Abstract for an Invited Paper
for the SHOCK09 Meeting of
The American Physical Society

The Configurationally-dependent Mechanochemical Behavior of Reactive Powder Mixtures

DAN EAKINS, Los Alamos National Laboratory

In reactive powder mixtures, the initiation of shock-induced chemical reactions is dependent upon the micromechanical processes (deformation, mass flow, and mixing) that occur during void collapse and the crush-up to full density. The specific modes of these processes are in turn affected by the intrinsic and extrinsic properties of the components, i.e. strength, density, particle size and morphology. For example, variations in particle size (micrometer to nanometer) and morphology (spherical to flake) in Ni+Al powder mixtures result in a wide range of crush-strengths, from 0.5 to 6 GPa, and varying chemical response, i.e. inert vs. reactive. Such a link between powder properties and reaction response has resulted from years of experimental, numerical, and theoretical work. In this talk, we will first review the key experiments that have supplied much of the evidence for shock-induced chemical reactions in powder mixtures. Next, we will discuss the results of numerical simulations to help describe the micromechanical processes that occur during crush-up. Finally, we will present a conceptual framework for shock-induced reactions, that may be used to guide development of energetic systems with tailored chemical response.