Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Probing ultrafast shock-induced chemistry in liquids using broadband mid-infrared absorption spectroscopy PAMELA BOWLAN, MICHAEL POWELL, ROMAIN PERRIOT, ENRIQUE MARTINEZ, EDWARD KOBER, MARC CAWKWELL, SHAWN MCGRANE, Los Alamos National Laboratory — Chemical reactions can happen within picoseconds (ps) behind strong shock waves. To better understand shock-induced chemistry in explosives, we developed an experiment to probe ultrafast shock-induced changes in the vibrational spectrum which can be linked to changes in molecular and intramolecular structure and can give information about the rate of loss of reactants, intermediate states and reactants. We will present our recent results applying this to shocked liquids where we compare a reactive and nonreactive case. For nitromethane, which was laser shocked to 25 GPa and promptly reacts, we see the vibrational modes vanish in less than 50 ps and the appearance of a broad infrared spectrum corresponding to the complex mixture of products. For benzene shocked to 18 GPa, which does not react within the 300 ps window of our experiment, we see pressure and temperature broadening of the vibrational modes. Comparing these results to reactive molecular dynamics simulations, we found good agreement and confirmed our interpretation of the measurements.

Pamela Bowlan
Los Alamos National Laboratory

Date submitted: 02 Mar 2019 Electronic form version 1.4