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Shock-to-detonation transition of RDX and NTO based composite high explosives: experiments and modeling GERARD BAUDIN, MARIE ROUDOT, MARC GENETIER, CEA DAM Gramat — Composite HMX and NTO based high explosives (HE) are widely used in ammunitions. Designing modern warheads needs robust and reliable models to compute shock ignition and detonation propagation inside HE. Comparing to a pressed HE, a composite HE is not porous and the hot-spots are mainly located at the grain – binder interface leading to a different behavior during shock-to-detonation transition. An investigation of how shock-to-detonation transition occurs inside composite HE containing RDX and NTO is proposed in this lecture. Two composite HE have been studied. The first one is HMX – HTPB 82:18. The second one is HMX – NTO – HTPB 12:72:16. These HE have been submitted to plane sustained shock waves at different pressure levels using a laboratory powder gun. Pressure signals are measured using manganin gauges inserted at several distances inside HE. The corresponding run-distances to detonation are determined using wedge test experiments where the plate impact is performed using a powder gun. Both HE exhibit a single detonation buildup curve in the distance – time diagram of shock-to-detonation transition. This feature seems a common shock-to-detonation behavior for composite HE without porosity. This behavior is also confirmed for a RDX – HTPB 85:15 based composite HE. Such a behavior is exploited to determine the heterogeneous reaction rate versus the shock pressure using a method based on the Cauchy-Riemann problem inversion. The reaction rate laws obtained allow to compute both run-distance to detonation and pressure signals.

Gerard Baudin
CEA DAM Gramat

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