14. Nano Materials and Polymer Composites for Electronic Packaging

Course Leaders: C.P. Wong – Georgia Tech and Daniel Lu – Henkel Corporation

Course Description:
Nano materials and polymer composites are widely used in electronic and photonic packaging as adhesives, encapsulants, thermal interface materials, insulators, dielectrics, molding compounds and conducting elements for interconnects. These materials also play a critical role in the recent advances of high performance encapsulants for ball grid array (BGA), chip scale package, system in package (SIP), package-on-package, and heterogeneous integration packaging, electrically conductive adhesives (both ICA and ACA), embedded passives (high K polymer composites), and nanoparticles and nano functional materials such as CNTs (some with graphenes). It is imperative that both materials suppliers and customers have a thorough understanding of polymeric materials, the latest advances on nano materials, and their impact to advance electronic packaging and integration technologies.

Course Outline:
- Introduction to Nanotechnology
- Nanosolder
- Carbon Nanotube (CNT)
- Nanomaterials for Wafer Level Packaging
- Super Hydrophobic Surface
- Surface Functionalization
- Functionalized Graphene for Energy Storage and Electrocatalysis
- Electrically Conductive Adhesives
- Conductive Nano Composites
- Conductive Nano-Ink
- Transparent Nanocomposite

Who Should Attend:
Students, researchers, engineers, scientists and managers who are involved in research and development, designing, processing and manufacturing of microelectronic and optoelectronic components and packages, and suppliers and developers of materials for semiconductor and electronic packaging.

Bio 1: Professor C. P. Wong is the Charles Smithgall Institute Endowed Chair and Regents' Professor. After his doctoral study, he was awarded a two-year postdoctoral fellowship with Nobel Laureate Professor Henry Taube at Stanford University. Prior to joining Georgia Tech, he was with AT&T Bell Laboratories for many years and became an AT&T Bell Laboratories Fellow in 1992.

His research interests lie in the fields of polymeric materials, electronic packaging and interconnect, interfacial adhesions, nano-functional material syntheses and characterizations. nano-composites such as well-aligned carbon nanotubes, graphene's, lead-free alloys, flip chip underfill, ultra-high k capacitor composites and novel lotus effect coating materials.
He received many awards, among those, the AT&T Bell Labs Fellow Award in 1992, the IEEE CPMT Society Outstanding Sustained Technical Contributions Award in 1995, the Georgia Tech Sigma Xi Faculty Best Research Paper Award in 1999, Best MS, PhD and undergraduate Thesis Awards in 2002 and 2004, respectively, the University Press (London) Award of Excellence, the IEEE Third Millennium Medal in 2000, the IEEE EAB Education Award in 2001, the IEEE CPMT Society Exceptional Technical Contributions Award in 2002, the Georgia Tech Class of 1934 Distinguished Professor Award in 2004, Outstanding Ph.D. Thesis Advisor Award

in 2005, the IEEE Components, Packaging and Manufacturing Technology Field Award in 2006, the Sigma Xi's Monie Ferst Award in 2007, the Society of Manufacturing Engineers (SME)'s TEEM Award in 2008, the 2009 IEEE -CPMT David Feldman Outstanding Contribution Award and the 2009 Penn State University Distinguished Alumni Award. The 2012 International Dresden Barkhausen Award (Germany).

He holds over 65 U.S. patents, numerous international patents, has published over 1000 technical papers, 12 books and a member of the National Academy of Engineering of the USA since 2000.

Bio 2: Dr. Daniel Lu is the Technical Director of Product Development of the General Industry business unit of Henkel Corporation (China). He was the director of product development of Henkel Electronics in China from 2008 to 2009. Prior to joining Henkel, he worked for the R&D department of Intel Corp, as a Sr. Scientist for 7 years. He also had worked for Lucent Technologies, Amoco's Electronics Materials Division, and the Electronics Materials Group of National Starch and Chemical Company before. He has extensive experience in development of electronic packaging materials such as underfills, adhesives, and molding compounds. His current research interests cover advanced materials for interconnects and packaging for electronics and optoelectronics applications, with emphasis on both high performance and low cost.

He received his MS and PhD degrees on Polymer Science and Engineering from Georgia Institute of Technology in 1996 and 2000, respectively. He received a BS in Chemistry from East China Normal University in Shanghai, China in 1990. Dr. Lu received many awards including the IEEE EPS Outstanding Young Engineer Award in 2004, the IEEE ECTC best poster paper in 2007, Intel's most patent filing in 2003-2007, Intel Divisional Recognition Awards in 2002, 2003, and 2007, Intel most patent granting of the year for 2006 and 2007. Dr. Lu has published more than 50 technical papers, wrote chapters for five books, and holds 75 US patents. He is the editor of the book "Materials for Advanced Packaging (2008)" and co-author of the book "Electronically Conductive Adhesives with Nanotechnologies (2009)". He has been serving key roles in organizing international electronic packaging conferences and teaching professional development short courses in these conferences. Dr. Lu is a Senior Member of IEEE, and an associate editor of IEEE Transactions on Components, Packaging and Manufacturing Technology and Journal of Nanomaterials, and an editorial board member of Nanoscience & Nanotechnology-Asia. Dr. Lu is a CPMT Board of Governors Member-at-Large. The following areas are of particular interest to Daniel: International growth - To help expanding the influence of CPMT into oversea regions especially Asia. Serve as catalyst from both cultural understanding and physical contacts to expedite the process of CPMT penetrating into China. Help to train local engineers and chemists through CPMT sponsored conferences and workshops in China.