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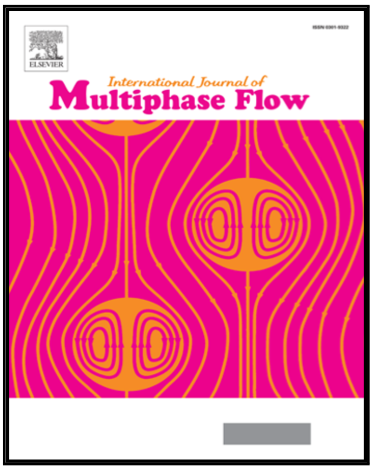

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Particle Evaporation and Hydrodynamics in a Shock Driven Multiphase Instability

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Abstract

This paper presents results from 3D numerical simulations of a shock-driven multiphase instability of a gas-particle system with a spherical interface. Two cases, one with an evaporating particle cloud and another with a gas only approximation were run in the hydrodynamics code FLASH. Both cases had an incident Mach number of 1.65 and an effective Atwood number of 0.046. It is shown that the gas only approximation, a classical Richtmyer-Meshkov instability, cannot replicate effects from particles like, lag, clustering, and evaporation. Instead, both gas hydrodynamics and particle properties influence one another and are coupled. Qualitative and quantitative differences in the Richtmyer-Meshkov instability and shock-driven multiphase instability are briefly presented. Coupling between the interface hydrodynamic evolution and particle evaporation is explored further by examination of the multiphase case. Hydrodynamic driven particle clustering is measured through particle spatial distribution statistics and particle-vorticity correlations. It is found that the small particles form vorticity driven small scale clusters quickly while hydrodynamics act to reorganize the particles into larger scale features at later times. Particle evaporation rates are found to vary greatly, even among similar sizes, and show poor agreement with existing 1D evaporation models. The role of hydrodynamic organization in evaporation is shown by examining the spatial distribution of variations in

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