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Effect of RDX Particle Size on the Mechanical and Combustion Properties of Nitramine Gun Propellant

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Abstract: To study the effect of RDX particle size on the mechanical property and combustion performance of nitramine gun propellant, three kinds of nitramine gun propellants containing 25.0% RDX with average particle sizes of 30, 50 μm and 150 μm were designed, their impact strength, crushing situation and combustion performance were studied by pendulum charpy impact machine, drop weight test apparatus and closed bomb, respectively. Results show that with the particle size of RDX decreasing from 150 μm to 30 μm , the impact strength of gun propellants at low temperature ($-40\text{ }^{\circ}\text{C}$) increases from $3.46\text{ J}\cdot\text{cm}^{-2}$ to $8.99\text{ J}\cdot\text{cm}^{-2}$, and the crushing degree under the action of drop hammer impact (hammer weight 5kg and drop height 80 cm) decreases from 96% to 18%. When the average particle size of RDX, D_{50} , is 30, 50 μm and 150 μm , the pressure exponent of burning rate is 0.985, 0.996 and 1.063, respectively. When the particle size of RDX is 30 μm or 50 μm , the u - p curve of gun propellant is smooth, its combustion is stable. When the particle size of RDX is 150 μm , in the pressure range of 100 ~ 150 MPa to 150 MPa $\sim p_{\text{dpm}}$, the pressure exponent of burning rate decreases from 1.125 to 0.612, revealing that there is a mutation in the pressure exponent of burning rate and the propellant combustion is unstable.

Key words: nitramine gun propellants; hexogen(RDX); particle size; mechanical property; combustion performance

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为了丰富学术交流形式,及时传递含能材料领域同行们的学术观点和思想,《含能材料》开设了“观点”栏目。“观点”栏目的来稿应观点鲜明、内容新颖、形式上短小精悍。欢迎含能材料各领域的专家积极来稿。来稿时请附个人简介及主要研究工作介绍。

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