

Cultivation, mechining and mechanical properties of RDX single crystal

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The bulk single crystal of explosive is the most effective and direct objects for researching the mechanical response, initiation mechanism and detonation wave propagation law of explosive, quantifying explosive's mechanics and detonation characteristic parameters, assessing explosive's intrinsic security. Cyclotrimethylene trinitramine (RDX) is a typical nitroamine explosive widely used in military and industrial applications and as a vital energetic component within plastic-bonded explosives (PBXs). Bulk single crystal of RDX (about $5 \times 4 \times 3$ cm3) has been prepared from acetone solution by solvent evaporation techniques.

Variable thickness single crystal slices were cut by diamond wire cutter along some oriented RDX crystal plane and polished, the surface roughness can be reduced to 5 nm which can effectively guarantee the accuracy of mechanical measuring values remarkablely influenced by surface roughness. The growth-induced dislocation in RDX single crystals was estimated by rocking curve (ω -scan) of high-resolution x-ray triple axis diffraction (TAXRD), and the full width at half maximum (FWHM) of (210), (200) and (111) planes were 35.35, 45.31 and 77.92 arc sec respectively, the ordering of plane dislocation density is (111)>(200) >(210). It can be concluded that the growth of (111) crystal plane is quickest, while (210) crystal plane is slowest.

The nanoindentation technique has been employed to measure elastic modulus, hardness, fracture toughness, coefficient of friction of (210), (200) and (002) oriented RDX single crystal. The result of nanoindentation tests show anisotropy in mechanical properties of RDX.

Keywords: RDX ;single crystal; Cultivation; mechining ; mechanical properties