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汽雾两相流强化冷却燃气轮机叶片内冷通道

Internal cooling passage of mist/steam two-phase flow enhanced cooling gas turbine blade

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中文关键词: 燃气轮机 叶片冷却 汽雾冷却 两相流 换热特性

英文关键词:gas turbine blade cooling mist/steam cooling two-phase flow heat transfer characteristics

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中文摘要:

实验研究了方形通道这一重型燃气轮机中常用叶片强制对流冷却通道结构.分析了雷诺数、壁面热流密度以及水雾质量流量比等关键参数对汽雾冷却通道的传热特性的影响,并建立了考虑离散相水雾的流动工况和通道壁面加热条件的实验关联式.结果表明:相对于纯蒸汽,汽雾两相流的传热系数显著提高,且传热性能提高的幅度随热流密度的增大而减小,随雷诺数和水雾质量流量比的增大而增大;通道上壁面平均传热系数低于下壁面,在高热流密度和低水雾质量流量比下,两者相差约13%,而在低热流密度与高水雾质量流量比的情况下,该比值增加到约25%.

英文摘要:

A square channel of a geometry commonly used in heavy-duty gas turbine blade as forced convection cooling channel was experimentally studied. The effect of Reynolds number, wall heat flux and mist mass flow rate on the heat transfer characteristic of mist/steam cooling channel wall were analyzed. A experimental correlation of heat transfer was developed to account for mist flow working conditions and channel wall heating conditions. Results show the heat transfer coefficient of mist/steam two-phase flow is significantly higher than the pure steam. Heat transfer performance of mist/steam decreases with increasing of heat flux and increases with increasing of Reynolds number and mist mass flow ratio. The average heat transfer coefficient of upper wall surface is lower 13% than bottom wall surface under higher heat flux and lower mist mass flow ratio, while in the case of low heat flux and high mist mass flow ratio, this ratio increases to approximately 25%.

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