Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:UH23-003P^
Published: 3/26/2024

Inventors

Joseph Brown
Kody Wakumoto
Geoffrey Garcia

Contact

Physical Sciences Team

Design of Microfabricated Mechanically Interlocking Metamaterials for Reworkable Heterogeneous Integration

Background

In the evolving field of electronic manufacturing, the integration of various components into cohesive systems presents significant challenges. Traditional methods often rely on soldering and adhesives for bonding, but these approaches have limitations in terms of reworkability, thermal constraints, and adaptability to diverse materials. As industries strive for miniaturization, performance enhancement, and reusability, there is a growing need for innovative solutions that can streamline the integration process while overcoming these limitations.

Invention Description

Researchers at the University of Hawaii have developed an approach to heterogeneous integration with the creation of microfabricated mechanically interlocking metamaterials. These metamaterials feature interlocking structures comprising of free-standing pillars and cantilevers, enabling robust mechanical retention between components. Assembly is facilitated by applying mechanical force, getting rid of the need for conventional bonding agents like solder or adhesives.

There are two primary cantilever designs:

- 3D Shaping Cantilevers: Utilizing multiple layers of photoresist, these enhance retention forces while enabling easier insertion and removal.
- Bimetallic or Curved Cantilevers: Materials with differing coefficients of thermal expansion are used to contour cantilevers into circular shapes, providing similar force asymmetry characteristics.

The invention's significance lies in its ability to enable both permanent and reworkable joints between microelectronic devices, offering advantages over traditional bonding methods. This approach facilitates chip attachment across various microdevices, accommodating purely mechanical attachment or incorporating electrical signal transfer via bonding on chip contact pads.

Potential Applications

- Consumer electronics
- Automotive
- Industrial automation

Benefits and Advantages

- Cost efficiency

- Enhanced reliability
- Increased flexibility and adaptability

Related Publication: Design of Microfabricated Mechanically Interlocking Metamaterials for Reworkable Heterogeneous Integration.