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Diamond Single Crystals Shocked to Multi-Megabar Stresses: Anisotropy and Deformation[1] M. D. KNUDSON, Washington State University and Sandia National Laboratories, J. M. WINEY, Washington State University, C. A. MCCOY, Sandia National Laboratories, Y. M. GUPTA, 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/deformation 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 300–700 GPa using the Sandia Z facility. Thin copper flyers are launched against diamond crystals, backed by quartz windows, to examine the shock compression and release response. Shock wave transit times in diamond samples and shock velocity histories of the optically reflective wave front in the quartz window are measured using laser interferometry. Preliminary results at ∼500 GPa and ∼700 GPa peak stresses reveal two-step wave profiles (elastic-inelastic response), with large elastic waves, for [110] and [111] diamond. In contrast, single (overdriven) wave profiles were determined for [100] diamond. Numerical simulations, undertaken to analyze and understand the measured velocity histories, suggest loss of strength for [110] and [111] diamond shocked beyond the elastic limit. Further experiments and comprehensive analysis are underway to understand the strong anisotropy at high stresses.

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