 40 minutes, more preferably from 10 to 30 minutes.~~.

~~43~~41. The method of ~~any of claims 39 to 42~~claim 37, wherein a pressure of from 2 to 18 MPa is applied during the step of heating~~, preferably from 3 to 15 MPa, more preferably from 5 to 13 MPa, even more preferably from 8 to 12 MPa~~.

~~44~~42. The method of ~~any of claims 39 to 43~~claim 37, wherein:

the sintering paste is screen-printed onto one or more of the work pieces to be joined to form a screen-printed pattern; and

solder is applied to the screen-printed pattern,

optionally wherein the screen-printed pattern is coated by an electroless nickel immersion gold (ENIG) technique prior to the solder being applied.

~~45. Use of the~~43. The sintering powder of any of claims 1 to ~~8,~~3 and~~/or the sintering paste of any of claims 9~~ 4 to ~~21, and/or the film of any of claims 22 to 25~~7, the sintering powder is used in a method selected from: die attachment, wafer-to-wafer bonding, hermetic and near hermetic sealing, sintering films comprising a sintering powder and a binder formed in a film on a backing layer, dispensing and the production of interconnect lines.

~~46~~44. A sintered joint formed using the sintering powder of any of claims 1 to ~~8,~~3 and~~/or the sintering paste of any of claims 9~~ 4 to ~~21, and/or the sintering film of any of claims 22 to 25.~~7.