

# **Experiments, simulation and prediction on impact ignition and safety of polymer bonded explosives**

P.W. Chen, R. Liu

State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology, Beijing,  
100081, China

**Abstract:** Impact ignition phenomenon has been focused for several decades due to the importance of safety assessment of polymer bonded explosives (PBX). Confined Steven test as classical standard impact test is applied to understand the ignition behavior of HMX-based PBX under low velocity impact. By pressure gauge and high speed photography, the mechanical response of the specimen is measured. The size effect with different diameters and thicknesses of the specimen is quantified in the test, and also the relative energy release corresponding to different dimensions is calculated. In order to understand the mechanism of the ignition, the ignition criterion considers both the effective plastic work and specific plastic power and successfully is applied for the ignition prediction. Also the thermal-mechanical-chemical model as Visco-SCRAM model and the hot spot model is applied to explain the temperature distribution of the specimen during confined Steven test. The size effect and the influence of the projectile shape is analysis based on the model. In these cases above, the ignition prediction matches experimental results well. Another important issue is the ignition uncertainty due to heterogeneous microstructure. The stochastic microcracks as the primary mechanism is investigate by Monte Carlo method. The ignition probability is predicted well. Further, considering the ignition probability is based on a big database, machine learning is developed to analyze the database. The machine leaning model is validated to reach up to bigger than 90% accuracy.