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High resolution simulations of shock-induced combustion of Aluminum droplets[1] PRATIK DAS, H.S. UDAYKUMAR, University of Iowa — Post-detonation combustion of shock-dispersed aluminum particles in heterogeneous explosive charges is known to enhance energy deposition. We present a numerical scheme to compute the combustion of aluminum droplets in strongly shocked flows. The calculations include the effects of viscosity, surface tension and evaporation of the liquid into the surrounding gaseous phase, while treating the liquid-vapor interface in a sharp manner. A levelset based sharp-interface method is used to track the deformation of the droplet surface. A Riemann solver based ghost-fluid method (GFM) captures interactions at the sharp interface, by allowing characteristics waves to travel across the droplet interfaces, a technique that is well suited to handling strong shocks. The sharp-interface treatment ensures that the jump conditions for the viscous stresses at the interface are imposed with high fidelity. The model also includes chemical reactions at the surface of the Aluminum droplet. In addition, a nine-step reaction model is used in this work to compute shock-induced combustion of Aluminum in the gas phase. We show that the overall scheme allows for high-resolution simulations to understand the detailed physics of shock-induced combustion of droplets in gas streams.

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