STUDY ON THE FLOW AND HEAT TRANSFER CHARACTERISTICS OF V-SHAPED UNEQUAL HEIGHT RIBS IN TWO-WAY OUTLET TURBINE BLADE

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The development of the internal cooling technology of the turbine blades has greatly increased the inlet temperature of the turbine. The internal cooling is mainly achieved by enhancing the internal convection heat transfer. The fin structure is simple, easy to implement and has a not weak heat transfer enhancement capability. Basically all turbine blade adopts a fin spoiler structure.

Due to the needs of aerodynamic characteristics, the trailing edge of the turbine blade is usually as thin as possible. Therefore, the cross section of the internal cooling channel is usually trapezoidal. In this paper, unequal height ribs are laid in the trailing edge channel of the two-way outlet turbine blade. The rib height of this fin changes uniformly along the rib span. The ratio of the lowest height to the highest height of the trailing edge channel in this paper is approximately 1:3, and the structure of the V-shaped rib is simple and has great heat transfer improvement performance, and in the trailing edge channel of the dual-pass gas turbine blade, it shows better pressure loss characteristics. Therefore, the V-shaped rib is selected for the study of unequal height ribs. The average rib heights of the unequal height ribs are 0.75mm and 1.5mm respectively, corresponding to When the e/Dh is 5% and 10%, four contrast models with rib height ratios of 1:1, 1:2, 1:3, and 1:4 are designed. Fig. 1 is V-shaped rib geometry model and Fig. 2 is Schematic diagram of unequal height ribs. The turbulence model in this study is Realizable , The range of Reynolds number is 6000-21100, There are six groups of Reynolds numbers of 6000, 9000, 12100, 15100, 18100, and 21100 .

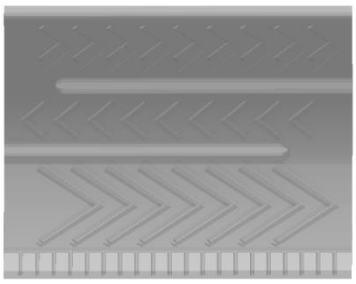

Fig. 1 – V-shaped rib model

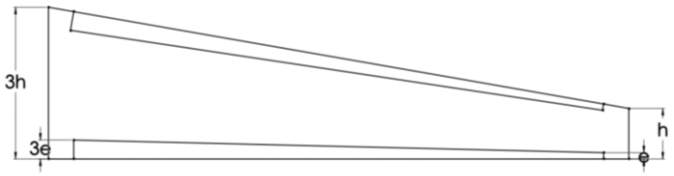

Fig. 2 – Rib of unequal height

The research results show that when the unequal height ribs are 0.75mm, the rib with rib height ratio of 1:1 obtain the best comprehensive heat transfer effect and heat transfer improvement ability. When the rib height ratio is 1:2, the comprehensive heat transfer effect and the heat transfer improvement ability is the worst. Compare with its comprehensive thermal performance parameters have dropped by 3.34%. When the unequal height rib is 1.5mm, the rib with rib height ratio of 1:1, which has the best comprehensive heat transfer effect and heat transfer improvement ability. When the height ratio is 1:1, the comprehensive heat transfer effect and heat transfer improvement ability are the worst, its comprehensive thermal performance parameters increase by 4.65% and Nu/Nu0 increase by 9.74%. Finally, when the rib height is 0.75mm, the use of unequal height ribs will slightly reduce the comprehensive heat transfer. When the rib height is 1.5mm, the unequal height ribs with the same channel height ratio (1:3) have the best comprehensive heat transfer performance.