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Ellipsometry Measurements of Shock-Induced Phase Transitions[1]

J.R. PATTERSON, J.H. NGUYEN, L.X. BENEDICT, J.E. KLEPEIS, N.C. HOLMES, Lawrence Livermore National Laboratory — *In situ* measurements of crystal structures and phase transitions during dynamic high-pressure experiments are complex, thus knowledge of high-pressure high-temperature phase diagrams for many materials is limited. Since typical Hugoniot EOS and sound speed experiments do not provide this information, we have developed an ellipsometric technique which allows the real-time measurement of optical constants. Coupling measured optical properties with calculations allows one to infer structural information complimentary to techniques such as x-ray diffraction. We present dynamic ellipsometry measurements of shock-induced solid-solid ($\alpha - Fe \rightarrow \epsilon - Fe$) and solid-liquid ($\beta \rightarrow liquid - Sn$) phase transitions. In addition, the time-resolution of such dynamic phenomena suggests that information on the kinetics of phase transitions as well as deformation/relaxation can be obtained. We will also discuss our efforts to incorporate multiple wavelengths into ellipsometry measurements of dynamically compressed materials.

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