

8. RELIABILITY MECHANICS AND MODELING FOR IC PACKAGING – THEORY, IMPLEMENTATION AND PRACTICES

Course Leaders: Ricky Lee -- HKUST and Xuejun Fan – Lamar University

Course Objective:

This course aims to present a comprehensive coverage of reliability mechanics and modeling under various stress conditions. The course contents are arranged in four modules. Module 1 covers modeling under temperature loading, such as thermal mismatch or temperature gradient induced thermo-mechanical problems, including chip-package interaction (CPI), TSV failure, warpage and solder joint fatigue. Module 2 will cover modeling under humidity/moisture loading for moisture related problems, such as failures in soldering reflow as well as under HAST and biHAST. Module 3 deals with the modeling under mechanical loading, such as mechanical bending and/or drop impact. Module 4 will introduce multi-physics modeling that involves the combined thermal, moisture, electrical, and mechanical loading. Theory, numerical implementation, and the best method for practices will be illustrated. Emerging trend and future perspective in reliability mechanics and modeling will be discussed.

Course Outline:

1. Introduction
2. Modeling under temperature loading, such as thermal mismatch and/or temperature gradient conditions
3. Modeling under moisture/humidity loading
4. Modeling under mechanical loading, such as drop impact and mechanical bending
5. Modeling under combined loading – multi-physics modeling

Who Should Attend:

This course is intended for technical managers and staff members, reliability engineers, scientific researchers, and graduate students who are involved in thermal/mechanical modeling, package design, material selection, qualification and reliability assessment of chip-package interaction, package, and package/board interaction.

Bio 1:

Ricky Lee graduated from Purdue University with a PhD degree in Aeronautical & Astronautical Engineering in 1992. After one year of post-doctoral research at Purdue, he joined the Hong Kong University of Science & Technology (HKUST). Currently Dr Lee is Chair Professor of Mechanical and Aerospace Engineering and Director of Center for Advanced Microsystems Packaging at HKUST. Dr Lee has been focusing his research on the development of packaging and assembly technologies for electronics and optoelectronics. The topics of his R&D interests include wafer level packaging and 3D IC integration, through silicon vias and high density interconnects, LED packaging for solid-state lighting, lead-free soldering and reliability analysis. The research outcomes of Dr Lee's group have been documented in numerous technical papers in international journals and conference proceedings. He also co-authored three books and nine book chapters. Due to his technical contributions, Dr Lee received many honors and awards over the years. In addition to being the recipient of ten best/outstanding paper awards and four major professional society awards, Dr Lee is Fellow of IEEE, ASME, IMAPS, and Institute of Physics (UK).

Bio 2:

Xuejun Fan is a Professor in the Department of Mechanical Engineering at Lamar University, Beaumont, Texas. Dr. Fan received his Ph.D. degree in solid mechanics from Tsinghua University, Beijing, China in 1989. He earned his Master degree and Bachelor degree in applied mechanics from Tianjin University, Tianjin, China in 1986 and 1984. Dr. Fan has had more than 30 years of experience in academia and semiconductor industry, in particular, 10 years in industry with Intel Cooperation, Philips Research, and the Institute of Microelectronics (IME). His interests and research lie in the areas of design, modeling, material characterization, and reliability in micro-/nano- electronic packaging and microsystems. His research has covered a broad spectrum of reliability issues in IC packaging. Dr. Fan received the CPMT Outstanding Sustained Technical Contribution Award in 2017 as well as the CPMT Exceptional Technical Achievement Award in 2011. His papers received the Best Paper Award in IEEE Transactions on Components and Packaging and Technology in 2017 and 2008, respectively. Dr. Fan is an Associate Editor of IEEE Transactions on Components, Packaging and Manufacturing Technologies, and an IEEE Distinguished Lecturer since 2007/ He serves as chair, co-chairs, and committee members of various conferences such as ECTC, EPTC, ESTC, EuroSimE, ICEPT, ESREF, EMPT, and ChinaSSL. Dr. Fan has published more than 220 papers, including over 4 books, 25 book chapters, and over 100 journal papers, and several patents. His recent two books on “Moisture Sensitivity of Plastic Packages of IC Devices” and “Solid State Lighting Reliability: Components to System”, have been downloaded over 70,000 times since its publication in 2010. Dr. Fan is a key contributing member for several white papers on solid state lighting reliability released by the Department of Energy (DOE), and a contributing member for a new JEDEC standard: JESD22-B111A: Board Level Drop Test Method of Components for Handheld Electronic Products, which is released in November 2016.