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μ-Raman studies of residual stress in SiC MEMS CHRIS ZINGARELLI, MICHAEL MARCINIAK, JASON FOLEY, Air Force Research Laboratory — μ-Raman spectroscopy is used to measure residual stress in single-crystal, 6H-SiC used in MEMS devices. These structures are bulk micro-machined by back etching a 250-μm-thick, single-crystal 6H-SiC wafer to form a 50-μm thick diaphragm. A Wheatstone bridge, patterned of piezoresistive elements, is formed across the membrane from a 5-μm, 6H-SiC epilayer; the output of the bridge is proportional to the flexure of the MEMS diaphragm. μ-Raman spectroscopy was performed with an Ar^+ laser ($\lambda = 514.5$ nm). By employing an incorporated piezoelectric stage with submicron positioning capabilities along with the Raman spectral acquisition, spatial scans revealed areas in the MEMS structures that contain residual stress. Shifts in the transverse optical (TO) Stokes peaks of up to 2 cm^{-1} along the edge of the diaphragm and through the piezoresistors indicate significant material strain induced by the MEMS fabrication process. The phonon deformation potential was measured to quantify the material stress as a function of the shift in the Raman peak position.

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