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Toward Rigorous Modeling of Extreme Compressible Multiphase Flows[1] Y. LING, M. PARMAR, S. ANNAMALAI, S. BALACHANDAR, University of Florida, D.L. FROST, Mcgill University — Modeling is an important approach to investigate extreme compressible multiphase flows, such as explosive dispersal of particles/droplets and volcanic eruptions. Since the scale of practical interest is much larger than the particle size, point-particle models are usually employed in macro-scale simulations. We have developed a physics-based point-particle model, which divides the overall particle force and heat transfer into physically meaningful contributions. The effects of finite Reynolds and Mach numbers and finite particle volume fraction on each force and heat transfer contribution are incorporated. The model is used to simulate the problems of a planar shock wave interacting with a dense particle curtain and the rapid radial spreading of an annular bed of particles emplaced around a cylindrical explosive. In both cases the numerical results agree well with experimental data. Shock refractions that occur at the particle fronts generate reflected and transmitted shocks. These shocks introduce strong velocity and pressure gradients across the curtain, which causes the curtain to expand. The presentation will also discuss the modeling and simulation challenges of detonation-particle interaction and strong interparticle interaction arising from large volume fraction.

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