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**Modeling reaction fronts of separated condensed phase reactants**[1]
SUSHILKUMAR KOUNDINYAN, MOSHE MATALON, D. SCOTT STEWART, JOHN BDZIL, University of Illinois, Urbana, IL — We present a Gibbs free energy approach to modeling reaction fronts in condensed phase reactive materials. The current interest is in chemical reactions of condensed phase reactants that are initially separated. In energetic materials such reactions are observed to occur extremely fast and at relatively sharp fronts. The solid-to-solid combustion process differs in several aspects from classical gaseous combustion due to the disparity between the characteristic thermal conductivity length and the mass diffusion lengths and a volume, temperature, stress, mass fraction equation of state that principally depends only on the component reference volumes and the current mixture composition. To retain a simple planar configuration, we consider the two reactants, in solid phase, are in motion towards each other characterized by counter-flow geometry. We apply the model to a simplified Titanium-Boron system and present the analysis of reaction zone length for various strain rates. The numerical results are validated with asymptotic approximations at the Burke-Schumann limit.

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