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IR Temperature Measurement in Pressure-Shear Plate Impact[1]
TONG JIAO, PINKESH MALHOTRA, RODNEY CLIFTON, Brown University, SCHOOL OF ENGINEERING, BROWN UNIVERSITY TEAM — Pressure-Shear Plate Impact (PSPI) experiments on samples sandwiched between two hard plates have been developed previously for measuring the shearing resistance of materials at high strain rates, large inelastic shear strains, and high pressures. To enhance the value of such experiments in developing constitutive models for the dynamic response of materials, concurrent temperature measurements are being pursued by monitoring the infrared radiation emitted from the sample/rear-plate interface. The emitted radiation is collected by fast HgCdTe detectors through a pair of 90^{o} off-axis parabolic reflectors. ZnSe is used as the rear plate (*window*) because its transmission band (0.6 μm -16 μm) covers an exceptionally wide range of wavelengths — extending beyond the cutoff wavelength of the IR detector . Moreover, ZnSe remains nominally linear-elastic up to a pressure of 12 GPa — encompassing the pressure range for most PSPI experiments. Because temperatures generated in PSPI experiments are modest, the emissivity of the interface is increased by applying a thin layer of SiC at the sample/window interface. The high shearing resistance of SiC ensures that the allowable range of shear stresses is not limited by the presence of the high-emissivity layer. Pilot experiments will be assessed for their potential and limitations.

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