PURDUE INNOVATES | Office of Technology Commercialization

Transient Liquid Phase Bonding: High Temperature Stability through Thermodynamic Liquid Phase Design

Novel, nontoxic bismuth-based alloys enable rapid, high-temperature transient liquid phase bonding (TLPB) to create strong joints, offering a viable replacement for lead solders in high-temperature electronics and automotive applications.

Transient liquid phase bonding (TLPB) is a bonding technique used for joining a wide range of materials that is capable of producing strong, nearly invisible joints. TLPB has grown in popularity because it creates a bond of two different materials that remains bonded at temperatures greater than the melting point of the component with the lowest melting point. However, to be commercially viable, the TLPB system has to meet many industry requirements, with an underlying goal of completely replacing the toxic and commonly used lead solders.

Researchers at Purdue University have identified several new bismuth-based alloys that permit high-temperature soldering without the detrimental effects of lead solder. Purdue researchers studied the thermodynamics of bismuth alloys to identify three different processing regimes, each with unique and promising attributes, especially with TLPB. These alloys each have the required stability and permit TLPB bonds at high temperatures, making them suitable for high temperature applications. They each have a maximum reaction time of only one hour, allowing the nontoxic, bismuth-based bonds to rapidly form.

Advantages:

-High temperature melting point

-Nontoxic

-Forms a strong bond

Potential Applications:

Technology ID
2016-HAND-67586

Category
Semiconductors/Packaging & Integration
Materials Science & Nanotechnology/Advanced Functional Materials
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

Authors
Carol A Handwerker
John Ryan Holaday

Further information
Aaron Taggart
adtaggart@prf.org

View online

-High temperature solders

-Replacement for lead solders, which are banned in the European Union

-Automotive electronics

-Electronics

TRL: 4

Intellectual Property:

Provisional-Patent, 2016-06-23, United States | Utility Patent, 2017-06-23, United States

Keywords: Transient liquid phase bonding, TLPB, bonding technique, bismuth-based alloys, high-temperature soldering, nontoxic solder, lead solder replacement, high temperature applications, automotive electronics, electronics joining