Means for solving Problem

【0012】

According to a first aspect of the present invention, there is provided a lead-free solder alloy having an alloy composition consisting essentially of, in mass percent, In: 1.0 or more and less than 3.0 %, Ag: 0.1 or more and less than 1.5 %, Cu: 0.3 through 1.0 %, and a remainder of Sn, wherein when the lead-free solder alloy is used as a solder joint under an energizing condition at a current density of 0.12 $mA/\mu m^2$ in the air at 165° C, a percent increase in a resistance value of the solder joint from a resistance value before the energization to a resistance value when 2500 hours have elapsed from the start of the energization is not more than 30 % and a difference between the percent increase in the resistance value when 2500 hours have elapsed from the start of the energization and a percent increase in a resistance value when 500 hours have elapsed from the start of the energization is not more than 5%.

【0013】

The Ag content of the lead-free solder alloy may be 0.3 - 1.5 % by mass.

【0014】

The alloy composition may contain, in mass percent, In: 2.0 - 3.0 %, Ag: 0.3 - 1.5 %, and Cu: 0.5 - 0.7 %.

【0015】

【0016】 Preferably, the alloy composition contains, in mass percent, In: 1.0 -2.0%.

【0016a】 According to a second aspect of the present invention, there is provided a lead-free solder alloy having an alloy composition consisting essentially of, in mass percent, In: more than 7.0 and 13.0 or less %, Ag: 0.1 or more and less than 1.5 %, Cu: 0.3 through 1.0 %, and a remainder of Sn,

wherein when the lead-free solder alloy is used as a solder joint under an energizing condition at a current density of 0.12 $mA/\mu m^2$ in the air at 165° C, a percent increase in a resistance value of the solder joint from a resistance value before the energization to a resistance value when 2500 hours have elapsed from the start of the energization is not more than 30 % and a difference between the percent increase in the resistance value when 2500 hours have elapsed from the start of the energization and a percent increase in a resistance value when 500 hours have elapsed from the start of the energization is not more than 5%.

【0016b】 Preferably, the alloy composition contains, in mass percent, In: 7.0 -10.0%.

【0017】

According to a third aspect of the present invention, there is provided a solder joint made from the lead-free solder alloy as defined in the first or second aspect.

【0018】

According to a fourth aspect of the present invention, there is provided a method of suppressing electromigration of a solder joint during electrical conduction comprises forming a solder joint using the lead-free solder alloy as defined in the first or second aspect.

Claims

1. A lead-free solder alloy having an alloy composition consisting essentially of, in mass percent, In: 1.0 or more and less than 3.0 %, Ag: 0.1 or more and less than 1.5 %, Cu: 0.3 through 1.0 %, and a remainder of Sn,

wherein when the lead-free solder alloy is used as a solder joint under an energizing condition at a current density of 0.12 $mA/\mu m^2$ in the air at 165° C, a percent increase in a resistance value of the solder joint from a resistance value before the energization to a resistance value when 2500 hours have elapsed from the start of the energization is not more than 30 % and a difference between the percent increase in the resistance value when 2500 hours have elapsed from the start of the energization and a percent increase in a resistance value when 500 hours have elapsed from the start of the energization is not more than 5%.

2. The lead-free solder alloy as set forth in claim 1 wherein the alloy composition contains, in mass percent, In: 1.0 -2.0%.

3. A solder joint made from the lead-free solder alloy as set forth in any one of claims 1 and 2.

4. A method for suppressing electromigration of a solder joint during electrical conduction comprising forming a solder joint using a lead-free solder alloy as set forth in any one of claims 1 and 2.

5. A lead-free solder alloy having an alloy composition consisting essentially of, in mass percent, In: more than 7.0 and 13.0 or less %, Ag: 0.1 or more and less than 1.5 %, Cu: 0.3 through 1.0 %, and a remainder of Sn,

wherein when the lead-free solder alloy is used as a solder joint under an energizing condition at a current density of 0.12 $mA/\mu m^2$ in the air at 165° C, a percent increase in a resistance value of the solder joint from a resistance value before the energization to a resistance value when 2500 hours have elapsed from the start of the energization is not more than 30 % and a difference between the percent increase in the resistance value when 2500 hours have elapsed from the start of the energization and a percent increase in a resistance value when 500 hours have elapsed from the start of the energization is not more than 5%.

6.The lead-free solder alloy as set forth in claim 5 wherein the alloy composition contains, in mass percent, In: 7.0 -10.0%.

7. A solder joint made from the lead-free solder alloy as set forth in any one of claims 5 and 6.

8. A method for suppressing electromigration of a solder joint during electrical conduction comprising forming a solder joint using a lead-free solder alloy as set forth in any one of claims 5 - 6.