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Experimental Study on Micron Crystal Defect of Explosive by μVCT

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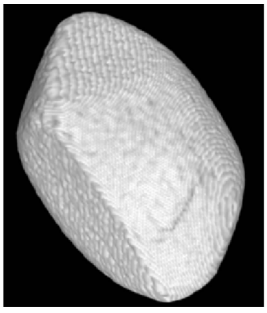
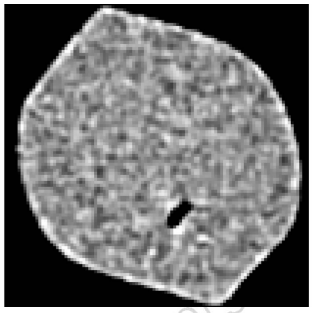
The structure of a typical crystal explosive (HMX) was studied with loose normal and recrystallized grains by 225 kV micro-focus X-ray industrial volume CT (μVCT). The micro-hole ratio was quantitatively analyzed with dimension of 0.2 – 1 mm. The cubic array of attenuation coefficient restoration of sample was obtained with the voltage of 130 kV and the current of 50 mA and the dimensional resolving power of 7.1 μm.

Results show that there are micron holes with distributions of $1-10\times10^{-5}$ mm^3 in HMX crystal (see in Fig. 1). The maximal hole-volume is about 7.2×10^{-5} mm^3, and the primary micro holes is $1-3\times10^{-5}$ mm^3, which indicates that initial damage exists in HMX molding parts, and the density difference in actual and theoretical and density instability are mainly caused by the micro hole in crystal. Additionally, Fig. 2 illustrates the whole CT-image of single normal HMX crystal and the amount, shape and location of holes are clearly displayed. Meanwhile the micro-hole ratio of HMX, as an important parameter of explosive crystal quality is expressed by volume hole ratio and superficial hole ratio in Table 1, showing that the volume hole ratio of recrystallized HMX is lower than that of normal HMX.



a. Three dimensional image of crystal



b. The slice image of XY -section

Fig. 1 CT images of a single normal HMX crystal grain

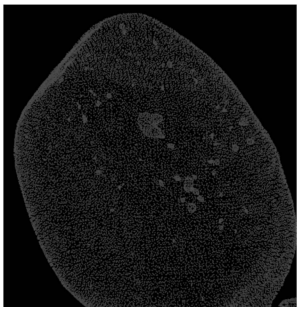


Fig. 2 The whole image of HMX crystal and inner hole

Table 1 Micro-hole ratio of HMX crystal

hole ratio	single normal HMX	loose normal HMX	loose recrystallized HMX
volume hole ratio/%	0.21	0.55	0.40
superficial hole ratio/%	0 – 2.11	0.28 – 1.14	0 – 2

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