Claims

1. A lead-free solder ball which is installed for use as an electrode on a module substrate for a BGA or a CSP, the solder ball having a solder composition consisting of 1.6 - 2.9 mass % of Ag, 0.7 - 0.8 mass % of Cu, 0.05 - 0.08 mass % of Ni, and a remainder of Sn.

2. A lead-free solder ball as set forth in claim 1 wherein the solder composition consists of 1.9 - 2.3 mass % of Ag, 0.7 - 0.8 mass % of Cu, 0.05 - 0.08 mass % of Ni, and a remainder of Sn.

3. A lead-free solder ball as set forth in claim 1 wherein the solder composition consists of 2.0 mass % of Ag, 0.75 mass % of Cu, 0.07 mass % of Ni, and a remainder of Sn.

4. A solder ball as set forth in any of claims 1 - 3 characterized in that the solder composition further contains at least one element selected from Fe, Co, and Pt in a total amount of 0.003 - 0.1 mass %.

5. A solder ball as set forth in any of claims 1 - 3 characterized in that the solder composition further contains at least one element selected from Bi, In, Sb, P, and Ge in a total amount of 0.003 - 0.1 mass %.

6. A lead-free solder ball as set forth in any of claims 1 - 5 wherein the solder ball has a diameter of at least 0.1 mm.

7. A lead-free solder ball as set forth in any of claims 1 - 5 wherein the solder ball has a diameter of at least 0.3 mm.

8. A lead-free solder ball as set forth in any of claims 1 - 5 wherein the solder ball has a diameter of at least 0.5 mm.

9. A method of forming solder bumps on a module substrate having electrodes selected from electrolytic Ni/Au electrodes, electroless Ni/Pd/Au electrodes, and Cu-OSP electrodes, wherein soldering is performed using a solder ball as set forth in any of claims 1 - 8.

Claims

1. A lead-free solder ball which is installed for use as an electrode on a rear surface of a module substrate for a BGA or a CSP, the solder ball having a solder composition consisting of 1.6 - 2.9 mass % of Ag, 0.7 - 0.8 mass % of Cu, 0.05 - 0.08 mass % of Ni, and a remainder of Sn.

2. A lead-free solder ball as set forth in claim 1 wherein the solder composition consists of 1.9 - 2.3 mass % of Ag, 0.7 - 0.8 mass % of Cu, 0.05 - 0.08 mass % of Ni, and a remainder of Sn.

3. A solder ball as set forth in any of claims 1 - 2 characterized in that the solder composition further contains at least one element selected from Fe, Co, and Pt in a total amount of 0.003 - 0.1 mass %.

4. A solder ball as set forth in any of claims 1 - 2 characterized in that the solder composition further contains at least one element selected from Bi, In, Sb, P, and Ge in a total amount of 0.003 - 0.1 mass %.

5. A lead-free solder ball as set forth in any of claims 1 - 4 wherein the solder ball has a diameter of at least 0.1 mm.

6. A lead-free solder ball as set forth in any of claims 1 - 4 wherein the solder ball has a diameter of at least 0.3 mm.

7. A lead-free solder ball as set forth in any of claims 1 - 4 wherein the solder ball has a diameter of at least 0.5 mm.

8. A method of forming solder bumps on a module substrate having electrodes selected from electrolytic Ni/Au electrodes, electroless Ni/Pd/Au electrodes, and Cu-OSP electrodes, wherein soldering is performed using a solder ball as set forth in any of claims 1 - 7.

9. A lead-free solder ball as set forth in claim 1 wherein the lead-free solder ball develops zero occurrence of fusion defects in a test for fusion defects.