中国电机工程学报 2012, 32(2) 93-98 DOI: ISSN: 0258-8013 CN: 11-2107/TM

工程热物理

单/多狭缝射流冲击柱状凸形表面流动和换热特性

姜泽毅[1]，柳翠翠[1]，张欣欣[1]，马强[2]，孙雨生[2]

1．北京科技大学机械工程学院，2．中国航空规划建设发展有限公司

摘要： 为分析单狭缝、双狭缝和四狭缝射流冲击柱状凸形表面的流动换热特性，应用Realizable k-e模型对其展开数值研究。通过与实验数据对比验证了数学模型的适用性，比较探讨了单、多狭缝冲击射流的流场分布、边界层分离现象和冲击换热特点。结果表明：单、多狭缝射流冲击柱状凸形表面，气体分别在流动阻力和相邻狭缝射流逆向相遇阻力形成的逆压梯度作用下，发生边界层分离；随流动发展，多狭缝射流在相邻射流逆向相遇作用下，Nu迅速下降至最低值，随后在逆流作用下有所回升；每狭缝具有相同雷诺数Re条件下，当狭缝数目增加时，Re的增加对提高平均努塞尔数Num的效果相对较小，当无量纲曲率半径(D/B)增大时，Num对Re的变化更加敏感，增大Re将有效地增加表面Num；狭缝射流总流量一定时，狭缝数目越多，Num越小，局部努塞尔数Nu分布越均匀。

关键词： 狭缝射流 凸形表面 边界层分离 流动换热

Flow and Heat Transfer Characteristic of Single and Multiple Slot Jets Impingement on a Cylindrical Convex Surface

JIANG Zeyi[1], LIU Cuicui[1], ZHANG Xinxin[1], MA Qiang[2], SUN Yusheng[2]

1. School of Mechanical Engineering, University of Science and Technology Beijing
2. China Aviation Planning and Construction Development Co, LTD

Abstract: Flow and heat transfer of single-slot jet, double-slot jets and quadric-slot jets impingement to a cylindrical convex surface were numerically investigated by realizable k-e model. The numerical model was validated through comparison with the experimental data. Flow distribution, boundary layer separation and impingement heat transfer were discussed and compared. The results show that: Boundary layer separation occurs in both of single and multiple-slot jets impingement due to adverse pressure gradient caused by the resistance of flow and reverse encountering of the adjacent slot jets, respectively. With flow development, Nu drops rapidly to the minimum due to the reverse encountering flow in multiple-slot jets and then has a small increase due to the adverse flow. Under the same Re of each slot, the effect of increasing Re is relative small on raising Num when slots number increases. While the effect of Re on Num becomes more sensitive with increasing dimensionless curvature radius(D/B). Num could be effectively increased by increasing Re under big D/B. Under a constant total flow rate, Num decreases but uniformity of local Nu increases with increasing slots number.

Keywords: slot jets impingement convex surface boundary layer separation flow and heat transfer

收稿日期 2011-02-24 修回日期 2011-04-15 网络版发布日期 2012-01-20

DOI:

基金项目:

通讯作者: 柳翠翠

作者简介:

作者Email:

参考文献：

本刊中的类似文章

1．王智 安连锁 韩中合.叶栅形状变化对自发凝结影响的数值研究[J]. 中国电机工程学报, 2009,29(35): 125-130