A Physical Model to Account for the Early Afterburn of Tritonal

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ABSTRACT

This paper presents a new model for calculating the energy released by the explosive products of Tritonal (gaseous products and solid aluminum particles) as they mix with the air behind the initial blast after the detonation phase is complete. The model, in the form of two rate-dependent source terms in the energy equation, is implemented into the MAZ code. The form of the rate equations is the same as that proposed by Guirguis & Miller [1]. 3D MAZ calculations are then made to determine the coefficients that would allow this model to best match the experimental data. For the set of pressure data from SBETA II [2], a surface burst experiment of a bare Tritonal cylinder, it is found that highly unusual adjustments must be made to the coefficients of the original single-equation rate model to obtain late-time agreement in impulse. It is further found that no amount of adjustments to these coefficients can be made to account for an important early-time feature shown in the experimental pressure-time histories, namely, the 'bench' immediately behind the first peak. This 'bench' is associated with the hydrodynamic mixing at the explosive-product/air interface behind the front of the blast. The energy released by the local burning of aluminum particles, in the products that are brought into contact with the oxygen in the air by the hydrodynamic mixing, increases the pressure behind the blast. To account for the energy added by the mixing, we introduced a second rate equation with a parameter that depends on the vorticity. The results of this new model match the experimental pressure-time histories much better than the single rate-equation model. The calculated impulse is within 5 percent of the measured at large times.