

**BiTS 2017**

**Poster Session**

**EIGHTEENTH ANNUAL**

**BiTS**

**Burn-in & Test Strategies Workshop**

TM

**March 5 - 8, 2017**

**Hilton Phoenix / Mesa Hotel  
Mesa, Arizona**

**Archive — Poster**

© 2017 BiTS Workshop – Image: tonda / iStock

## Copyright Notice

The presentation(s)/poster(s) in this publication comprise the Proceedings of the 2017 BiTS Workshop. The content reflects the opinion of the authors and their respective companies. They are reproduced here as they were presented at the 2017 BiTS Workshop. This version of the presentation or poster may differ from the version that was distributed in hardcopy & softcopy form at the 2017 BiTS Workshop. The inclusion of the presentations/posters in this publication does not constitute an endorsement by BiTS Workshop or the workshop's sponsors.

There is NO copyright protection claimed on the presentation/poster content by BiTS Workshop. However, each presentation/poster is the work of the authors and their respective companies: as such, it is strongly encouraged that any use reflect proper acknowledgement to the appropriate source. Any questions regarding the use of any materials presented should be directed to the author(s) or their companies.

The BiTS logo and 'Burn-in & Test Strategies Workshop' are trademarks of BiTS Workshop. All rights reserved.





Design, Fabrication, and Characterization of Dense and Large-stand-Off Compressible MicroInterconnects (CMIs) for Advanced Testing and Socket System Application

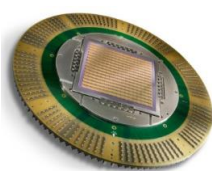
Paul K. Jo, Muneeb Zia, Joe L. Gonzalez, and  
Muhannad S. Bakir  
Georgia Institute of Technology

Introduction

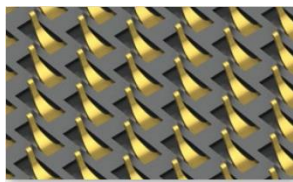
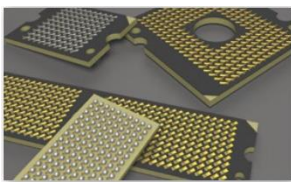
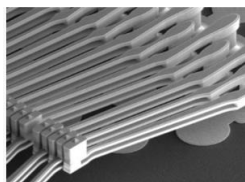
- Commercial applications of mechanically compliant interconnects



Intel Core™ i7 Processor and Opteron™ Processor with Land Grid Array (LGA) Socket

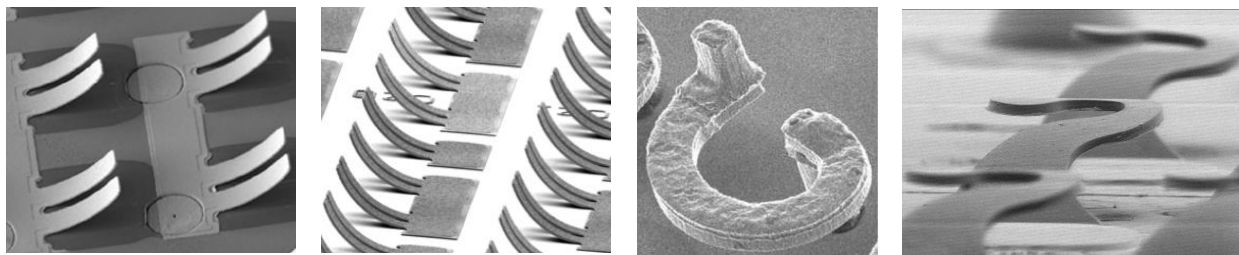


FormFactor Probe Cards



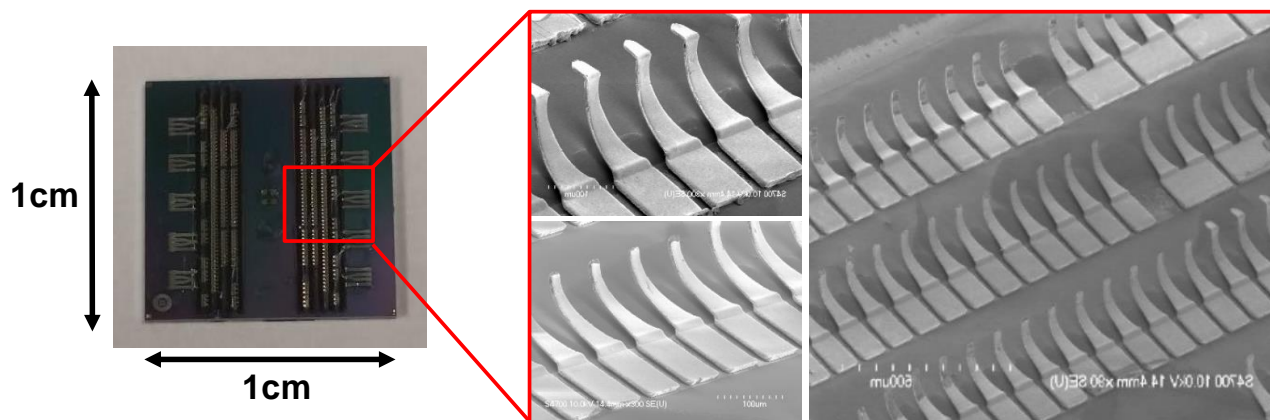
Samtec Micro-Interposer

Challenges with Current Efforts



- Non-standard fabrication process
- Limited compliance
- Rolling effect
- Small elastic range of motion
- Limitation on interconnects design

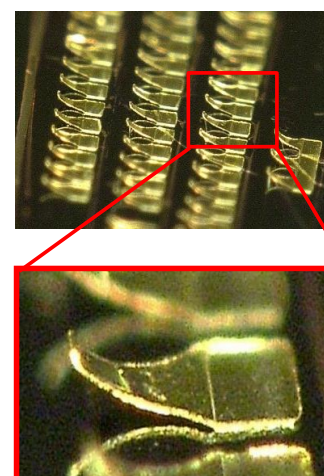
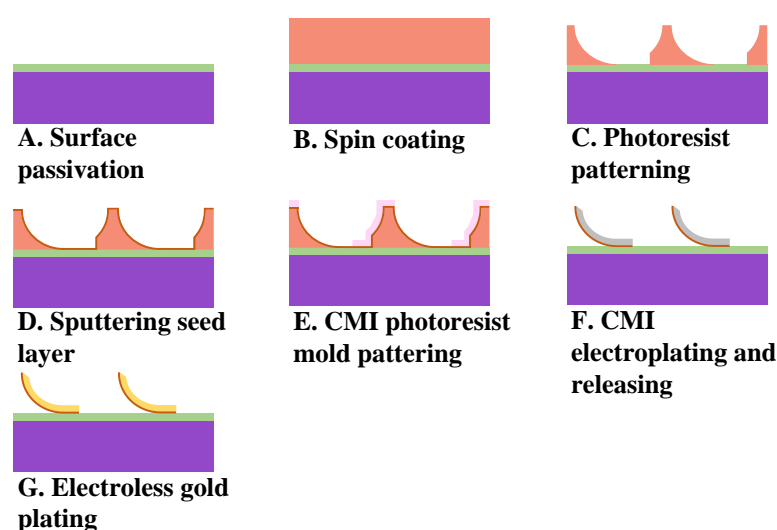
## Gold Plated NiW Compressible MicroInterconnects (CMIs)



Batch fabricated CMIs on a silicon substrate (80  $\mu\text{m}$  height, 150  $\mu\text{m}$  in-line pitch)

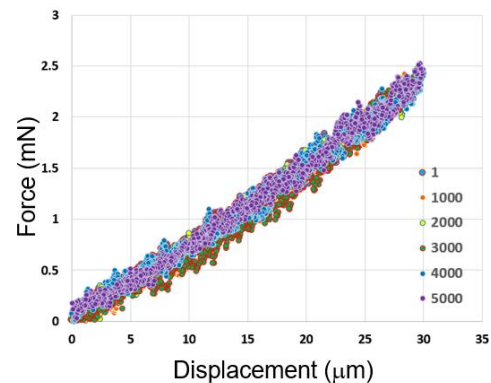
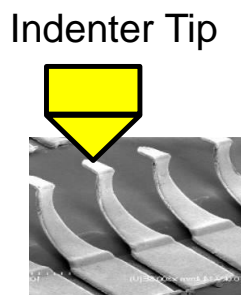
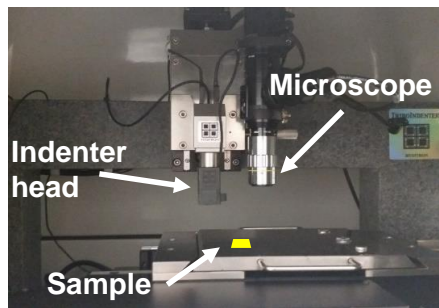
- **Lithographic-defined, CMOS compatible** fabrication process
- **Pressure-based and non-permanent** contact
- **High-degree of freedom** in interconnect design  
(height, length, thickness, top-view design, and side-view geometry)
- **Large elastic range of motion**  
(45  $\mu\text{m}$  elastic deformation from 75  $\mu\text{m}$  height CMI; 60% of its total height)
- **Large height and Highly scalable pitch**  
(up to 100  $\mu\text{m}$  height and down to 40  $\mu\text{m}$  pitch has been demonstrated)
- **Multi-height & multi-pitch fabrication**

## Fabrication Process Flow



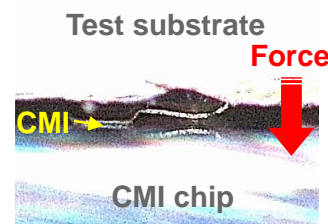
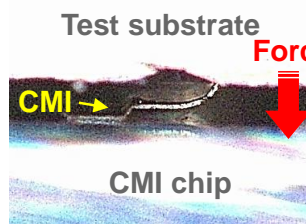
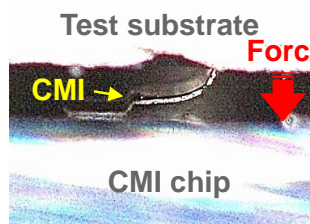
3D microscope image of the fabricated CMIs

## Mechanical Characterization



Nano-indenter

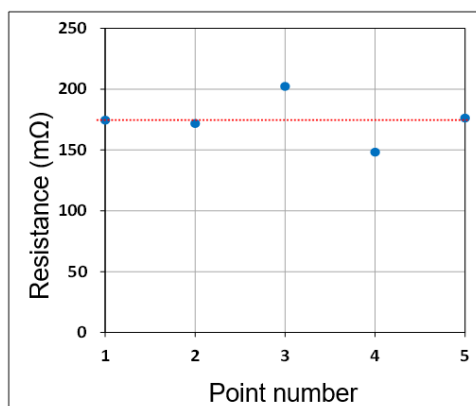
5,000 indentation cycles



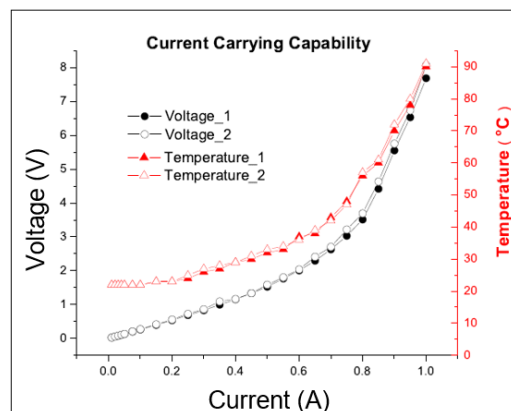
Cross section images of flip-chip bonded CMI

- NiW yield strength: 1.93 GPa (Cu has 136 MPa)
- Reliable compliance ( $\approx 12.24$  mm/N) of 70  $\mu$ m height CMI during **5,000 indentation cycles**
- Compliance range from 2.63 mm/N to 59.13 mm/N has been demonstrated

## Electrical Characterization



4-point resistance of CMIs  
(Average resistance: 176.3 mΩ)



Current Carrying Capability: Up to 1A

## Conclusion

- Highly flexible NiW CMIs are batch-fabricated using **simple and standard CMOS compatible processes**
- **High degree of freedom in interconnect design** enables an ability to reasonably control mechanical and electrical properties of CMI
- This can allow CMIs to be used in various fields of application including **testing and socket system application**