Claims

1. A tin-based solder alloy powder in the form of 2 to 38 µm small spherical tin-based solder alloy particles exhibiting an oxygen/carbon (O/C) weight ratio in the range of 1.0 to 2.2, wherein the spherical tin-based solder alloy particles have a thin outer surface layer of plant oil, the thin outer surface layer has a thickness in the range of 0.5 to 5.2 nm determined by Auger electron spectroscopy using an argon sputtering ion beam at 1 keV, the thickness and for the O/C weight ratio, the oxygen content and the carbon content of the spherical tin-based solder alloy particles are determined based on inert gas fusion analysis and combustion and infrared detection, respectively.

2. The tin-based solder alloy powder of claim 1, wherein the O/C weight ratio is in the range of 1.0 to 2.0.

3. The tin-based solder alloy powder of claim 1 or 2, 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.%.

4. The tin-based solder alloy powder of any one of the preceding claims, wherein the plant oil is castor oil.

5. The tin-based solder alloy powder of claim 4, wherein the castor oil is selected from the group consisting of fresh castor oil having an acid number in the range of 0.14 to 1.97 mg KOH/g and of stressed castor oil having an acid number in the range of 3 to 4 mg KOH/g.

6. 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 exhibiting an oxygen/carbon (O/C) weight ratio in the range of 1.0 to 2.2, wherein the spherical tin-based solder alloy particles have a thin outer surface layer of plant oil, the thin outer surface layer has a thickness in the range of 0.5 to 5.2 nm determined by Auger electron spectroscopy using an argon sputtering ion beam at 1 keV, the thickness and for the O/C weight ratio, the oxygen content and the carbon content of the spherical tin-based solder alloy particles are determined based on inert gas fusion analysis and combustion and infrared detection, respectively, the process comprising the successive steps:

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

ratio of the tin-based solder alloy melt to the plant oil is in a range of 0.2 to 5 kilograms of the tin-based solder alloy melt per liter of the plant oil,

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

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

(4) repeatedly rinsing and finally drying the solid spherical tin-based solder alloy particles until they have a thin outer surface layer of plant oil so as to exhibit an O/C weight ratio in the range of 1.0 to 2.2,

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

the repeatedly performed rinsing comprises 5 to 20 successive rinsing steps, 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.

7. The process of claim 6, wherein the O/C weight ratio is in the range of 1.0 to 2.0.

8. The process of claim 6 or 7, 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.%.

9. The process of any one of claims 6 to 8, wherein the plant oil is castor oil.

10. The process of claim 9, wherein the castor oil is selected from the group consisting of fresh castor oil having an acid number in the range of 0.14 to 1.97 mg KOH/g and of stressed castor oil having an acid number in the range of 3 to 4 mg KOH/g.

11. The process of any one of claims 6 to 10, wherein the liquid composition consists of at least one halogenated hydrocarbon solvent.

12. The process of claim 9 wherein the repeatedly performed rinsing comprises 8 to 20 successive rinsing steps,

or of claim 10, wherein the castor oil is stressed castor oil and wherein the repeatedly performed rinsing comprises 8 to 15 successive rinsing steps.

13. The process of any one of claims 6 to 12, wherein after said successive rinsing steps is performed by stirring the mixture of the rinsing fluid and the spherical tin-based solder alloy particles for said period in the range of 20 to 60 minutes, allowing the mixture to stand for the spherical tin-based solder alloy particles to sink within the rinsing fluid.

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14. A solder paste comprising the tin-based solder alloy powder of any one of claims 1 to 5 or manufactured by the process of any one of claims 6 to 13.