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涡流冷却推力室流场特征与性能仿真

Simulation of flow characteristics and performance of vortex cooling thrust chamber

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中文摘要:

针对2000N气氢/气氧涡流冷却推力室, 采用三维全尺寸计算模型开展了仿真研究, 得到了流场速度分布特点, 验证了涡流冷却推力室内具有双向涡旋结构, 内外涡流分界面约占涡流冷却推力室圆柱段半径的86%, 燃烧区域约占涡流冷却推力室圆柱段半径的70%。分析表明: 外层涡流主要受来流速度与涡流冷却推力室几何参数影响, 内层涡流在黏性、燃烧等作用下室压、密度稳定。侧壁温度平均为388K, 比冲效率达92%以上, 仿真结果与试验对比一致。

英文摘要:

Numerical simulation of 3-D full-size model was conducted for 2000N gas hydrogen/gas oxygen vortex cooling thrust chamber. Velocity distribution characteristics of the flow field were obtained, and existence of the bidirectional vortex structure was verified. The interface of inner and outer vortexes accounted for 86% of the thrust chamber cylinder radius, and the combustion zone took up 70% of the thrust chamber cylinder radius. Analysis showed that the outer vortex cooling layer was mainly influenced by incoming stream velocity and geometric parameters of thrust chamber. The pressure and density of the inner vortex maintained stable due to the viscosity and combustion. The average temperature of the thrust chamber sidewall was 388K. The specific efficiency was above 92%. The results of computation were consistent with the experiment results.

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