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Criticality and Induction Time of Hot Spots in Detonating Heterogeneous Explosives[1] LARRY HILL, Los Alamos National Laboratory — Detonation reaction in physically heterogeneous explosives is–to an extent that depends on multiple material attributes–likewise heterogeneous. Like all heterogeneous reaction, detonation heterogeneous reaction begins at nucleation sites, which, in this case, comprise localized regions of higher-than-average temperature–so-called hot spots. Burning grows at, and then spreads from these nucleation sites, via reactive-thermal (R-T) waves, to consume the interstitial material. Not all hot spots are consequential, but only those that are 1) supercritical, and 2) sufficiently so as to form R-T waves before being consumed by those already emanating from neighboring sites. I explore aspects of these two effects by deriving simple formulae for hot spot criticality and the induction time of supercritical hot spots. These results serve to illustrate the non-intuitive, yet mathematically simplifying, effects of extreme dependence of reaction rate upon temperature. They can play a role in the development of better reactive burn models, for which we seek to homogenize the essentials of heterogeneous detonation reaction without introducing spurious complexity.

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