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Shock compression of pyrolytic graphite to 18 GPa: Effect of orientational order M. LUCAS, J.M. WINEY, Y.M. GUPTA, Washington State University — Wave profiles for highly-oriented pyrolytic graphite (HOPG) shocked above the onset stress for phase transformation (∼20 GPa) depend strongly on the HOPG orientational order [Erskine and Nellis, Nature 349, 317 (1991)]. To gain insight into this finding, the shock responses for three pyrolytic graphites, differing in their orientational order, are compared for peak stresses below the onset for phase transformation. Measured wave profiles reveal significant differences in the elastic-inelastic response of: (from most to least oriented) ZYB-grade HOPG, ZYH-grade HOPG, and as-deposited pyrolytic graphite (PG). For peak stresses above 9 GPa, ZYB-grade HOPG exhibits elastic-inelastic wave profiles with large elastic wave amplitudes. The elastic wave amplitude increases linearly with peak stress, reaching 16 GPa for a peak stress of 18 GPa. In contrast, overdriven waves for ZYH-grade HOPG and PG suggest negligible elastic limits. Measured peak states indicate that PG is more compressible than ZYB- and ZYH-grade HOPG. These differences indicate that the elastic-inelastic response of shocked pyrolytic graphite depends strongly on the orientational order, and this dependence will likely persist to peak stresses approaching the phase transformation onset. Work supported by DOE/NNSA.

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