CLAIMS

[Claim 1]

A method for manufacturing a solder product, the method comprising:

a heating step of heating and melting a raw material to obtain a molten metal, the raw material containing tin as a main component, a metal element other than lead as a secondary component, and a carboxylic acid having 10 to 20 carbons;

a filtration step of filtering the molten metal set to a temperature from 230°C to 260°C with a filter having an aperture size of not more than 10 μm; and

a cooling step of cooling and solidifying the filtered molten metal and depositing the carboxylic acid at a surface of the solder product.

[Claim 2]

The method for manufacturing a solder product according to claim 1, wherein in the filtration step, the filter is heated.

[Claim 3]

The method for manufacturing a solder product according to claim 1 or 2, wherein in the filtration step, wire mesh made of stainless steel is used as the filter.

[Claim 4]

The method for manufacturing a solder product according to any one of claims 1 to 3, wherein in the heating step, the raw material contains copper as the metal element serving as the secondary component.

[Claim 5]

A method for manufacturing a solder product, the method comprising:

a heating step of heating and melting a raw material to obtain a molten metal, the raw material containing tin as a main component, a metal element other than lead as a secondary component, and a carboxylic acid having 10 to 20 carbons;

a removing step of removing, from the molten metal set to a temperature from 230°C to 260°C, solids having a diameter of more than 10 μm and present within the molten metal; and

a cooling step of cooling and solidifying the molten metal with the solids removed therefrom and depositing the carboxylic acid at a surface of the solder product.

[Claim 6]

The method for manufacturing a solder product according to claim 5, wherein in the removing step, the molten metal is set to a temperature from 235°C to 250°C.

[Claim 7]

The method for manufacturing a solder product according to claim 5 or 6, wherein in the removing step, the solids having a diameter of more than 5 μm are removed from the molten metal.

[Claim 8]

A method for manufacturing a solder product, the method

comprising:

a step of melting a raw material containing an alloy of a mixture of a plurality of metal elements and a carboxylic acid having 10 to 20 carbons to obtain a molten metal;

a step of removing, from the molten metal set to a temperature from 230°C to 260°C, solids with a grain size of more than 10 μm derived from the alloy; and

a step of manufacturing a solder by solidifying the molten metal with the solids removed therefrom and depositing the carboxylic acid at a surface of the solder product.

[Claim 9]

The method for manufacturing a solder product according to claim 8, wherein the solder is manufactured without mixing another metal element after removing the solids.

[Claim 10]

The method for manufacturing a solder product according to claim 8, wherein the solder is manufactured by mixing another metal element after removing the solids.

[Claim 11]

The method for manufacturing a solder product according to claim 1, wherein the carboxylic acid is a fatty acid having 12 to 16 carbons.

[Claim 12]

The method for manufacturing a solder product according to claim 11,

wherein the carboxylic acid is a palmitic acid.

[Claim 13]

A solder made of an alloy of a mixture of a plurality of metal elements, the solder being made by using a solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12, wherein

solids with a grain size of more than 5 μm derived from the alloy that remain in a molten metal of the alloy when the alloy is melted account for not more than 0.03 wt. % of the alloy before melting.

[Claim 14]

The solder according to claim 13, wherein

solids with a grain size of more than 3 μm derived from the alloy that remain in the molten metal of the alloy when the alloy is melted account for not more than 0.03 wt. % of the alloy before melting.

[Claim 15]

The solder according to claim 13 or 14, wherein

when the alloy is melted, solids with a grain size of more than 5 μm derived from the alloy do not remain in the molten metal of the alloy.

[Claim 16]

The solder according to claim 13 or 14, wherein

when the alloy is melted, solids with a grain size of more than 3 μm derived from the alloy do not remain in the molten metal of the alloy.

[Claim 17]

The solder according to any one of claims 13 to 16, wherein

the alloy contains tin as a main component and a metal element other than lead as a secondary component.

[Claim 18]

The solder according to claim 17, wherein

the alloy contains copper as the secondary component.

[Claim 19]

A soldered component joined by the solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12.

[Claim 20]

The soldered component according to claim 19, wherein

the soldered component includes a light-emitting diode joined onto a substrate by the solder.

[Claim 21]

The soldered component according to claim 19, wherein

the soldered component includes a micro light-emitting diode joined onto the substrate by the solder, the micro light-emitting diode having a light-emitting portion sized at or below 100 μm.

[Claim 22]

A printed wiring board comprising:

a substrate; and

an electronic component soldered onto the substrate by a solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12, wherein

the solder contains tin as a main component, a metal element other than lead as a secondary component, and a carboxylic acid having 10 to 20 carbons, the carboxylic acid being mainly distributed over a surface of the solder to form a surface layer.

[Claim 23]

A printed circuit board comprising:

a substrate;

a wiring pattern layer formed in a thin-film shape on the substrate, the wiring pattern layer constituting a wiring pattern; and

a solder layer formed in a thin-film shape on the wiring pattern layer, the solder layer containing a solder made by using a solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12, wherein

the solder in the solder layer contains tin as a main component, a metal element other than lead as a secondary component, and a carboxylic acid having 10 to 20 carbons, the carboxylic acid being mainly distributed over a surface of the solder to form a surface layer.

[Claim 24]

The printed circuit board according to claim 23, further comprising an electronic component joined to the solder layer.

[Claim 25]

The printed circuit board according to claim 24, wherein

the electronic component is joined to the solder layer by soldering, and

a solder used for the soldering is made by using a solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12 and contains tin as a main component, a metal element other than lead as a secondary component, and a carboxylic acid having 10 to 20 carbons, the carboxylic acid being mainly distributed over a surface of the solder to form a surface layer.

[Claim 26]

The printed circuit board according to any one of claims 23 to 25, wherein the wiring pattern layer contains copper.

[Claim 27]

A wire containing, in at least a portion thereof, the solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12.

[Claim 28]

The wire according to claim 27 comprising:

a linear conductor; and

a covering layer covering the linear conductor, the covering layer containing tin as a main component and a carboxylic acid having 10 to 20 carbons, the carboxylic acid being mainly distributed over a surface of the covering layer to form a surface layer.

[Claim 29]

The wire according to claim 27, wherein a linear conductor is coated with the solder product.

[Claim 30]

A soldered product comprising connecting members that are soldered to each other via the solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12.

[Claim 31]

A flexible printed board including a terminal, wherein

a surface of the terminal is covered with the solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12.

[Claim 32]

An electronic component including a terminal, wherein

a surface of the terminal is covered with the solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12.

[Claim 33]

A conductive member made by using a solder product manufactured by the method for manufacturing a solder product according to any one of claims 1 to 12, the conductive member comprising:

tin as a main component; and

a carboxylic acid having 10 to 20 carbons, the carboxylic acid being mainly distributed over a surface of the conductive member to form a surface layer.

[Claim 34]

A method for manufacturing a tin article, the method comprising:

a heating step of heating and melting a raw material to obtain a molten metal, the raw material containing tin as a main component and a carboxylic acid having 10 to 20 carbons;

a filtration step of filtering the molten metal set to a temperature from 230°C to 260°C with a filter having an aperture size of not more than 10 μm;

a cooling step of cooling and solidifying the molten metal and depositing the carboxylic acid at a surface of the molten metal; and

a forming step of shaping the molten metal into a tin article.

[Claim 35]

The method for manufacturing a tin article according to claim 34, wherein the raw material further contains a metal element other than lead and cadmium as a secondary component, in addition to tin as the main component.

[Claim 36]

The method for manufacturing a tin article according to claim 35, wherein the secondary component comprises at least one of silver, copper, zinc, nickel, antimony, and bismuth.

[Claim 37]

The method for manufacturing a tin article according to claim 34, further comprising a coloring step after the forming step, the coloring step forming a colored layer at a surface of the tin article to color the tin article.

[Claim 38]

The method for manufacturing a tin article according to claim 37, wherein the colored layer comprises gold leaf.

[Claim 39]

The method for manufacturing a tin article according to any one of claims 34 to 38, wherein the tin article is a piece of tableware.

[Claim 40]

The method for manufacturing a tin article according to claim 34, wherein the carboxylic acid is a fatty acid having 12 to 16 carbons.

[Claim 41]

The method for manufacturing a tin article according to claim 40, wherein the carboxylic acid is a palmitic acid.

[Claim 42]

A method for manufacturing a tin intermediate product, the method comprising:

a heating step of heating and melting a raw material to obtain a molten metal, the raw material containing tin as a main component and a carboxylic acid having 10 to 20 carbons;

a filtration step of filtering the molten metal set to a temperature from

230°C to 260°C with a filter having an aperture size of not more than 10 μm; and

a cooling step of cooling and solidifying the molten metal and depositing the carboxylic acid at a surface of the tin intermediate product.

[Claim 43]

A tin intermediate product manufactured by the method for manufacturing a tin intermediate product according to claim 42, the tin intermediate product comprising:

tin as a main component; and

a carboxylic acid having 10 to 20 carbons, the carboxylic acid being mainly distributed over a surface of the tin intermediate product to form a surface layer.