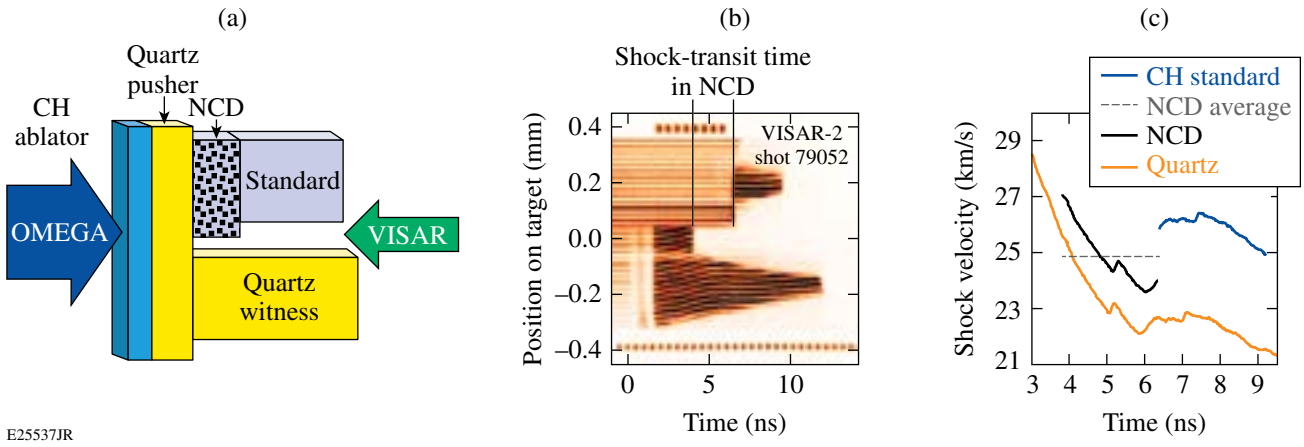
About the Cover:

The cover photo (courtesy of Clayton Dahlen, LLNL) shows Michelle Gregor, graduate student in the Physics and Astronomy Department, at the target area of the National Ignition Facility (NIF). Her thesis work measured the shock and release behaviors of nanocrystalline diamond that is used as an ablator material on ignition targets on the NIF. Knowledge of the behavior of shocked material as it releases to lower pressures is important to inertial confinement fusion target design and the general behavior of high-energy-density material. Previous to Michelle's work, there were no shock data on nanocrystalline diamond, which has nanometer-scale grains and a density that is ~4% less than single-crystal diamond. Her experiments measured shocked diamond up to 25 Mbar and demonstrated that the nanocrystalline diamond has a stiffer response to shocks than predicted by models. She found that a porosity model accurately predicts this behavior.



Michelle designed targets (a) comprising a CH ablator, a quartz pusher and witness, a nanocrystalline diamond (NCD) sample, and a standard positioned to facilitate measurements of transit times that allowed accurate shock-velocity measurements in the opaque NCD. Raw VISAR data are shown in (b) and extracted shock velocities in (c). The shock-velocity profile in NCD (solid black line) was inferred from the average shock velocity (dashed gray line) and the observed shock-velocity profile in the adjacent quartz witness (solid orange line) using the nonsteady waves correction. The shock-velocity profile in the CH standard (solid blue line) is observed once the shock breaks out of the NCD. Michelle's experiments measured nanocrystalline and single-crystal diamond that was shocked and then released into various standard materials whose properties are known. Using these data a Mie–Grüneisen equation of state was formulated that adequately modeled the release of both types of diamond.

The work described in this volume includes current research at the Laboratory for Laser Energetics, which is supported by New York State Energy Research and Development Authority, the University of Rochester, the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-NA00001944, and other agencies.

Printed in the United States of America
Available from
National Technical Information Services
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
www.ntis.gov

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