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Fabrication and Mechanical Properties of Micro-porousNC/TEGN/RDX Composites

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Abstract: Micro-porous combustible composites of NC/TEGN/RDX were fabricated by the extrusion molding process of solvent method and supercritical carbon dioxide ($SC\text{-}CO_2$) foaming technique using nitrocellulose (NC), triethylene glycol dinitrate (TEGN) and cyclotrimethylenetrinitramine (RDX) as energetic matrix, and thermoplastic elastomer-methyl methacrylate (MMA) as binder. Scanning electron microscopy and impact test of simple supported beam were used to investigate the cell morphology and mechanical property of the composite, respectively. Results show that increasing the saturation pressure is beneficial to reducing the pore size and increasing the pore density. With increasing the foaming temperature, the cell size of the composites gradually increases, and the cell density shows a trend of increasing first and then decreasing. When the content of thermoplastic elastomer increases from 5% to 15%, the impact strength can increase by 37.74%. The impact strength of the micro-porous combustible composites of NC/TEGN/RDX increases from 3.21 $kJ\cdot m^{-2}$ to 4.31 $kJ\cdot m^{-2}$ when the saturation pressure is in the range of 10 MPa to 25 MPa. However, the impact strength gradually decreases with the increase of foaming temperature. Cell size and cell density are important factors affecting the mechanical properties of NC-based energetic micro-porous composites, and the dense and uniform cell structure can effectively improve the mechanical properties.

Key words: combustible composites; supercritical carbon dioxide ($SC\text{-}CO_2$); microcellular foaming; cell morphology; 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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