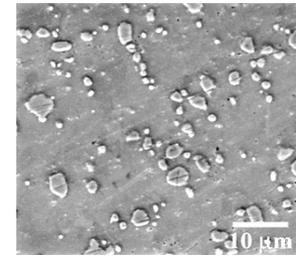
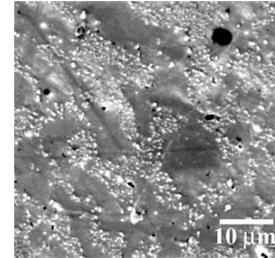


Creep and Microstructural Coarsening of Lead Free Solders

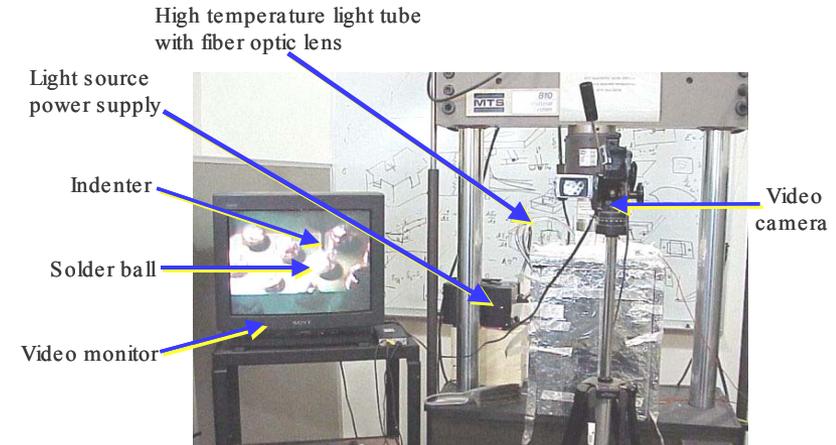
DMR Award 0209464 (GOALI Program with INTEL Corp.)

PI : Indranath Dutta, Naval Postgraduate School, Monterey, CA

- Solder joints are a critical part of a microelectronic package (e.g., INTEL Pentium)
- Solders undergo extensive creep deformation and microstructural changes during the service life of a chip/package
- Limits performance, and ultimately life
- Very important for reliability, particularly as new lead-free alloys are deployed due to environmental concerns
- Goal : characterize creep and coarsening behaviors, understand mechanisms, develop models



Micrographs of a flip-chip electronic solder joint before and after thermo-mechanical cycling showing microstructural coarsening of solder during thermo-mechanical cycling.



Impression Creep apparatus designed by postdoctoral associate Dr. R. Marks for testing of microelectronic solders attached to package (seen on TV screen)

1. I. Dutta, "A Constitutive Model for Creep of Lead-Free Solders Undergoing In-situ Microstructural Coarsening: A First Report", *J. Electronic Mater.*, 32, no. 4 (2003) pp. 1-7.
2. D. Pan and I. Dutta, "A Mechanics-Induced Complication of Impression Creep and Its Solution: Application to Sn-3.5Ag Solders", *Mater. Sci. Eng. A*, in press (2003).
3. C. Park, S. Choi and I. Dutta, "Impression Creep of Rapidly Cooled Sn-3.5Ag Solders", in review (*Mater. Sci. Eng. A*).

Creep and Microstructural Coarsening of Lead Free Solders

Indranath Dutta, Naval Postgraduate School, DMR Award 0209464

TRAINING

- 2 graduate students (Elroy Crocker and John Walsh) are participating
- 2 post-doctoral associates (Dr. R. Marks, and Dr. Deng Pan) are participating
- Materials engineer, Dr. Chanman Park, and postdoctoral associate Dr. S. Choi were trained in the design of an apparatus for high resolution impression creep testing. Dr. Choi is currently with Samsung Electronics.



MS student John Walsh and Postdoctoral associate Dr. Deng Pan working on impression creep apparatus

OUTREACH

- Prof. Dutta served as a mentor for an internship program administered by the Monterey Academy for Oceanography and Sciences (MAOS), through which a high school junior, Nicholas Vlahos, participated in the project during June-Aug 2003. Jesse Sherburn, a college junior in Physics, worked on this project part-time during June-Aug 2003. Both Mr. Vlahos and Mr. Sherburn learned how to prepare samples for optical and scanning electron microscopy.