such as automobiles, high power electronics, energy, LED illumination, etc. For example, an Sn-Ag-Cu-Ni-Bi-Sb-Co-Ge solder alloy with a melting temperature of 220°C or more is disclosed.

Citation List

Patent Documents

[0008] Patent Document 1: Japanese Patent Publication No. 6730999

Patent Document 2: Japanese Patent Publication No. 6836040

Patent Document 3: Chinese Patent Application Publication No. 112475664

Patent Document 4: International Publication No. WO2021/043437

Summary

[0008a] In a first aspect of the present disclosure, there is provided a solder alloy having an alloy composition consisting of, by mass%,

Ag: 1.4 to 3.9%,

Cu: 0.1 to 1.0%,

Bi: 0.6 to 1.4%,

Sb: 5.1 to 7.9%,

Ni: 0.01 to 0.30%,

Co: 0.001 to 0.100%,

optionally at least one of In, Ga, As, Fe, Pd, Mn, Zn, Zr, and Mg: 0.1% or less in total, and

with the balance being Sn.

[0008b] In another aspect of the present disclosure, there is provided a solder paste comprising the solder alloy as disclosed herein.

[0008c] In a further aspect of the present disclosure, there is provided a solder joint comprising the solder alloy as disclosed herein.

Technical Problem

[0009] In each of Patent Documents 1 to 4, an Sn-Ag-Cu-Ni-Bi-Sb-Co-based solder alloy with a liquidus-line temperature of 200°C or more is disclosed to achieve the object of invention described in the corresponding document. For example, among SiC semiconductor devices, there is that which is capable of high temperature operation at 200°C or more. If the melting point of a solder alloy is less than 200°C, the solder alloy melts during operation and cannot be applicable to a high-performance electronic component.

CLAIMS

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

Ag: 1.4 to 3.9%,

Cu: 0.1 to 1.0%,

Bi: 0.6 to 1.4%,

Sb: 5.1 to 7.9%,

Ni: 0.01 to 0.30%,

Co: 0.001 to 0.100%,

optionally at least one of In, Ga, As, Fe, Pd, Mn, Zn, Zr, and Mg: 0.1% or less in total, and

with the balance being Sn.

2. The solder alloy according to claim 1, wherein the alloy composition satisfies at least one of the following relations (1) to (4):

$426 \leq (Ag \times Cu)/(Ni \times Co) \leq 8530$ Relation (1)

$0.10 \leq Bi/Sb \leq 0.28$ Relation (2)

$10.8 \leq Sn/Sb \leq 18.0$ Relation (3)

$0.00004 \leq Bi \times Sb \times Ni \times Co \leq 0.00254$ Relation (4)

wherein Sn, Ag, Cu, Bi, Sb, Ni, and Co in the relations (1) to (4) each represent the content in mass% thereof in the solder alloy.

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

4. A solder joint comprising the solder alloy according to claim 1 or 2.