Topics in Nanopackaging

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We live in an Information Age driven by the astonishing progression of solid state electronics over the past 70 years since the invention of the transistor, and especially by the relentless march forward driven by industrial roadmaps based on faith in the infallibility of Moore's Law. But even as Moore's Law falters in the face of the challenges of nanoscale device manufacturing,, new applications are opening up, e.g. flexible electronics, wearables, Internet of Things, etc. As IC chips became bigger and on-chip devices became smaller, electronics packaging, which has provided the chip with mechanical support, environmental protection, thermal dissipation, signal and power integrity, and system reliability from mainframe computers and PCs to smart phones, has kept pace through comparable innovations. Electronics packaging areas are becoming more specialized in meeting new environmental challenges, e.g. biomedical, oil well, space, aeronautics, and of that information center formerly known as an automobile! The current "grand challenges" for electronics packaging are 3D system integration by chip-stacking, embedded passives to provide more board real estate for active silicon, and the continuing battle against increasing power dissipation.

Nanotechnologies offer a variety of materials options for reliability improvements in microelectronics packaging, primarily in the applications of nanocomposites, or in the exploitation of the superior properties of carbon nanotubes and graphene. Nanoparticle composite materials are studied for resistors, high-k dielectrics, electrically conductive adhesives, conductive "inks," underfill fillers, and solder enhancements, while nanowires, CNTs and graphene may also find thermal, interconnect, and shielding applications. The presentation will briefly cover electronics packaging as an introduction to nanopackaging, and then will emphasize some selected recent developments in the field,, specifically:

- Printed and sintered nanoparticle interconnects
- Nanoparticle film sensors for electronics package reliability
- Carbon nanotube (CNT) applications

and concluding with some relevant EHS (environment, health and safety) cautions..

Biography

Jim is Professor Emeritus of Electrical & Computer Engineering at Portland State University, Oregon, USA, with B.Sc. and M.Sc. degrees in Physics from the University of Auckland, New Zealand, and a Ph.D. in Electrical Engineering from the University of Saskatchewan, Canada. He was awarded an honorary doctorate by the Politehnica University of Bucharest in 2015. He is an IEEE Life Fellow and an Electronics Packaging Society (EPS) Distinguished Lecturer. He has served the EPS in multiple roles for 25 years, including 20 years on the Board of Governors and periods as Treasurer and Conferences VP. He is now equally involved in the IEEE Nanotechnology Council (NTC), currently as Vice-President for Finance and as General Chair for NMDC 2018 (ieeenmdc.org). . His research activities are focused on electrically conductive adhesives, the electrical conduction mechanisms in discontinuous metal nanoparticle thin films, and on nanotechnology education. He has edited or co-authored five books on electronics packaging, (two of which have been published in Chinese,) and two on nanodevices. The second edition of his Nanopackaging book (from 2008) is currently in press (Feb '18).