CLAIMS:

1. A lead-free, antimony-free solder alloy comprises:

(a) silver in the range of 3 to 4.5 wt. %;
(b) bismuth in the range of 2 to 5 wt. %;
(c) copper in the range of 0.3 to 1.5 wt. %;
(d) nickel in the range of 0.05 to 0.4 wt. %;
(e) germanium in the range of 0.001 to 1 wt. %;
(f) the balance including tin and any unavoidable impurities.

2. The solder alloy according to claim 1, wherein the alloy comprises:

silver in the range of 3 to 4.5 wt.%;
bismuth in the range of 2 to 4 wt.%;
copper in the range of 0.3 to 1.2 wt.%;
nickel in the range of 0.05 to 0.3 wt.%;
germanium in the range of 0.001 to 0.01 wt.%,
the balance including tin and unavoidable impurities.

3. The solder alloy according to claim 2, wherein the copper concentration is in the range of 0.6 to 0.7 wt. %.

4. The solder alloy as claimed in claim 2, wherein the alloy has a melting range of from 208.2 to 218.6 °C.

5. The solder alloy according to claim 1 in the form of a bar, a stick, a solid or flux cored wire, a foil or strip, or a powder or paste, or solder spheres for use in ball grid array joints or chip scale packages, or other pre-formed solder pieces, with or without a flux core or a flux coating.

6. The solder alloy according to claim 1, wherein the alloy comprises:

silver in the range of 3.5 to 4 wt.%;
bismuth in the range of 3.5 to 4.5 wt.%;
copper in the range of 0.4 to 0.7 wt.%;
nickel in the range of 0.05 to 0.3 wt.%;
germanium in the range of 0.005 to 0.01 wt.%,
the balance including tin and unavoidable impurities.

7. The solder alloy according to claim 1, wherein the alloy comprises:

silver in the range of 3.0 to 4.5 wt.%;

bismuth in the range of 2.0 to 5.0 wt.%;

copper in the range of 0.3 to 1.5 wt.%;

nickel in the range of 0.05 to 0.4 wt.%;

germanium in the range of 0.005 to 1.0 wt.%,

the balance including tin and unavoidable impurities.

8. The solder alloy according to claim 7, wherein the alloy comprises:

3.83 wt.% of silver;

3.93 wt.% of bismuth;

0.63 wt.% of copper;

0.15 wt.% of nickel;

0.06 wt.% of germanium,

the balance including tin and unavoidable impurities.