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On the Burn Topology of Hot-Spot Initiated Reactions LARRY HILL, Los Alamos National Laboratory, BJORN ZIMMERMANN, Wolfram Research, Inc. — The bulk rate of heterogeneous reaction of an energetic material depends on both the decomposition chemistry and the physical microstructure. Simple thermal decomposition models and most detonation reactive burn models express the reaction rate as the product of two functions. One expresses the sensitivity of the rate to the thermodynamic state; the other expresses the effect of reactant depletion. For a homogeneous reaction, the depletion function structure depends on the reaction pathways (overall reaction order, autocatalysis, etc.). For a heterogeneous reaction, the depletion function also depends on the reaction topology (e.g., how reaction spreads from nucleation sites to consume the material). We numerically generate depletion functions for simultaneously initiated, randomly oriented hot spots, and compare the result to the analytic solution for regularly spaced hot spots. The effect of randomization is substantial. We also compare the depletion function for ideal randomly located hot spots to those employed by various reactive burn models that are calibrated to detonation experiments.

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