SCHOOL OF MECHANICAL & MATERIALS ENGINEERING

GRADUATE SEMINAR SERIES

Interfacial Effects in Highly Flexible Electronics and Very Thin Solder Joints for 3D Electronics

Presented by Yeasir Arafat, Ph.D. Mechanical Engineering candidate

Abstract

Interfaces can play critical role in enhancing the stretchability of interconnects to be used in highly flexible electronics. Their role in formation of intermetallic compounds in thin solder joints for 3D electronics are also very important that necessitates further understanding of growth kinetics of these compounds. This work will first demonstrate how the modification of interfaces can lead to drastic improvement in stretchability in interconnects for flexible electronics. Second, an analytical model will be shown that can predict the formation of intermetallic compound in between adjacent interfaces within very thin solder joints for 3D electronics. To date, the principal strategy to produce stretchable metal lines on flexible substrates has comprised creating serpentine structures of metal films with either in-plane or out-of-plane waves using thin -films of gold. These wavy, helical patterns, however, preclude high-density packing of interconnect lines on devices/ packages. Cu films on polyimide can show can show high ductility, but form numerous visible cracks beyond ~10% elongation. This work aims to address these challenges by engineering the metal-polymer interfaces and by using low melting-temperature ductile metals such as Indium to realize highly stretchable interconnects that do not show a degradation in electrical performance under large deformation. A material system consisting of Indium metal film over an elastomer (PDMS) with a discontinuous thin Cr interlayer will be demonstrated such that the metal interconnect can be stretched to extremely high linear strain (up to 100%) without any visible cracks. For the second part of the work, development of a multidiffusion model will be described to analyze the growth kinetics of the intermetallic compounds (Cu_6Sn5 and Cu_3Sn) that are formed between the Cu-Sn interfaces in thinner solder joints.

Biography

Yeasir Arafat is a Ph.D. candidate in Mechanical Engineering at Washington State University. His current research involves identifying the interfacial effects on the stretchability of interconnects for flexible electronics and modeling of growth kinetics of intermetallic compounds for 3D electronics. He received his BSc. in Mechanical Engineering from Islamic University of Technology (IUT-OIC), Bangladesh in 2012. After graduation, he had worked as an engineer in the oil and gas industry from 2013-2014. He started working in the Multiphysics lab at WSU from Fall of 2014.

Thursday, October 4, 2018
11:00am to Noon

ETRL room 101

Meet the speaker before the seminar in ETRL room 119, 10:30am to 10:50am. Light refreshments will be served.

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