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Strength and nonlinear elasticity of natural and synthetic diamond crystals shocked along [100] JOHN LANG, YOGENDRA GUPTA, Institute for Shock Physics and Department of Physics, Washington State University — To examine the nonlinear elastic response and strength of natural and synthetic diamonds, single crystals were shock compressed along [100] to peak elastic stresses as high as 120 GPa. Laser interferometry was used to measure elastic shock wave velocities and particle velocity histories in the diamond samples. A single, flat-top elastic wave was observed in samples shocked up to 75 GPa. At higher peak stresses, a two-wave structure (elastic-inelastic response) was observed. The elastic wave amplitudes of both natural and synthetic crystals were comparable, but the time-dependent inelastic response showed measurable differences. Surprisingly, the elastic limit was lower for samples shocked to a higher peak stress. The elastic stress-strain response was the same for both sample types, and these results were used to obtain the third-order elastic constant C_{111}. Beyond 1% compression, third-order elastic constants need to be considered in determining the elastic response of diamond. Work supported by DOE/NNSA.

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