Mechanical homogenization at the level of the microvia in printed circuit boards containing embedded components

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E-mobility has raised the need in power electronics for higher chip densification. One solution is to integrate active components into printed circuit boards (PCB). This technology increases the diversity of materials, particularly in interconnection areas. As a single failure in the board can lead to the total failure of electronic assemblies, these interconnection regions are studied in order to increase the service life of PCBs [1].

The proposed talk focuses on the finite element analysis of double-sided microvia technology for buried components. The first obstacle to overcome concerns the large number of microvias present on a chip. It is indeed impossible to model such a PCB, both because of the meshing time and the calculation time required. Therefore a method based on the homogenization of a unit cell including a microvia is proposed. Thus, the mechanical response of the equivalent homogeneous material is captured and next validated by experimental tensile tests containing a large number of RVEs. Once validated, reduced models of the interconnection layer are introduced, on the one hand with the equivalent homogeneous material and on the other hand with the completely discretized geometry. The average responses in terms of stress and strain tensors are found to be accurate, see [2] for stacked microvias. To address local failure mechanism, a coupled model is defined and is found to have predictive capabilities comparable to the full discretized model. Finally, the proposed method allows access to local fields so as to anticipate potential failure in the interconnection layer for embedded components in printed circuit boards, subject to thermal cycles.

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