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Effects of Carbon Nanotubes(CNTs) on the Combustion and Mechanical Properties of AP/CMDB Propellant

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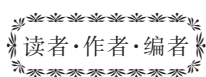
Abstract: To improve the combustion and mechanical properties of ammonium perchlorate (AP)/composite modified double base (CMDB) propellant prepared by the solvent-extrusion method, the effects of carbon nanotubes (CNTs) on the thermal decomposition performances of the main components of AP/CMDB propellant and the microstructure of AP/CMDB propellant were studied by differential scanning calorimetry (DSC) and scanning electronic microscope (SEM). The burning rate and impact strength of AP/CMDB propellants with CNTs of mass fraction as 0.1%, 0.3% and 0.5% were tested. Results show that CNTs can effectively catalyze the thermal decomposition of AP, and make the low temperature decomposition peak of AP disappear, and the peak temperature of high temperature decomposition of AP shift 39.9 °C downwards, but it has little effect on the thermal decomposition of double base components NC and NG. CNTs can improve the microstructure of AP/CMDB propellant. There are no obvious micro cracks in the AP/CMDB propellant with the addition of 0.5% CNTs. CNTs can effectively improve the combustion and mechanical properties of AP/CMDB propellant. With increasing the content of CNTs the burning rate increases, the pressure exponent decreases, and the impact strength increases of the propellant. For AP/CMDB propellant with 0.5% CNTs, the burning rate at 10 MPa is 61.19 mm·s⁻¹, the pressure exponent between 10 MPa and 22 MPa is 0.51 and the impact strength is 5.55 kJ·m⁻² at -40 °C.

Key words: carbon nanotubes (CNTs); ammonium perchlorate/composite modified double base (AP/CMDB) propellant; burning rate; pressure exponent; impact strength

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《含能材料》“损伤与点火”专栏征稿

含能材料的损伤特征与点火过程有密切的联系,炸药、推进剂的内部损伤及其对力学特性、安全特性和点火行为的影响规律受到了含能材料学界的高度重视,为推动这一重要研究方向的学术交流,本刊特设立“损伤与点火”专栏。专栏主要征集炸药、推进剂等含能材料的损伤观测与多尺度表征技术、含损伤的本构方程、准静态与动态损伤演化规律、损伤与破坏的宏(细)观模式、损伤对起爆、爆炸、爆轰成长以及非冲击起爆行为的影响等方向的原创性研究论文。来稿请注明“损伤与点火”专栏。

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