1. ACHIEVING HIGH RELIABILITY OF LEAD-FREE SOLDER JOINTS – MATERIALS CONSIDERATIONS

Course Leader: Ning-Cheng Lee – Indium Corporation

Course Objective:

This course covers the detailed material considerations required for achieving high reliability for lead-free solder joints. The reliability discussed includes joint mechanical properties, development of type and extent of intermetallic compounds (IMC) under a variety of material combinations and aging conditions and how those IMCs affect the reliability. The failure modes, thermal cycling reliability, and fragility of solder joints as a function of material combination, thermal history, and stress history will be addressed in detail, and novel alloys with reduced fragility will be presented. Electromigration, corrosion, and tin whisker growth will also be discussed. Furthermore, the new alloys developed for high reliability of automotive applications will be presented and discussed. The emphasis of this course is the understanding of the various factors and how each contribute to the failure modes, and how to select proper solder alloys and surface finishes for achieving high reliability. Also presented are the desirable future alloys and fluxes in order to meet the challenge of miniaturization.

Course Outline:

1. Implementation Status
2. Prevailing Materials: Alloys and Finishes
3. Surface Finishes Issues: ENIG, Immersion Ag, and Immersion Sn
4. Mechanical Properties: Shear, Pull, and Creep
5. Intermetallic Compounds: Effect of Cu, Ni, Other Additives, and Heat History
6. Failure Modes: Grain Deterioration, Orientation, Mixed Alloys, and Interfacial Voiding
7. Thermal Cycle Reliability: Effect of Cycling Condition, Surface Finishes, and Reflow Temperature
8. High Reliability Alloys for Automotive Applications
9. Fragility: Effect of Surface Finishes, Alloys, Reflow, Strain Rate, Aging, Cycling, and IMC
10. Electromigration: Effect of Current Density, Back Stress, and Cu UBM Thickness
11. Corrosion: SAC and Performance of Surface Finishes Under Harsh Conditions
12. Tin Whisker: Causes of Formation, Methods for Control

Who Should Attend:

Anyone interested in achieving high reliability lead-free solder joints and wants to know how to achieve it should take this course.

Bio:

Ning-Cheng Lee is the Vice President of Technology of Indium Corporation. He has been with Indium since 1986. Prior to joining Indium, he was with Morton Chemical and SCM. He has more than 20 years of experience in the development of fluxes and solder pastes for SMT industries. In addition, he also has very extensive experience in the development of underfills and adhesives. He received his PhD in polymer science from University of Akron in 1981, and BS in chemistry from National Taiwan University in 1973. Ning-Cheng is the author of book “Reflow Soldering Processes and Troubleshooting: SMT, BGA, CSP, and Flip Chip Technologies”, and co-author of book “Electronics Manufacturing with Lead-Free, Halogen-Free, and Conductive-Adhesive Materials”. He is also the author of book chapters for several lead-free soldering books. He received several best conference papers awards from SMTA and IPC. He was honored as 2002 Member of Distinction from SMTA, 2003 Lead Free Co-

Operation Award from Soldertec, 2006 Exceptional Technical Achievement Award from CPMT, 2007 Distinguished Lecturer from CPMT, 2009 Distinguished Author from SMTA, 2010 Electronics Manufacturing Technology Award from CPMT, 2015 IEEE Senior Member, 2015 Founder’s Award from SMTA, and 2017 IEEE Fellow.