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Initiation of Reactive Waves in Metallic Powder Mixtures Using a High Explosive Booster JULIAN LEE, DRDC Suffield — Shock-induced reactions were initiated in a number of metallic powder mixtures including titanium-silicon, titanium-boron, and aluminum with copper oxide or molybdenum trioxide. The reactions were initiated in long cylinders ten charge diameters in length filled with compacted powders of micron-size particles. The cylinders were fitted with a high explosive booster in a donor-acceptor configuration to initiate the reaction with a strong shock. Using embedded shock pins to detect the arrival of the shock and embedded fiber-optic cables to detect luminous reactions, the propagation of the transmitted shock and ensuing reaction was observed. The strong shock from the booster was found to transmit into the powder, then steadily decay until the end of the cylinder. A luminous front was found to follow the leading shock closely for two to four charge diameters, then gradually decouple and lag behind. The shock and reactive waves were found to share some similarities with an overdriven detonation, however self-sustained, reaction-driven waves were clearly not observed. Certain mixtures showed erratic velocity fluctuations of the luminous front rather than a gradual deceleration and transformation into a diffusion flame. The behavior of these waves was interpreted in terms of shock propagation in porous media and mechanical-chemical reaction mechanisms.

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