

Review on Jet Impingement Atomization of Gelled Propellant

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Abstract: As a kind of new rocket propellant, gelled propellant is thought to integrate the advantages of traditional liquid propellant and solid propellant. Gelled propellant's special non-Newtonian rheological characteristics make it difficult to be atomized and atomization is one of the key problems of gel propulsion technology. Jet impingement atomization was the mainly used atomization method. The statuses of research on experiment, theory and simulation of gelled propellant jet impingement atomization were reviewed. From the discussion, the following conclusions could be drawn: firstly, in aspect of atomization experiment, with the analysis of experiment obtained atomization data, the influences of rheology and impinging parameters on atomization could be got, but hardly any quantitative result could be concluded. Secondly, in aspect of atomization theory, the liquid sheet characteristics, such as liquid sheet shape, liquid sheet breakup length, etc., could be predicted by the stationary antisymmetric wave theory and the linear stable theory, but the accuracy of the prediction was not so high and the atomization theory should be further improved. Thirdly, in aspect of atomization simulation, the main developing processes of jet impinging atomization could be simulated with both traditional mesh based methods and newly developed mesh free methods, but the simulation results was fairly rough and the atomization simulation was still on in a fledging period. In a word, the mechanism of the gelled propellant atomization was still beyond being fully understood, future work could be carried in the following aspects: to develop a quantitative gelled propellant atomization characterizing method, to develop a new non-Newtonian rheological based and impingement included atomization theory, to improve the numerical simulation methods according to the characteristics of jet impingement atomization of gelled propellant, etc.

Key words: gelled propellant; jet impingement atomization; atomization experiment; atomization theory; atomization simulation

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《含能材料》高效毁伤弹药专栏征稿

高效毁伤弹药以“利用最小化成本获得最大化效果”为目标,对含能材料的性能和能量提出了更高的要求。为进一步促进高效毁伤弹药及其技术的研究,本刊将于2015年增设高效毁伤弹药专栏,内容涉及(1)传统含能材料的优化和改进以及先进含能材料的开发和应用,包括:传统含能材料合成、制造、处理和应用的新技术,新的CHON含能材料的开发和应用,金属化炸药,非传统概念炸药(如燃料空气炸药、温压炸药),高能量密度材料;(2)含能材料能量的控制输出研究,包括:能量输出增强(如组合装药),能量输出聚焦/定向,能量输出模式可控(如多模装药),能量输出范围可控(如低附带毁伤炸药)。欢迎广大学者投稿,来稿时请选择对应的专栏。

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