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Diamond Single Crystals Shocked to Multi-Megabar Stresses: Anisotropy and Deformation[1] Y. M. GUPTA, Washington State University, M. D. KNUDSON, Washington State University/Sandia National Laboratories, J. M. WINEY, Washington State University — Although the shock wave response of diamond at high stresses is of wide-ranging scientific and technical importance, it remains poorly understood. To gain insight into material strength and crystalline anisotropy effects at high stresses, plate impact experiments are underway on diamond single crystals shocked along the [100], [110], and [111] orientations to 400 900 GPa elastic impact stress (EIS) using the Sandia Z facility. Thin copper flyers are launched against diamond crystals, backed by quartz or LiF windows, to examine the shock compression and release response. Shock wave transit times in the diamond samples and either shock velocity histories of the optically reflective wave front in the quartz window or particle velocity histories at the diamond/LiF window interface are measured using laser interferometry. Preliminary results reveal two-step waves (elastic-inelastic response), with large elastic waves, to 900 GPa EIS for [110] and [111] diamond. In contrast, single (overdriven) wave profiles were determined at 480 GPa EIS and above for [100] diamond. In addition, the elastic wave amplitudes show significant orientation dependence. Further experiments and the development of a continuum model are underway to understand the strong anisotropy observed at high stresses.

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Michael Winey
Washington State University

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