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Time-resolved measurements of structural changes in shocked crystals

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Plane shock wave experiments provide a unique approach to examine compression induced structural changes in real time (sub-ns and ns resolution). Past studies have focused on time-resolved continuum measurements and the propagating wave profiles have been related to material thermodynamic states. Following a brief review of past continuum studies, recent experimental developments related to fast time-resolved optical spectroscopy and x-ray diffraction to examine structural changes at the microscopic level will be presented. Challenges associated with the use of these methods in shock wave experiments will be indicated. Specific examples will be described to demonstrate how continuum and microscopic results can be combined to gain detailed insight into shock wave induced structural changes in condensed matter. Directions for future work will be discussed. Work supported by DOE/NNSA.