Thermal Decomposition and Combustion Characteristics of TKX-50 with Network Nanostructure Fabricated by Rapid Freeze-drying Method

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Abstract: To study the thermal decomposition properties and combustion characteristics of nano-scale dihydroxylammonium 5,5′-bistetrazole-1,1′-diolate(TKX-50), TKX-50 samples with network-like nanostructure were prepared by rapid freeze-drying method. Their morphologies and structures were characterized by scanning electron microscope(SEM)and X-ray diffractometer(XRD). Thermal decomposition properties were measured by thermogravimetric analysis-differential scanning calorimetry(TG-DSC). Combustion process was tested by camera. The effects of nano-sized structure on the thermal decomposition and combustion characteristics of TKX-50 were discussed. Results show that the nano-scale TKX-50 obtained by rapid freeze-drying method has a nano-level network-like connection structure and good crystal stability. The two-step thermal decomposition peak temperatures of nano-scaleTKX-50 are 238.0 ℃ and 267.7 ℃, compared with raw TKX-50, which are decreased by 12.1 ℃ and 5.6 ℃, respectively. The nano-scaleTKX-50 samples have lower ignition delay and higher burning rate, revealing that compared with raw TKX-50, the surface active atoms and groups of nano-scale TKX-50 samples prepared by rapid freeze-drying method are increased and samples are easily activated, which promotes the thermal decomposition and combustion of TKX-50.

Key words: rapid freeze drying; 5,5′-bistetrazole-1,1′-diolate (TKX-50); network-like nanostructures; thermal property; combustion characteristic

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