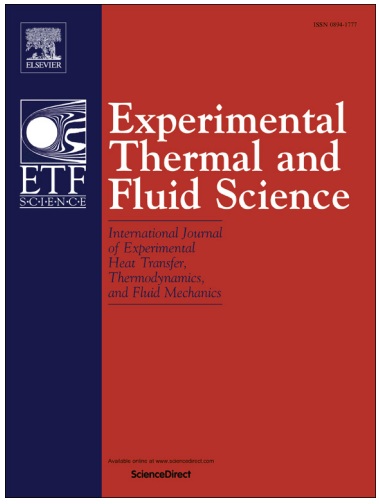

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Abstract

Using the Thermochromic Liquid Crystal (TLC) technique, one downstream sister holes and one base round hole were investigated experimentally to study the effect of rotation on film cooling performance on a flat plate test model. Blowing ratios of 0.3, 0.5, 1.0, 1.5, 2.0 and 2.5 were studied. Density ratio of the cooling air to hot air was 1.05. The mainstream Reynolds number (Re_D) was 3400, and 4 rotation speeds of 200, 400, 600 and 800rpm were applied on both the pressure side (PS) and suction side (SS). Under rotation, the film cooling performance of the downstream sister holes improved clearly at blowing ratio M=0.3-2.5, both on the PS and SS. For both the base hole and downstream sister holes, the film trajectory showed a distinct centrifugal deflection on the SS, with lower film cooling effectiveness than that on the PS. On the PS, the rotation number had a clear effect on film cooling performance, which increased first and then decreased with increased rotation speeds and reached the highest value at 600rpm.

Keywords

downstream sister holes; film cooling; Thermochromic Liquid Crystal; blowing ratio; rotation number

1.Introduction

Designers have increased the inlet temperature in modern gas turbines to get better heat efficiency and output power. As the increased inlet temperature is much higher than is the melting point of the turbine blades, it is inevitable to cool the blades to guarantee a secure and optimal operational lifetime. The film cooling method is