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An extension of detonation shock dynamics for insensitive explosives MARK SHORT, JOHN BDZIL, TARIQ ASLAM, LANL — Resolved, direct numerical simulations of the detonation of high explosives (HE) in geometries of engineering interest are largely unattainable due to the scale disparity between the shorter detonation reaction-zone length and the longer characteristic explosive charge dimension. However, multi-scale mathematical modeling, utilizing this scale disparity, has led to the development of the theory of detonation shock dynamics (or DSD). With DSD, the propagation of a detonation in a HE configuration is described by a surface evolution equation for the detonation front. For insensitive high explosives (IHE), detonations typically have two characteristic reaction stages: a fast reaction where the majority of the heat of reaction is released, followed by a second significantly slower reaction (e.g. through carbon coagulation in PBX-9502). We show that the presence of this slowly reacting, weak heat release zone can have a significant (time-dependent) influence on the evolution of a detonation in IHE. We also describe an extension to the DSD concept, specifically tailored to detonations, in IHE which treats fast-slow chemistry models. The fast chemistry is handled with a DSD front rationally coupled to a distributed, resolved (reactive burn) model for handling the slow chemistry step.

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