Heraeus

Microbond Assembly Materials

InnoRel – for a higher reliability

InnoRel for higher reliability

InnoRel high reliability lead-free alloys for:

- **PCB assembly: InnoRel F640IL solder paste with Innolot® alloy**
- **Ceramic substrate assembly: InnoRel F640HT1 solder paste with HT1 alloy**

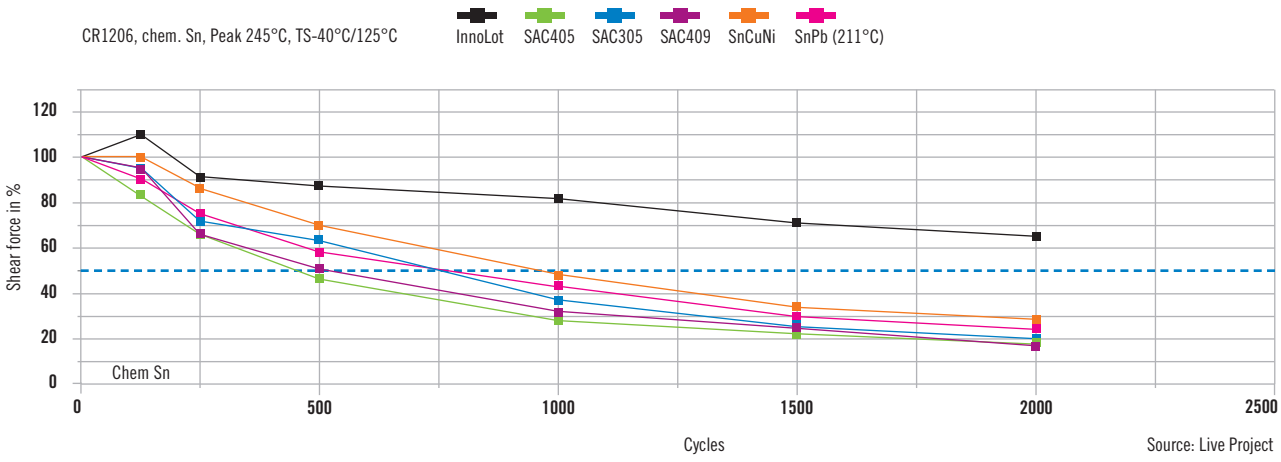
InnoRel Series with Innolot® alloy optimized for PCB assembly

InnoRel F640IL is a new, lead-free solder paste that provides the highest reliability of available SAC-based alloy systems. It is a combination of Heraeus' successful SolderPro Flux technology and the Innolot® alloy. F640IL enables assemblers to meet the industry's most stringent reliability requirements and maintain the highest possible production yields.

InnoRel F640IL significantly improves the creep strength of solder joints with ceramic components like resistors and capacitors. After accelerated thermal cycling tests of -40 to +125°C, solder joints assembled with F640IL retained 80% of their initial shear strength after 1000 cycles, compared to 50% for those assembled with conventional SAC solder pastes (1206 chip resistor with Sn finish). After 2000 cycles, the InnoRel joints retained over 60% of their initial shear strength, compared to an average of 25% for joints produced with SAC305, SAC405 and SAC409.

InnoRel solder pastes contain the Innolot® alloy system, which adds Bismuth (Bi), Antimony (Sb) and Nickel (Ni) to a SAC metallurgical system. The additions of these alloying elements allows operating temperatures as high as 150 to 165°C, whereas standard SAC systems are generally limited to operating temperatures below 125°C.

Chip resistor 1206 with Sn-finish TS -40/+125°C

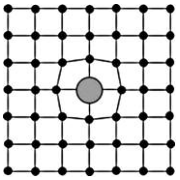


Source: Live Project

Ni, Sb and Bi improve the creep resistance of the familiar SAC (SnAgCu) alloy:

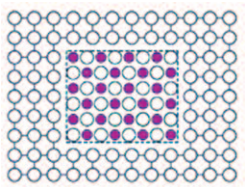
- **Ni** forms intermetallic phases, is scarcely soluble in Sn, and raises the melting point of the alloy
- **Sb** is soluble in Sn and provides a slight increase in the melting temperature and hardness of the solder joint
- **Bi** is also soluble in Sn, lowers the melting temperature, and increases the strength.

The improved properties are due to both solid solution hardening and dispersion hardening. Solid solution hardening occurs when the added alloying elements, such as Sb or Bi, dissolve in the Sn solid solution and increase its strength.



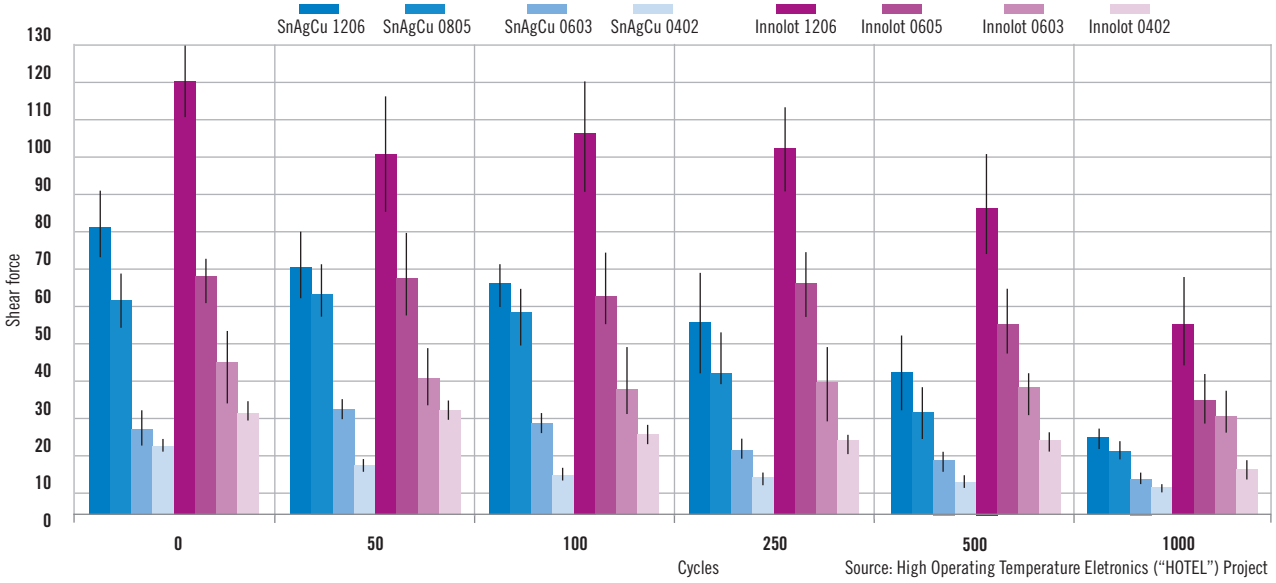
Solid solution hardening

Dispersion hardening, also known as precipitation hardening, occurs when elements that do not dissolve in Sn, such as Ni, form intermetallic phases.



Dispersion hardening

The reliability was determined in a comparison between SAC and Innolot® with the temperature change -40°C to +165°C (30'/30')



Source: High Operating Temperature Eletronics ("HOTEL") Project

Heraeus develops and produces reliable SMT materials for the automotive industry, including the Innolot® alloy in powder form that is used to make solder paste. Heraeus strictly controls the quality of the solder powder, and blends it with their production-proven F640 lead-free flux system, creating the InnoRel F640 Series with the Innolot® alloy:

- **InnoRel F640IL-89M30 solder paste for printing**
- **InnoRel F640IL-87D30 solder paste for dispensing**
- **InnoRel W640IL wire solder for rework**
- **InnoRel SF64 rework flux**

Properties of F 640IL-89M30

- Alloy composition: SnAg3.8Cu0.7Ni0.12Sb1.5Bi3
- Melting range: 206°C – 218°C
- Reflow atmosphere: nitrogen
- Stencil Life: 8 hours
- Excellent wetting properties, especially to Ni base metals
- Wide print temperature window from 22°C to 30°C
- Available with Type 3 and Type 5 powders

Flux classification

- J-STD-004: L0
- Bellcore GR-78-Core: L0
- DIN EN 61190-1-1 ISO: 1.2.2.C

Their use for you

- Higher reliability than standard SAC alloys at operating temperatures of 125°C
- Operating temperatures of 150°C possible
- Large print process window
- No change in reflow process window necessary under N_2

InnoRel Series with HT1 alloy optimized for assembly on ceramic

InnoRel F640HT1 is a new, lead-free solder paste that provides high reliability in applications using ceramic substrates (thick film) or direct bonded copper (DBC). HT1 adds Indium and other special dopants which modify the crystal structure of a typical SAC-based alloy. The resulting engineered properties of the alloy include the minimization of metal dissolution on components and pads, and a reduction of the intensive formation and growth of intermetallic phases like Ag_3Sn. The InnoRel 640HT1 solder paste is ideal for mounting components on ceramic substrates that will operate at temperatures of 125 to 175 °C.

Heraeus is your exclusive source of high reliability, lead-free solutions for hybrid circuit assembly

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The descriptions and engineering data shown here have been compiled by Heraeus using commonly-accepted procedures, in conjunction with modern testing equipment, and have been compiled as according to the latest factual knowledge in our possession. The information was up-to date on the date this document was printed (latest versions can always be supplied upon request). Although the data is considered accurate, we cannot guarantee accuracy, the results obtained from its use, or any patent infringement resulting from its use (unless this is contractually and explicitly agreed in writing, in advance). The data is supplied on the condition that the user shall conduct tests to determine materials suitability for particular application.

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