

Experimental Study on the Effect of Storage Conditions on Thermal Hazard of Nitrocellulose

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Abstract : Nitrocellulose (NC), a kind of energetic material, has been widely used in the industrial and military fields. However, this material can also cause serious social disasters due to storage conditions. Thermal hazard of nitrocellulose (NC) was experimentally investigated using the CALVET heat flux calorimeter C80, and three kinds of storage conditions were considered in the experiments: (1) drying time, (2) moisture content, (3) cycles. The results showed that the heat flow curves of NC moved to the low-temperature direction firstly and then slightly moved back by increasing the drying hours. Moisture that was responsible for the appearance of small exothermic peaks was proven to be the unfavorable safety factor yet it could increase the onset temperature of the main peak to some extent. And cycles could both lower the onset temperature and the maximum heat flow but enlarged the peak temperature. Besides, relevant kinetic parameters such as the heat of reaction (ΔH) and the activation energy (E_a) were obtained and compared. It was found that all the three conditions could reduce the values of E_a and most of them produced larger reaction heat. In addition, the critical explosion temperature (T_b) of the NC samples were derived. It was clear that not only the drying time but also the cycles would increase the thermal hazard of the NC. Yet, the right amount of water helped to reduce the thermal hazard.

Keywords : C80, nitrocellulose, storage conditions, the critical explosion temperature, thermal hazard

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