[MS46-04] Crystal Growth and Influence of the Crystal Structure Characteristics on the Shock Sensitivities of RDX, HMX and CL-20 Nitramine Explosives Hongzhen Li*, Rong Xu, Bing Kang, Jinshan Li, Xiaoqing Zhou, Ming Huang

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Three tipical nitramine explosives of cyclotrimethlyene trinitramine (RDX), cyclotetramethlyene tetranitramine (HMX) and 2,4,6,8,10,12-hexanitro-2,4,6,8,10,12-hexaazatetra- cyclo [5,5,0,$0^{3,11}$ $0^{5,9}$] dodecane (CL-20) are applied in many weapons as their good properties and performance. Their crystal particle structure characteristics are closely related to processability including rheology, hazard, processing technique as well as final applications such as solid load, shock sensitivity, ballistics, mechanical properties[1-5]. Shock sensitivity is an important performance of explosives. In this paper, our aim is to study the relationship bewteen crystal structure characteristics and shock sensitivity , which guide the preparation of differently qualified crystals of RDX, HMX and CL-20, and other explosives.

The crystal structure characteristics RDX, HMX and CL-20 are influenced by crystallization method , solvent and crystallization conditions[2,3,5-7]. The different crystal structure RDX, HMX and CL-20 samples with various crystal apparent densities, particle sizes and distributions, and crystal morphologies were prepared by cooling crystallization, precipitation and evaporation under various conditions, respectively. In order to exclude effects on shock sensitivity of the binder/crystal interface, binder porosity as much as possible ，we adopted a new immersion molding method, in which the explosive crystals are immersed in rape oil or other liquid and extragranular porosities are completely removed. The shock sensitivities were determined by Large-Scale Gap Test（LSGT）, established in Chinese Military Testing Standard for shock sensitivity (GJB 772A-97-605.1A). As a result, it shows that (1) the immersion of crystals in liquid leads to sensitivity obviously decrease ; (2) for all three explosives, their shock sensitivities are lowered with increasing their crystal apparent densities and decreasing their particle sizes, and almost not affected by particle morphology; (3) the crystal twins are readily formed for HMX and the most distinct factor influencing its shock sensitivities; (4) it is found that the crystal apparent density affects most obviously the shock sensitivities for RDX and CL-20; and (5) CL-20, HMX and RDX are less and less sensitive to shock, suggesting chemical components are also a determining factor.

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