Claims

1. A tin-based solder alloy powder in the form of 2 to 38 µm small spherical tin-based solder alloy particles having an inorganic surface and a thin outer surface layer of stressed castor oil,
wherein the thin outer surface layer of stressed castor oil has a layer thickness in the range of 0.5 to 5.2 nm, the stressed castor oil has an acid number in the range of 3 to 4 mg KOH/g and is obtainable by subjecting fresh castor oil to oxidative and/or thermal stress, and the inorganic surface plus the thin outer surface layer of stressed castor oil together form a surface region of the spherical tin-based solder alloy particles, and
wherein the surface region, when subjected to a ToF-SIMS analysis carried out with Ga^+ primary ions having an energy of 15 keV and with a total scan time of 5 minutes, exhibits a secondary ion mass spectrum comprising the negatively charged secondary ion fragments 113 amu with a relative signal intensity in the range of 0.7 to 3.1,
127 amu with a relative signal intensity in the range of 0.9 to 4.4,
136 amu with a relative signal intensity in the range of 1.4 to 6.7,
137 amu with a relative signal intensity in the range of 0.6 to 3.9,
152 amu with a relative signal intensity in the range of 1.3 to 12,
153 amu with a relative signal intensity in the range of 2.3 to 20,
183 amu with a relative signal intensity in the range of 0.6 to 16,
279 amu with a relative signal intensity in the range of 0.5 to 12, and
297 amu with a signal intensity of 1.

2. The tin-based solder alloy powder of claim 1, wherein the tin-based solder alloy is a solder alloy comprising at least 42 wt.% of tin or a tin-rich solder alloy having a tin content of 90 to 99.5 wt.%.

3. A process for the manufacture of a tin-based solder alloy powder in the form of 2 to 38 µm small spherical tin-based solder alloy particles having an inorganic surface and a thin outer surface layer of stressed castor oil, wherein the thin outer surface layer of stressed castor oil has a layer thickness in the range of 0.5 to 5.2 nm, and the inorganic surface plus the thin outer surface layer of stressed castor oil together form a surface region of the spherical tin-based solder alloy particles, the process comprising the successive steps:

(1) converting a hot mixture of a tin-based solder alloy melt and a stressed castor oil into a dispersion of molten spherical tin-based solder alloy particles within the stressed castor oil by

subjecting the hot mixture to a rotor-stator process until a particle size in the range of 2 to 38 µm is obtained, wherein the stressed castor oil has an acid number in the range of 3 to 4 mg KOH/g and is obtainable by subjecting fresh castor oil to oxidative and/or thermal stress, and the ratio of the tin-based solder alloy melt to the stressed castor oil is in a range of 0.2 to 5 kilograms of the tin-based solder alloy melt per liter of the stressed castor oil,

(2) allowing the dispersed molten spherical tin-based solder alloy particles formed in step (1) to solidify within the stressed castor oil,

(3) separating the solidified spherical tin-based solder alloy particles from the stressed castor oil to obtain solid spherical tin-based solder alloy particles covered by residual stressed castor oil, and

(4) repeatedly rinsing and finally drying the solid spherical tin-based solder alloy particles until they have the surface region which, when subjected to a ToF-SIMS analysis carried out with Ga^+ primary ions having an energy of 15 keV and with a total scan time of 5 minutes, exhibits a secondary ion mass spectrum comprising the negatively charged secondary ion fragments 113 amu with a relative signal intensity in the range of 0.7 to 3.1, 127 amu with a relative signal intensity in the range of 0.9 to 4.4, 136 amu with a relative signal intensity in the range of 1.4 to 6.7, 137 amu with a relative signal intensity in the range of 0.6 to 3.9, 152 amu with a relative signal intensity in the range of 1.3 to 12, 153 amu with a relative signal intensity in the range of 2.3 to 20, 183 amu with a relative signal intensity in the range of 0.6 to 16, 279 amu with a relative signal intensity in the range of 0.5 to 12, and 297 amu with a signal intensity of 1, wherein a liquid composition consisting of 50 to 100 wt.% of at least one halogenated hydrocarbon solvent and of 0 to 50 wt.% of at least one organic solvent other than halogenated hydrocarbon solvents is used as rinsing fluid, wherein the wt.% total 100 wt.%, and wherein the repeatedly performed rinsing comprises 8 to 15 successive rinsing steps.

4. The process of claim 3, wherein the tin-based solder alloy is a solder alloy comprising at least 42 wt.% of tin or a tin-rich solder alloy having a tin content of 90 to 99.5 wt.%.

5. The process of any one of claims 3 and 4, wherein the liquid composition consists of at least one halogenated hydrocarbon solvent.

6. The process of any one of claims 3 to 5, wherein each of said successive rinsing steps is performed by stirring the mixture of the rinsing fluid and the spherical tin-based solder alloy particles for a period in the range of 20 to 60 minutes and thereafter allowing the mixture to stand for the spherical tin-based solder alloy particles to sink within the rinsing fluid.

7. A solder paste comprising the tin-based solder alloy powder of any one of claims 1 and 2 or manufactured by the process of any one of claims 3 to 6.