Microstructure-Based 2D and 3D Modeling of the Deformation of Pb-free Solders

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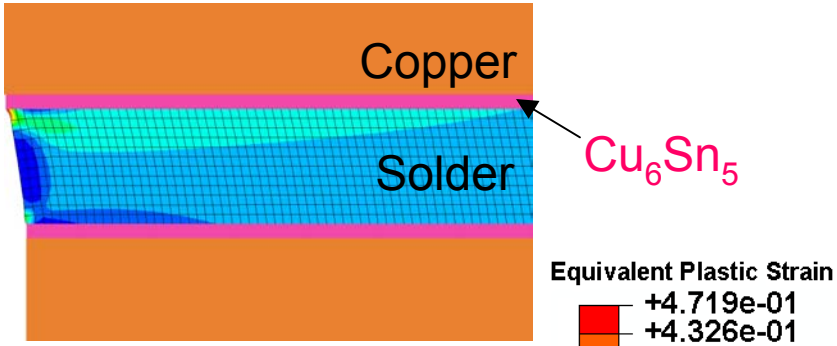
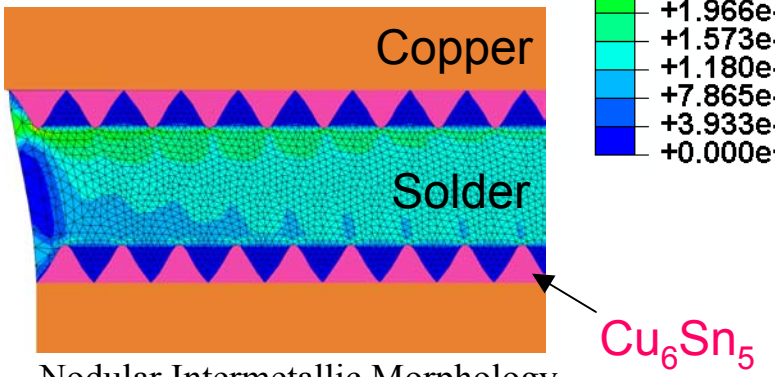
The harmful effects of lead on the environment and human heath have prompted the development of lead-free solders for microelectronic packaging. Tin-silver solder is being looked at as a possible replacement due to its appreciable mechanical properties. It has been found that the microstructure and the morphology of the intermetallic compound (Cu_6Sn_5), evolved at the solder/copper interface (interconnects) during joining, greatly affect the reliability of the joint. Finite-Element Modeling (FEM) is being used to study the effect of these variables on the deformation, damage and mechanical properties of the joint. Understanding these behaviors will help improve the robustness of interconnects in packaging devices. Here we present a 2D comparison of the plastic strain produced at the solder/copper joint interface for planar and nodular morphologies of Cu_6Sn_5.



Planar Intermetallic Morphology



Nodular Intermetallic Morphology

Deformation of Pb-free Solders – Educational Outreach

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- We continue to provide undergraduates with research experience through the REU program. Two of our former participants are now graduate students in my group.

- Physical metallurgy and deformation behavior of solders has been incorporated in two courses that I teach: Physical Metallurgy and Mechanical Behavior of Materials
  - A new lab on casting and properties of Pb-Sn solders has also been developed