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Detonation Initiation of Heterogeneous Melt-Cast High Explosives VINCENT CHUZEVILLE, GERARD BAUDIN, ALEXANDRE LEFRANCOIS, CEA, DAM, Gramat, REMI BOULANGER, Nexter Munitions, LAURENT CATOIRE, ENSTA ParisTech — The melt-cast explosives' shock initiation mechanisms are less investigated than pressed and cast-cured ones. If the existence of hot-spots is widely recognized, their formation mechanism is not yet established. We study here two melt-cast explosives, NTO-TNT 60:40 and RDX-TNT 60:40 in order to establish a relation between the microstructure and the reaction rate using a two-phase model based on a ZND approach. Such a model requires the reaction rate, the equations of state of the unreacted phase and of the detonation products and an interaction model between the two phases to describe the reaction zone thermodynamics. The reaction rate law can be written in a factorized form including the number of initiation sites, the explosive's deflagration velocity around hot spots and a function depending on gas volume fraction produced by the deflagration front propagation. The deflagration velocity mainly depends on pressure and is determined from pop-plot tests using the hypothesis of the single curve build-up. This hypothesis has been verified for our two melt-cast explosives. The function depending on gas volume fraction is deduced from microstructural observations and from an analogy with the solid nucleation and growth theory. It has been established for deflagration fronts growing from grain's surface and a given initial grain size distribution. The model requires only a few parameters, calibrated thanks to an inversion method. A good agreement is obtained between experiments and numerical simulations.

Vincent Chuzeville
CEA, DAM, Gramat

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