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Ultrafast laser diagnostics for studies of shock initiation in energetic materials DARCIE FARROW, BROOK JILEK, URAYAMA JUNJI, IAN KHOL, SEAN KEARNEY, Sandia National Laboratories — Ultrafast laser diagnostics have opened new pathways for investigation of shock physics and initiation of energetic materials. Recent work (Bolme LANL/Armstrong LLNL) has demonstrated that short laser pulses can be utilized for direct laser drive and coupled with imaging, spectroscopic, and interferometric tools for studies of dynamic shock loading on picosecond time scales. At Sandia, we are developing diagnostic platforms which extend this earlier work including: (1) Ultrafast Shock Interferometry (USI) (Armstrong LLNL) for tabletop measurement of Hugoniot/Equation-of-state data and characterization of shock structure in heterogeneous materials with micron spatial resolution; (2) coherent Raman diagnostics, including Coherent anti-Stokes Raman spectroscopy (CARS) and stimulated Raman scattering (SRS) for measurement of temperature and dynamic changes in chemical bonding; and (3) femtosecond transient absorption spectroscopy, which can monitor shock-induced shifts in electronic structure, which have been proposed to drive rapid chemical changes behind the shock front. We are pursuing a path where each of these tools is being developed independently and then combined for the study of shock physics studies in thin films of energetic materials. At the APS/SCCM, we will describe the details of our measurement systems, as well as recent progress toward new laser-diagnostic data on inert/explosive thin-film samples.

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