Stress-Gradient Based Compliant Interconnects

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Objectives

• Develop a novel compliant interconnect to meet the ITRS requirements for chip-to-next-level interconnect pitch size (30 μm in 2011 and beyond). It can also deform elastically to accommodate the thermal expansion mismatch in microelectronic package and improve thermo-mechanical reliability;

• Develop assembly process and appropriate underfill material for fine pitch (21 μm) compliant interconnect package;

• Understand geometry effects on the mechanical and electrical characteristics;

• Design alternative compliant interconnect to improve the performance;

• Understand thermo-mechanical reliability of compliant interconnect package and identify failure mechanisms for packages assembled by different methods.

Accomplishments

• 5 DOF assembly station with 1 μm alignment accuracy has been set up; capillary flow and no-flow underfilling assembly methods have been tested; thermo-mechanical characterization of photosensitive underfills has been done;

• A new compliant interconnect, *J-Spring*, has been patented in Georgia Tech (Georgia Tech Provisional Patent N0.2413);

• Release model predicts the release height well; compliance and inductance study identify the coupling limits due to geometry effects;

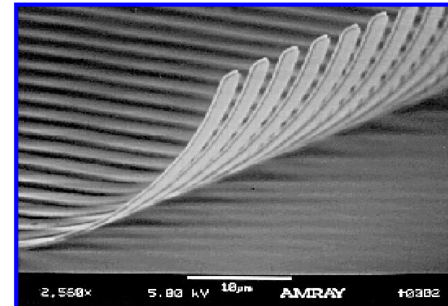
• Thermal cycling test is underway; several failure modes are found in the test;

• Alternative compliant interconnect design is underway

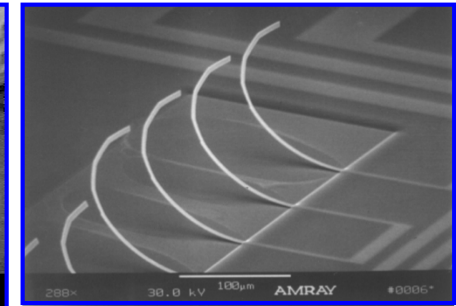
Approach

• Optical alignment method and photosensitive fast-curing underfill material are applied to improve the accuracy and assembly speed;
• Finite element analysis (FEA) based release model and compliance study for mechanical characteristics; Electrical characteristics study using analytical solution and finite element model (FEM);
• MIL-STD-883E/Cond.B (-55/+125 ˚C and +30/+125 ˚C) thermal cycling test and electrical continuity measurement; identification of failure modes;
• Experimental approach and numerical study for alternative compliant interconnect;

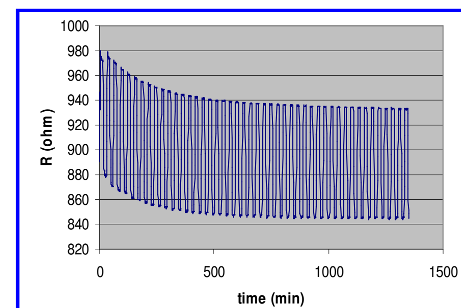
Results



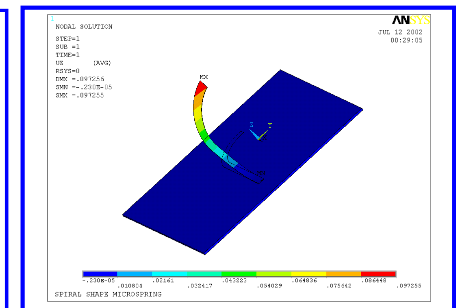
Linear Spring



J-Spring



Thermal Cycling Test



Release Model of J-Spring

Georgia Institute of Technology