



Speech subject: Board Level Interconnect Reliability under Harsh Conditions - Testing, Modelling and Prognostic Perspectives

Speech leader: Karsten Meier—Senior Researcher, Assistant Director, Technische Universität Dresden

Speech Description/Objective:

As of today, electronic modules are widely used for reliability sensitive applications in e.g. automotive, industrial as well as avionic systems yet. Hence, the modules sub-components as substrates, packages and interconnects among many others are exposed to harsh use case conditions involving severe low and high temperatures, mechanical vibrations and shocks as well as high levels of humidity etc. While the extreme values of these loads continue to increase due to the evolving implementation of wide band gap power electronics, closer embedding of electronics in e.g. automotive drives or the trend of using advanced packaging technologies in demanding environments, the package structure dimensions become continuously smaller due to the effects of geometric miniaturization and progressive increase in function and integration density. It is therefore obvious that existing test and simulation methodologies to assess the electronics reliability and to enable novel technologies need to evolve accordingly to keep the idea of accelerated testing as well as to access detailed understanding of material and package behaviour. In this talk, in the specific background of automotive applications, the development of and selected results from combined tests at vibration and temperature will be presented. These results include tests on custom flip chip components. This is followed by an introduction of research on shock testing to enable an efficient drop test alternative. Experiments and simulations on test boards with CSP-scale components to identify optimized test parameters will be presented. Next, to pave the way for data driven machine learning model creation, data synthesis and augmentation methods will be discussed. This research is done to cope with the expected huge efforts connected to run combined load scenario experiments as well as simulations. Finally, the development of a damage prediction model will be introduced that is supposed to ease the definition of combined and balanced experiment conditions besides its purpose to prognose damage progress under varying load conditions.

Speech Outline:

1. Introduction/Motivation
2. Combined Vibration and Temperature Cycling
3. Mechanical Shock Test Developments
4. Data Synthesis and Augmentation for NN Modeling
5. Damage Prognostics for Combined Load Cases
6. Conclusions

Who Should Attend:

The targeted audience includes PhD students, junior but also experienced researchers as well as engineers, and managers who work with package and board level reliability experiments and simulations with focus on thermo-mechanical load scenarios. This applies for package and board development, understanding of yet existing systems as well as trouble shooting backgrounds. The talk is intended to provide attendees who are interested in gaining knowledge about experiments, simulations and material understanding input or inspiration. The talk will consider Flip Chip and CSP-like components but the content can be transferred to other package technologies to serve chip-package and package-board interaction in general.

Introduction of Speaker:

Dr. Karsten Meier is with the Institute of Electronic Packaging Technology at the Technische Universität Dresden (Dresden, Germany) since 2006. After studying electrical engineering he received his Ph.D. from Technische Universität Dresden in 2015. During his studies he spent a research visit at the Packaging Research Center at the Georgia Institute of Technology in Atlanta (Georgia, USA). At the Institute of Electronic Packaging Technology he leads the board level reliability group and is in charge as assistant director. His research activities cover projects on packaging technology developments and package reliability for 5G and automotive applications, power electronics, material characterisation, and thermo-mechanical simulation which all are source for more than 150 papers he authored or co-authored. Also, he supports a research collaboration with the Center for Advanced Life Cycle Engineering at the University of Maryland (Maryland, USA) on combined mechanical and thermal loadings on solder interconnections. He chairs the IEEE ECTC sub-committee Thermal/Mechanical Simulation and Characterisation, is a member of the IEEE EPTC sub-committee Advanced Packaging and the IEEE ESTC sub-committee Reliability of Electronic Devices and Systems. As a reviewer he supports the IEEE EuroSimE conference, the ASME and CPMT societies and the Journal of Microelectronics Reliability and other journals.