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In situ insights into shock-driven reactive flow

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Shock-driven reactions are commonplace. Examples include the detonation of high explosives, shock-driven dissociation of polymers, and transformation of carbon from graphite to diamond phases. The study of shock-driven chemical reactions is important for understanding reaction thresholds, their mechanisms and rates, and associated state sensitivities under the extreme conditions generated by shock compression. Reactions are distinguished by their thermicity – e.g. the volume and enthalpy changes along the reaction coordinate. A survey of the hallmarks of shock-driven reactivity for a variety of simple molecules and polymers will be presented, including benzene, acetylenes and nitriles, and formic acid. Many of the examples will illustrate the nature of the reactive flow through particle velocity wave profiles measured by *in situ* electromagnetic gauging in gas gun-driven plate impact experiments. General trends will be presented linking molecular moieties, shock temperatures, and reaction state sensitivities. Progress in applying bond-specific diagnostics will also be presented, including time-resolved Raman spectroscopy, and recent results of *in situ* x-ray diffraction of carbon at the Linac Coherent Light Souce (LCLS) free electron laser.