Influence Mechanism of Phase Transition and Micro Cracks on Impact Sensitivity of HMX Crystal at High Temperature

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Abstract: To study the multi-factor coupling problem existed in the impact safety of explosive at high temperature, an impact sensitivity testing installation of explosive at high temperature was designed and an impact sensitivity testing method at high temperature was proposed. Combined with the scanning electron microscopy and X-ray diffraction techniques, the response of octogen (HMX) crystal particles under impact process at high temperature was studied by the established test method. Results show that with the increase of temperature, the drop hammer impact sensitivity of HMX crystal particles increases gradually. Meanwhile, the quality of HMX crystal is gradually reduced as temperature increasing. At 140 ℃, a small number of crystals are fragmented, and more crystals are fragmented at 180 ℃. When temperature reaches 200 ℃, all HMX crystals are fragmented. The $\beta\rightarrow\delta$ phase transition temperature of HMX occurs between 184 ℃ and 186 ℃. After the temperature is reduced to room temperature, δ phase crystal gradually returns to β phase, and the impact process is helpful to the recovery of β phase. The main factors affecting the impact sensitivity of HMX crystal particles before and after thermal loading include temperature increasing, micro cracks and phase transition. The temperature range acted by different influence factors is different.

Key words: high temperature impact sensitivity; phase transition; micro crack; octogen(HMX) crystal

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