

Abstract Submitted
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Shock-induced reaction in Ti-Si powder mixtures JULIAN LEE, FAN ZHANG, DRDC Suffield — The reactive properties of shocked powders consisting of a mixture of titanium and silicon have been investigated experimentally in cylindrical charges initiated by high explosives. Selected tests using a flyer plate for initiation were also performed for comparison. Although titanium and silicon are known to deflagrate and produce high-temperature solid products, shock-initiated reactions are not yet understood. In the present work, fine powders 1-5 μm in size are thoroughly mixed and packed into cylindrical containers with varying degrees of confinement. The packing density was varied between 30% and 50% TMD. Upon shock impact, a rapidly decaying supersonic reactive wave was observed through both optical and piezo-electric time-of- arrival gauges. The decay rate of the wave was found to depend very weakly on strength of confinement, but more strongly on packing density. Traditional detonation mechanisms such as volume expansion and front curvature may consequently not be applicable in systems with solid reactants and products. Post- test examination of the charges showed nearly complete reaction of the powder in most cases, indicating a sustained reaction in spite of the decay of the supersonic part of the reaction.

Julian Lee
DRDC Suffield

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