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论文

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### 旋转光滑及带肋U形通道的局部换热特性

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### Local Heat Transfer in a Rotating Smooth and Ribbed U-shaped Channels

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摘要

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**摘要** 用实验方法研究了旋转状态下光滑及带肋U形方截面通道的换热特性。带肋通道中,90°直肋对称布置在前、后缘,肋片高径比为0.143,节距比为7。在实验雷诺数及旋转数范围分别为6100~25100和0~0.26下,对比分析了光滑及带肋通道的旋转换热特性。结果表明,带肋通道的换热明显好于光滑通道;旋转强化了第1通道后缘及第2通道前缘的换热,但削弱了第1通道前缘及第2通道后缘的换热;旋转效应对带肋结构的第1通道前后缘换热的影响最为明显;光滑通道中,弯道效应对其下游换热的影响较为显著。

**关键词:** 燃气轮机 叶片冷却 对流传热 蛇形通道 旋转

**Abstract:** Experiments are made to determine the local heat transfer performances in a U-shaped square channel with smooth walls and those with ribbed surfaces. The rib turbulators are placed symmetrically on the trailing and leading walls with an angle of attack of 90°. The rib height-to-hydraulic diameter ( $e/D_h$ ) is 0.143; the rib pitch-to-height ratio ( $P/e$ ) is 7. The Reynolds number and rotation number are varied in 6 100-25 100, and 0-0.26, respectively. Results for the smooth serpentine channel are compared with those for rib-roughened one. These results show that a significant enhancement in the heat transfer is achieved by means of rib turbulators in a serpentine channel in stationary state as well as in rotation state. The heat transfer of the first pass trailing surface and the second pass leading surface is enhanced by rotation, whereas the first pass leading surface and the second pass trailing surface show a decrease in heat transfer with rotation. The rotation effect on heat transfer is most significant in the first straight section of the rib roughened channel. The bend induced vortices exert more influence on local heat transfer after 180° sharp turn in the smooth channel.

**Keywords:** gas turbine blade cooling convective heat transfer serpentine channel rotating

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