In the above relations (1) to (3), Cu, Ni, P, and Ge each represents a content (mass%) thereof in the solder alloy.

[0020a] In one aspect, there is provided a solder alloy, having an alloy composition consisting of, in mass%: Cu: 0.1% to 2.0%; Ni: 0.01% to 0.4 %; P: 0.001% to 0.08%; Ge: 0.001% to 0.08%, and optionally at least one selected from at least one group of: the group consisting of at least one of Bi, In, Zn, and Ag in a total amount of 5% or less; and the group consisting of at least one of Mn, Cr, Co, Fe, Si, Ti, and rare earth elements in a total amount of 1% or less, with the balance being Sn and inevitable impurities, wherein the alloy composition satisfies the following relations (1) to (3):

$(Cu + 5Ni) \leq 0.945\%$ Relation (1)

$(P + Ge) \leq 0.15\%$ Relation (2)

$2.0 \leq (Cu + 5Ni)/(P + Ge) \leq 1000$ Relation (3)

wherein, in the above relations (1) to (3), Cu, Ni, P, and Ge each represents a content (mass%) thereof in the solder alloy.

[0021]

(2) The solder alloy according to the above (1), wherein the alloy composition further contains at least one selected from at least one group of: the group consisting of at least one of Bi, In, Zn, and Ag in a total amount of 5% or less; and the group consisting of at least one of Mn, Cr, Co, Fe, Si, Ti, and rare earth elements in a total amount of 1% or less.

[0022]

(3) A cast product comprising the solder alloy according to the above (1) or (2).

(4) A formed product, formed from the cast product according to the above (3).

[0023]

(5) A solder joint, obtained by using the cast product according to the above (3).

BRIEF DESCRIPTION OF DRAWINGS

[0024]

[FIG. 1] FIG. 1 is a diagram showing the range of the present invention in which the relation (2) is taken as the x-axis and the relation (1) is taken as the y-axis.

[FIG. 2] FIG. 2 is an enlarged view of FIG. 1 with the x-axis range being 0 to 0.01 and the y-axis range being 0 to 1.

DESCRIPTION OF EMBODIMENTS

[0025]

The present invention is described in more detail below. In the description, "%" related to a solder alloy composition is "mass%", unless otherwise specified.

[0026]

1. Solder alloy

(1) Cu: 0.1% to 2.0%, and Ni: 0.01% to 0.4%

Cu and Ni are essential elements which can contribute to control of the liquidus temperature of the solder alloy. In the case where both contents of Cu and Ni are within the above range, the flowability of the molten solder is optimized, so that a cast product having a desired thickness can be obtained. In terms of the lower limit, the content of Cu is 0.1% or more, preferably 0.14% or more, more preferably 0.5% or more, and still more preferably 0.6% or more. In terms of the lower limit, the content of Ni is 0.01% or more, preferably

CLAIMS

1. A solder alloy, having an alloy composition consisting of, in mass%:

Cu: 0.1% to 0.6%;

Ni: 0.01% to 0.4 %;

P: 0.001% to 0.08%;

Ge: 0.001% to 0.08%, and

optionally at least one selected from at least one group of: the group consisting of at least one of Bi, In, Zn, and Ag in a total amount of 5% or less; and the group consisting of at least one of Mn, Cr, Co, Fe, Si, Ti, and rare earth elements in a total amount of 1% or less,

with the balance being Sn and inevitable impurities,

wherein the alloy composition satisfies the following relations (1) to (3):

$(Cu + 5Ni) \leq 0.945\%$ Relation (1)

$(P + Ge) \leq 0.15\%$ Relation (2)

$2.0 \leq (Cu + 5Ni)/(P + Ge) \leq 1000$ Relation (3)

wherein, in the above relations (1) to (3), Cu, Ni, P, and Ge each represents a content (mass%) thereof in the solder alloy.

2. The solder alloy according to claim 1, wherein the alloy composition consists of, in mass%:

Cu: 0.1% to 0.6%;

Ni: 0.01% to 0.4 %;

P: 0.001% to 0.08%; and

Ge: 0.001% to 0.08%,

with the balance being Sn and inevitable impurities.

3. A cast product comprising the solder alloy according to claim 1 or 2.

4. A formed product, formed from the cast product according to claim 3.

5. A solder joint, obtained by using the cast product according to claim 3.