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Mesoscale Studies of Mixing in Reactive Materials During Shock Loading ILYA LOMOV, ERIC HERBOLD, LLNL — One of the requisite processes for reactions between solid powder particles resulting from shock loading is that they undergo large deformations, exposing new surfaces while mixing with surrounding material. The deformability of Al particles on the scale of hundreds of nanometers to several microns with an oxide layer or Ni coating during shock loading is investigated. Mesoscale simulations with an Eulerian hydrocode GEODYN show enhanced fracture of the outside layer of the Al particles when even small volume fractions of a larger or dense material is added to the mixture. Rate of reactions in solid- solid mixtures is not a unique function of pressure, temperature and the plastic strain. Reactions under shock loading happen in reaction zone, which extent is defined by the surface of interfacial area and the depth of the diffusion layer. The former depends on the level of hydrodynamic mixing of heterogeneous material under shock, while the latter depends on the temperature-dependent species diffusion. These processes introduce time and length scales onto the problem. To study diffusion-limited reactions on the grain scale level, material diffusion and a simple reaction kinetic which depends on the interfacial surface area is implemented in GEODYN. Several scenarios of diffusion-reaction processes initiated by shock loading in loose or consolidated powders with initially well- defined material interfaces are considered.

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