Numerical and experimental methods development for the investigation of mechanical stress and fails induced in advanced microelectronic devices

Idir RAID

Supervisors: R. Estevez

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Abstract: During the assembly of microelectronic devices, some Chip-package compatibility concerns are observed while processing, such as reflow or thermal cycles. More precisely, mechanical reliability of new products becomes a real challenge. Despite previous in-house works, further developments are still required on this topic, . The proposed thesis aims to define and develop dedicated methodologies to prevent and to forecast these mechanical fails. Both experimental and numerical investigations will be performed. Experimentally, various methods and tools will be developed and investigated: improvement of crack detector structures, assessment of methods to measure the fracture toughness of a complex structure and use of in-situ stress sensors. Numerically, the aim is to provide finite element models enabling to get a deeper understanding of the phenomena involved and to correlate simulation with experiments. The final objective is to be able to determine the failure hazard of a given product and forecast its lifespan priori to any true manufacturing. This CIFRE thesis is collaboration between STMicroelectronics and the SIMAP-Grenoble INP laboratory.