Dynamic Measurement of Intrinsic Shock Front Anisotropy in Diamond

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ABSTRACT
We have fielded a high resolution two-dimensional imaging VISAR at the OMEGA laser facility. Over an 800 μm field this instrument captures spatial variations in the velocity across a shock front transmitted through a sample with relative velocity sensitivity $\Delta V/V \sim$ few x 10^{-4}, where V is the shock velocity. The instrument is sensitive to mode wavelengths ranging from 2.5 μm to 100 μm. We have observed shock front non-uniformities accumulated on a multi-Mbar shock front after passage through samples of polycrystalline diamond. The shock front showed significant structure for shocks at amplitudes below the threshold for shock melting, and showed a high degree of non-uniformity on spatial scales of a few microns or less. Above the threshold for shock-melting (near 6 Mbar) the level of non-uniformity diminished significantly after the shock front entered the coexistence region (partial melt). We are continuing experiments on diamond and other materials to elucidate details of the shock front structure above and below the melt transition.

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