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Effect of Particle Morphology on the Reactivity of Explosively Dispersed Titanium Particles DAVID FROST, MALCOLM CAIRNS, SAMUEL GOROSHIN, McGill University, FAN ZHANG, DRDC-Suffield — The effect of particle morphology on the reaction of titanium (Ti) particles explosively dispersed during the detonation of either cylindrical or spherical charges has been investigated experimentally. The explosive charges consisted of packed beds of Ti particles saturated with nitromethane. The reaction behavior of irregularly-shaped Ti particles in three size ranges is compared with tests with spherical Ti particles. The particle reaction is strongly dependent on particle morphology, e.g., 95 μm spherical Ti particles failed to ignite (in cylinders up to 49 mm in dia), whereas similarly sized irregular Ti particles readily ignited. For irregular particles, the uniformity of ignition on the particle cloud surface was almost independent of particle size, but depended on charge diameter. As the charge diameter was reduced, ignition in the conically expanding particle cloud occurred only at isolated spots or bands. For spherical charges, although large irregular Ti particles ignited promptly and uniformly throughout the particle cloud, the smallest particles dispersed nonuniformly and ignition occurred at isolated locations. In general, particle ignition is a competition between particle heating (which is influenced by particle morphology, size, number density and the local thermodynamic history) and expansion cooling of the products.

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