DPP11-2011-000291

Abstract for an Invited Paper
for the DPP11 Meeting of
the American Physical Society

Refractive Index of Lithium Fluoride Ramp Compressed to 800 GPa[1]

DAYNE FRATANDUONO[2], Laboratory for Laser Energetics (LLE)

The compression of materials to high pressure can alter their optical properties in ways that provide insight into the resulting structural changes. Under strong shock compression, transparent insulators transform into conducting fluids as a result of pressure-induced reduction of the band gap and thermal promotion of electrons across that gap. LiF is ramp compressed to 800 GPa on the Omega Laser Facility without generating shocks, producing high pressures at significantly lower temperatures than would be created by shock waves. Ramp compressed lithium fluoride (LiF) is observed to remain transparent to 800 GPa, pressures seven times higher than previous shock compression experiments. The ramp-compressed refractive index of LiF is measured at pressures up to 800 GPa and depends linearly on density. This is the highest-pressure refractive index measurement made to date. The linear dependence of the refractive index and density is examined using a single oscillator model. This model indicates that the linear behavior is a result of monoatomic closure of the band gap. Extrapolation of these results indicates that the band gap closure (metallization) will be greater than 4,000 GPa. The high metallization pressure of LiF is attributed to its large band gap and isoelectronic counterparts that exhibit high metallization pressures. The observed high-pressure transparency and measurement of LiF refractive index enables advancement of in situ experiments to higher-pressure regimes. In collaboration with T.R. Boehly (LLE), M.A. Barrios (LLE – now at LLNL), D.D. Meyerhofer (LLE), J.H. Eggert (LLNL), R.F. Smith (LLNL), D.G. Hicks (LLNL), P.M. Celliers (LLNL), and G.W. Collins (LLNL).

[1]This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.

[2]Now at Lawrence Livermore National Laboratory (LLNL)