

- 2005, 127: 143 - 155.
- [11] 杨伟东, 张蒙正. 凝胶推进剂模拟液直圆管流动特性初步研究 [J]. 火箭推进, 2006, 32(3): 12 - 17, 23.
- YANG Wei-dong, ZHANG Meng-zheng. Investigation of flow characteristics in straight round pipe of gelled propellant simulants [J]. *Journal of Rocket Propulsion*, 2006, 32(3): 12 - 17, 23.
- [12] 林建中, 阮晓东, 陈邦国, 等. 流体力学 [M]. 北京: 清华大学出版社, 2005: 108 - 111.
- LIN Jian-zhong, RUAN Xiao-dong, CHEN Bang-guo, et al. *Fluid Mechanics* [M]. First Edition. Beijing: Tsinghua University Press, 2005: 108 - 111.
- [13] 沈崇棠, 刘鹤年. 非牛顿流体力学及其应用 [M]. 北京: 高等教育出版社, 1989: 84 - 86.
- SHEN Chong-tang, LIU He-nian. *Non-newtonian Fluid Mechanics and Its Application* [M]. First Edition. Beijing: High Education Publication, 1989: 84 - 86.

Numerical Analysis of Factors Affecting Flow Property of Gel Propellants in Round Pipes

QIANG Hong-fu, XIA Xue-li

(No. 201 Staffroom, Faculty of Mechanical & Propulsion Engineering, Xi'an Hi-Tech Institute, Xi'an 710025, China)

Abstract: To evaluate the effect of the tapered round pipe geometry, volumetric flow rate and gellant type or content on the pressure drop, the velocity and viscosity fields, the governing equations of the steady, incompressible, isothermal, laminar flow of a Power-Law, shear-thinning gel propellants in pipe were formulated, discretized and solved. A SIMPLEX numerical algorithm was applied for the solution of the flow field. Results show that the mean apparent viscosity decreases with increasing of the volumetric flow rate and increasing of the gellant content results in an increase in the viscosity. The results also show that the cone semi-angle can produce additional decrease in the mean apparent viscosity of the fluid. The mean apparent viscosity decreases significantly with increasing of the convergence angle of the pipe, and its value is limited by the Newtonian viscosity η_{∞} . The effect of the cone semi-angle on the mean apparent viscosity is more significant than that of the volumetric flow rate and the gellant type or content on the mean apparent viscosity. Additional decreasing of the viscosity results in an increase in the pressure drop with the increasing of cone semi-angle. It is important to pipe design that the viscosity decreasing and the pressure drop increasing are taken into account together.

Key words: fluid mechanics; gel propellant; flow property; effecting factor; numerical analysis



俄罗斯专家来绵讲学

应中国工程物理研究院化工材料研究所邀请, 俄罗斯科学院有机化学研究所的 Tatiana S. Pivina 和 Nina N. Makhova 两位教授于 2009 年 3 月 18 日至 19 日来绵阳讲学。本次讲座共有交流报告 6 篇, 主题涉及含能材料理论模拟计算和合成两个方面, 来自化工材料研究所及西安近代化学研究所等单位的 60 余名科技人员参加了讲座交流。

从交流报告来看, 利用计算机模拟技术来研究含能材料的结构与性能以及合成含氮高能化合物已成为俄罗斯极有前景的发展方向。Tatiana S. Pivina 教授在含能材料理论模拟方面取得了相当大的进展, 实现了利用理论计算方法从大量有机化合物结构中筛选、确定具有优异物理化学性质(如生成焓、分子晶体密度、热安定性等)的含能化合物结构, 并能推测其结构与性能之间的关系, 进而研究含能化合物的一些反应机理。Nina N. Makhova 教授主要介绍了基于含氮高能化合物的合成, 其中着重于呋喃 furazan 和 furoxan 衍生物的合成与能量特性以及 diaziridines 的合成、反应、热化学和应用的特性。这次讲学达到了交流、沟通和共享的目的。

(化工材料研究所 陈瑾 供稿)