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Imaging the Reactive Flow Structure Evolution in Shocked Nitromethane and Nitromethane with Additives ERIN NISSEN, MITHUN BHOWMICK, DANA DLOTT, University of Illinois at Urbana-Champaign — We used a tabletop laser driven flyer plate to generate planar shock waves in cuvettes to produce detonations in liquid nitromethane (NM), and NM with sensitizing and inert additives. The liquid is sandwiched between an optical window and a thin aluminum lid. Photon Doppler velocimetry was used to track the flyer and particle velocity at the lid/NM interface. Images were taken using a 5-ns gated sCMOS camera at different times to analyze the flow structure evolution as a function of impact velocity and additive. Three distinct structure regimes were found to be controlled by impact velocity in pure NM, while the additives in NM control the size of the cellular structures. This may be used to calculate the reaction zone length to corroborate PDV measurements. Mechanical defects at the lid/NM interface were also investigated. There were no changes in structures between rough or smooth aluminum or steel lids, signifying the structures are a property of NM and not propagating from the lid. Molecular layers that inhibit or enhance the shock chemistry were patterned on the lid interface to control the shock to detonation time and cellular structures.

Erin Nissen
University of Illinois at Urbana-Champaign

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