Experimental Study of Hypergolic Process of Ionic Liquids with BH₃(CN)BH₃(CN) Anion

WENG Xin-yan¹, DU Zong-gang², YU Jun², TONG Shang-ging¹, LI Jian-ling³, ZHANG Qing-hua⁴, TANG Cheng-long¹, HUANG Zuo-hua1

(1. School of Energy and Power Engineering, Xi'an Jiaotong University, Xi'an 710049, China; 2. Xi'an Aerospace Propulsion Institute, Xi'an 710100, China; 3. School of Power and Energy, Northwestern Polytechnical University, Xi'an 710072, China; 4. Institute of Chemical Materials, CAEP, Mianyang 621999, China)

Abstract: The reactions of 8 newly synthesized ionic liquids containing BH₂(CN)BH₂(CN) anion, (I. L. 1 ~ I. L. 8), with white fuming nitric acid (WFNA) and red fuming nitric acid (RFNA) respectively were tested by using the long focus microscope-high speed photography technique and droplet method test device, respectively. Results show that each test achieves stable hypergolic reaction and two different flame development processes were observed. Specifically, after the contact of I.L.8 with WFNA, the microexplosion is occurred and hypergolic ignition is occurred in a short time, while after the contact of I. L. 8 with RFNA the aplashing of secondary droplet is occurred. Due to the effect of Leiden Frost effect, the foam like droplets after reaction is rebounded and a short combustion reaction is appeared, the hypergolic ignition is occurred after a long time. For the ionic liquid with same heterocyclic core, the ignition delay time of the ionic liquid containing the allyl group on the side chain is the shortest, followed by the ionic liquid containing ethyl, while the ignition delay time of the ionic liquid containing butyl and WFNA is the longest. For the ionic liquid with the same side chain, the ignition delay time of the ionic liquid containing the pyridine heterocyclic ring is the longest, followed by the imidazole heterocyclic ionic liquid, and the ignition delay time of the ionic liquid containing tetrahydropyrrole reacted with WFNA is the longest. The higher the enthalpy of formation is, the shorter the ignition delay time is. **Key words:** hypergolic ignition; ionic liquids; ignition delay; white fuming nitric acid (WFNA); red fuming nitric acid (RFNA) **CLC number**: V511; V231.2⁺4 **DOI**: 10.11943/j. issn. 1006-9941. 2018. 07. 002 Document code: A

※读者・作者・编者 ※

《含能材料》"含能共晶"征稿

含能共晶是不同含能分子通过氢键等相互作用力形成的具有稳定结构和性能的分子晶体。含能共晶充分组合了单质 含能分子的优点,呈现出感度低,综合性能优良的特点,具有潜在的应用前景,共晶研究已经引起国内外含能材料学界的高 度关注。为推动含能共晶的研究和交流,本刊特推出"含能共晶"专栏,主要征稿范围包括含能共晶晶体设计与性能预测、 不稿请注 含能共晶的制备、结构解析、性能等。来稿请注明"含能共晶"专栏。

《含能材料》编辑部