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Effect of shock compression on aluminum particle reaction in condensed media AKIO YOSHINAKA, FAN ZHANG, DRDC Suffield — While it is known that aluminum particles, when mixed with an explosive, can react with detonation products and air, the effect that the detonation front has on the onset of aluminum reaction is not well understood. Past experiments have shown a dependence of particle reaction start time on confinement; reaction for 1-10 micrometer particles occurs 1-10 microsec behind the detonation front. It is speculated that oxide layers are compromised by the detonation front and particle morphology changes significantly upon detonation passage. Of particular interest is the extent to which the presence and concentration of surrounding materials (e.g., binder, explosive, ...) can influence the removal of the thin oxide layer encapsulating each particle. Samples consisting of aluminum powder tens of microns in diameter and mixed with an inert condensed phase additive were shock compressed through flyer plate impact to pressure levels comparable to those encountered during detonation (15-20 GPa). To confirm the extent to which particles react with detonation products, particle beds saturated with explosive were tested under similar conditions. Each sample, confined within a hermetically sealed test cell, was recovered after the experiment for microscopic analysis. The effects of particle size and particle-to-additive ratio were investigated as well.

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