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Raman Mapping of Stress Distribution in Diamond Composites
M. WIELIGOR, T.W. ZERDA, Texas Christian University — Mapping of residual stress in diamond-SiC composites, sintered by liquid silicon infiltration, was obtained by analyzing splitting of Raman peak of diamond. Under biaxial strain this peak splits and its components shift toward higher (compressive) or lower frequencies (tensile strain). The magnitudes of the shifts can be used to estimate residual stress. Using a confocal Raman microscope we obtained spectra from areas less than 1 micron in diameter and thus acquired information on stress distribution within diamond crystals. Only shifts corresponding to compressive strains were detected. For the samples sintered at 10 GPa stress increased with increasing sintering temperature reaching a maximum value of 3.2 GPa. Largest concentrations of strains were found on diamond surfaces in direct contact with other diamonds. We explain these results in terms of different thermal expansion coefficients of silicon and diamond phases. Although during the early stages of the infiltration diamonds were under hydrostatic conditions, later after SiC was formed and the system cooled down, due to different thermal expansion coefficients SiC contracted more than diamond and thus exerted compressive forces.

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