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Modeling the Response of Steven Tests ELISHA REJOVITZKY, RAFAEL, YEHUDA PARTOM, Retired, ROMAN KOSITSKI, ALON MALKA-MARKOVITZ, RAFAEL — Steven test was introduced for studying low velocity impact initiation of explosives. The original diagnostic of Steven test was blast gauges at a distance of about 10m. Trying to use this diagnostic to characterize the response of the explosive after its ignition, we realized that it's not reliable and not informative enough. We therefore replaced the blast gauges by interferometric velocity gauges looking at the free surface of the back plate. Our explosive was similar to LX07, and we performed several tests with impact velocities from 30 to 122m/s. The velocity histories we obtained from the gauges show the following: 1) there's a rather long delay between impact and ignition (or gauge response), 50s for the highest impact velocity and around 350s for 36m/s; 2) there's no ignition for an impact velocity of 30m/s; and 3) gauge velocity histories rise gradually to a maximum and then continue with elastic oscillations. We model the response of the explosive assuming that it reacts through shear initiation. The projectile impact causes shear flow in the explosive, which leads to strain localization and formation of shear bands. The shear bands heat up and reach ignition temperature, and deflagration fronts expand out of them, similar to deflagration fronts out of hot spots for shock initiation. Shear initiation reaction rate is rather slow, and it depends on pressure and not on reactant temperature. Here we use this pressure dependent reactive flow model to reproduce our Steven test data. We get good agreement with delay times and amplitudes of the velocity gage data.

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