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Sound velocities in highly-oriented pyrolytic graphite shocked to 18 GPa: Orientational order dependence MARCEL LUCAS, J.M. WINEY, Y.M. GUPTA, Washington State Univ — Previous studies on shocked highly oriented pyrolytic graphite (HOPG) indicated a link between the orientational order and the HOPG response above and below the graphite-to-diamond phase transformation onset (>18 GPa) [Erskine and Nellis, Nature 349, 317 (1991); Lucas, et al., JAP 114, 093515 (2013)]. To gain insight into this link, the response of ZYH- and ZYB-grade HOPG shocked to 18 GPa was examined by measuring particle velocity profiles and peak state sound speeds in front surface impact experiments. The measured peak stress-particle velocity states are the same for the two HOPG grades. In contrast, the measured sound speeds and longitudinal moduli in the peak states reveal significant differences: the sound speed and modulus for ZYH-grade HOPG increase smoothly with increasing stress, whereas those for ZYB-grade HOPG exhibit softening for peak stresses of 12-17 GPa and an abrupt increase for 17-18 GPa. Comparison with the calculated moduli reveals an elastic instability for ZYB-grade HOPG shocked above 15 GPa. These findings, together with those from the previous reports, suggest that the elastic instability for shocked ZYB-grade HOPG is likely a precursor to the rapid phase transformation observed for this grade. Work supported by DOE/NNSA.

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