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Observations and Modeling of the Component Mechanisms in Deflagration LAURA SMILOWITZ, BRYAN HENSON, DAVID OSCHWALD, ALAN NOVAK, MATTHEW HOLMES, Los Alamos National Lab — We have used dynamic x-ray and proton radiography to observe the behavior of a series of HMX based energetic materials formulations undergoing thermal explosions. The result of these observations is a mechanism for deflagration based on both gas phase convective burning and solid phase conductive burning. The velocities for both the convective and conductive burns are tied together by the single combustion pressure driving both in a single experiment. The convective rate is directly measured as the burn front in the radiographs. The pressure associated with that rate is inferred from independently measured burn rate verses pressure data. This same pressure is then assumed to drive the conductive burning which begins as the convective burn front lights the material surface. Using a single, independently validated particle size distribution for damaged HMX, the combination of pressure driven convective lighting and conductive consumption is then calculated and compared to the measured transmission data sets. This same model with different initial pressurizations is used to successfully model deflagration in PBX9501, PBXN-9, and LX-07. In addition, a correlation between initial pressurization, convective/conductive velocity, and final "reaction violence" is observed. This leads us to the use of convective velocity as a metric for final energy release rate and therefore overall reaction violence.

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