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Application of Ellipsometry to Shock-Compressed Materials[1] J. REED PATTERSON, JEFFREY H. NGUYEN, NEIL C. HOLMES, Lawrence Livermore National Laboratory — Measurements of optical properties, such as the dielectric tensor, along the shock Hugoniot can be achieved in real time and *in-situ* via ellipsometry. Since standard Hugoniot-EOS and sound speed experiments do not provide crystal structure information, our knowledge of the phase diagrams of high-pressure high-temperature materials is limited. Complementary to x-ray diffraction techniques, ellipsometry of dynamically compressed materials provides data that can be coupled with calculations, yielding information on phase transitions and crystal structures. Single-wavelength ellipsometry experiments demonstrate our ability to observe solid-solid ($\alpha - Fe \rightarrow \epsilon - Fe$) and solid-liquid (e.g. Sn) phase transitions. In addition, changes in the complex index of refraction are related to changes in the strain state of a material, as observed in preliminary experiments on LiF, which demonstrated stress-incduced birefringence. Time-resolved ellipsometric measurements have the potential to provide insight into dynamic phenomena such as elastic/plastic deformation/relaxation and phase transition kinetics. We will also discuss our efforts to extend the applicability of ellipsometry of dynamically compressed materials by incorporating multiple wavelengths.

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