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Characterization of strain fields around Through-Silicon Vias by second-harmonic scanning microscopy FARBOD SHAFIEI, MING LEI, ZHUUJIE WU, PAUL HO, MICHAEL DOWNER, The University of Texas at Austin — 3D integration is currently a forefront technique for achieving high transistor integration density while reducing inter-chip RC delay and power consumption. Among numerous 3D integration designs, metallic "through-silicon vias" (TSVs) are a promising strategy for interconnecting stacked devices. However, the large mismatch in coefficients of thermal expansion between metal and silicon compromises thermal-mechanical reliability. Moreover, thermal strain introduced during TSV fabrication can induce defects that degrade carrier mobility within the strain field, voids within the metal interconnect, and cracking of the Si wafer. A strong need therefore exists for fast non-invasive methods of characterizing the strain fields surrounding TSVs. Here we show that scanning SHG microscopy is sensitive to these strain fields. Even though SHG is forbidden to lowest order from unstrained bulk Si, strain gradients break the centrosymmetry of the diamond-structure lattice, creating a second-order dipolar optical nonlinearity.

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