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Shock induced chemistry in liquids on picosecond timescales

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While great progress has been made in theory and simulation of shock induced chemical reactivity, there are few experiments sensitive to the time and length scales necessary to validate these theories. In this talk, we will report the results of experiments on liquids exposed to ultrafast laser driven shocks observed by interferometry and spectroscopy with picosecond time resolution. These time and length scales correspond to those accessible to reactive molecular dynamics simulations, and are often required to observe chemical kinetics using optical methods prior to sample opacity caused by product formation. We will report interferometric and transient absorption data for times up to 300 ps on nitromethane, carbon disulfide, phenylacetylene, acrylonitrile, and several other liquids shocked to initial states between 5 and 22 GPa. Indications of volume increasing and decreasing chemical reactions are observed interferometrically. Chemical products are observed via transient absorption signatures. Efforts to identify these products with vibrational spectroscopies will be reported. We will also compare the results observed in these small scale experiments with literature results from experiments acquired on time and length scales larger by orders of magnitude.