Advanced Packaging
Room Ballroom A - Session PK-ThP

Advanced Packaging Poster Session

PK-ThP-1 A Numerical Investigation of Acoustic Void Detection in Through Silicon Vias using the Rayleigh-Ritz Method, ***George Antonelli***, Antonelli Research & Technology; *Shiva Mudide,* Massachusetts Institute of Technology

Voids formed in through silicon vias (TSVs) during metallization pose significant reliability risks and are challenging to detect using conventional optical, x-ray, and electron beam defect inspection and review techniques. Non-destructive acoustic approaches such as scanning acoustic microscopy (SAM) and photoacoustics have been proposed to fill this gap. The expected signals from voided TSVs can be investigated with mechanical simulations using the finite element method to guide the development of hardware; however, these calculations can be slow and tedious to setup. We propose the application of a frequency-domain modeling framework based on the Rayleigh–Ritz variational method. Closed-form expressions for monomial volume moments can be derived for spherical, conical, cylindrical, and composite voids, enabling rapid parametric evaluation of void-induced perturbations to the vibrational spectrum. Symmetry constraints imposed by photoacoustics and SAM excitation conditions reduce the accessible mode space, further reducing the complexity of the calculation. Numerical studies demonstrate strong mode-specific sensitivity to void size and shape and reveal the dominant influence of geometric parameters—such as aspect ratio and radius—on modal dispersion.

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