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The Shock and Release Behaviors of Diamond at Terapascal Pressures[1] MICHELLE GREGOR, DAYNE FRATANDUONO, PETER CELLIERS, TOM BRAUN, JON EGGERT, Lawrence Livermore National Laboratory, DANAE POLSIN, ANDREW SORCE, RYAN RYGG, GILBERT COLLINS, THOMAS BOEHLY, Laboratory for Laser Energetics, University of Rochester, CHAD MCCOY, Sandia National Laboratories, DAVID MEYERHOFER, Los Alamos National Laboratory — The behavior of carbon at terapascal pressures is important to modeling ice giants and white dwarf stars and to designing inertial confinement fusion (ICF) experiments, where diamond is used to contain and compress the hydrogen fuel. We report on experiments using the OMEGA laser that shock compressed diamond to 26 Mbar. The shocked diamond released into standard materials with known Hugoniots (quartz, silica foam, liquid deuterium, and polystyrene). Hugoniot and release data were obtained for both single-crystal diamond (SCD) and nanocrystalline diamond (NCD), which is comprised of nanometer-scale diamond grains and is ∼5% less dense than SCD. We find that the NCD used in ICF experiments has a stiffer Hugoniot than SCD that can be attributed to porosity. A Grüneisen parameter of ∼1 for high-pressure fluid carbon was derived from the NCD and SCD Hugoniots and is used in Mie-Grüneisen models to accurately describe the NCD and SCD release data.

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