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TG-FTIR Study on Waste Propellants for Enhanced Combustion of Anthracite

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Abstract: Large amount of solid propellants would be discarded each year due to failure, and the recycling/reuse of the waste propellants is important for energy conservation and environmental protection. On the basis of thermogravimetry-differential scanning calorimetry, coupled with Fourier transform infrared spectroscopy (TG-DSC-FTIR) technique, the solid-state reaction properties of the mixtures of propellant and anthracite has been investigated with details. Propellant-anthracite blends at different ratios were heated up to 1300 °C at 10 K·min⁻¹ heating rate in air, and the FTIR spectra have been obtained synchronously. The results show that as the propellant content increases, the decomposition process moves to the low temperature zone. The ignition temperature of anthracite decreases from 560 °C to 383 °C. The burn out temperature decreases from 676 °C to 616 °C, and the comprehensive combustion characteristic index increases from 2.36 E-8 to 1.27 E-7. Moreover, the apparent activation energy of the fixed carbon combustion part decreases from 165.6 to 91.2 kJ·mol⁻¹. The FTIR spectra show that as the propellant content increases, the release of CO₂ and CO as the major gaseous products of anthracite oxidation, move to the low temperature zone. It indicates that the waste propellants can greatly enhance the oxidation process, ignition and combustion of anthracite.

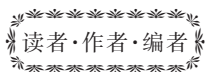
Key words: waste propellant; anthracite; co-combustion; thermogravimetric analysis; infrared spectrum

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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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