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Critical Conditions for Ignition of Aluminum Particles in Cylindrical Explosive Charges DAVID FROST, SAMUEL GOROSHIN, JEFFREY LEVINE, McGill University, Canada, FAN ZHANG, DRDC-Suffield, Canada — The critical conditions for the ignition of spherical aluminum particles dispersed during the detonation of long cylindrical explosive charges have been investigated experimentally. The charges consist of packed beds of aluminum particles (Valimet, CA), ranging in size from 3 - 115 μm in diameter, and saturated with sensitized liquid nitromethane. The ignition conditions depend on both the charge and particle diameters, which govern the thermal history of the particles as they are dispersed within the conically expanding products. For a given charge diameter, the most reactive particles correspond to an intermediate size ($\sim$55 μm dia). For this particle size, with increasing charge diameter the particle reaction behavior progresses through several distinct regimes: i) no particle reaction, ii) reaction at isolated spots, iii) reaction in distinct radial bands, and iv) continuous reaction of the particle cloud. In each case, a separation between the detonation front and the onset of aluminum reaction is always observed. To determine the point of particle ignition, visible radiation from the charge is recorded, through a slit, with a 3-color pyrometer and with a line spectrometer, with the wavelengths chosen to overlap the AlO emission lines.

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