(CE-)Package Reliability Concerns and Improvements Derived in TRACE

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Abstract

During the past three years, the successful CATRENE project TRACE has systematically assessed and clearly identified the main shortcomings of the existing high-performance electronics at all levels of integration and packaging, i.e., from wafer and component via module to the system level comprising the full ECU. In this talk, we will first give an illustrative example for the large gap between the available electronics and the actual needs in automotive and automation applications with respect to product maturity, reliability, and functional safety. Then, we will highlight the root causes of the package reliability concerns and the improvement measures developed within the TRACE project. In particular, it was figured out that not only differences with regard to component design and operating conditions between consumer electronics and automotive electronics are to be considered, but also multiple effects related to board and system level packaging. As an example, the complex field of solder joint reliability will be addressed by discussing the aspects of chip/package/system interaction, evolution of microstructure in the joints, lead and via cracks as well as component and board deformation. These effects result in failure modes that are quite typical and risky to automotive use cases but rather seldom or even unknown in consumer and office electronics. Hence, new assessment and analysis strategies have been developed within TRACE. They include new approaches to physical testing, deformation analysis as well as numerical simulations enabling virtual prototyping dedicated to the most efficient design for reliability of the future automotive electronics. Analogously, new ways of electrical detection of early cracking in the signal path were developed allowing for future health monitoring approaches as needed for applications like fully connected and automated driving. In that way, the TRACE results directly support the development of sellable products. They will only become feasible based on the most performant electronic components available, which needs to operate in the harsh automotive service conditions without any compromise in terms of reliability and safety assured to end users like you!

Curriculum Vitae

Sven Rzepka leads the Micro Materials Center at Fraunhofer ENAS and is professor for 'smart systems reliability' at TU Chemnitz, Germany. He joined Fraunhofer in 2009 after working as Principal simulation at Qimonda, Backend development, and at Infineon, BEoL reliability department. In 2002, he graduated from TU Dresden with PhD and habilitation degrees. In total, Dr. Rzepka has been working in BEoL and packaging technologies for 35 years with the focus on microelectronics and smart systems reliability testing and simulation. He is member of IEEE and EPoSS. He has published his work in more than 150 papers in international journals and at conferences around the world and is member of the core team editing the European ECS SRA.

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