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~~6~~ wt. %;

(c) copper in the range of 0.3 to 1.5 ~~2~~ wt. %;

(d) nickel in the range of ~~0.03~~0.05 to 0.4~~0.6~~ wt. %;

(e) germanium in the range of 0.001 ~~0.005~~ 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 ~~3.5~~ to 4 ~~4.5~~ wt.%;

copper in the range of 0.3 ~~0.4~~ to 1.2 ~~0.7~~ wt.%;

nickel in the range of 0.05 to 0.3 wt.%;

germanium in the range of 0.001~~0.005~~ 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~~195~~ to 218.6~~222~~ °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 4, wherein the alloy has a melting range of from 208.2 to 218.6 °C.~~

7~~8~~. The solder alloy according to claim 1, wherein the alloy comprises~~A lead-free, antimony-free solder alloy comprising~~:

silver in the range of 3.0 to 4.5 ~~5.0~~ 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~~9~~. The solder alloy according to claim 7~~8~~, 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.