Experimental Study of Convective Heat Transfer in Rotary Blade Coupling

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ABSTRACT

This study attempts to improve the local high temperature distributions in rotary-blade-coupling (RBC), which is the source of motive power for sport-utility-vehicles (SUV). The experiment takes RBC with forced convection and circumferential ribs for the research on heat transfer enhancement. During rotation, RBC produces centrifugal fluid flow, convection phenomenon and temperature distributions that differ with rotational speed. Simultaneously, rotation enhances the turbulence intensity of the flow field, promoting heat transfer and destabilizing Taylor vortices. This instability influences the local heat transfer distribution and damages the machine parts because of overheating. To analyze the actual convection of the rotary flow field, the experiment testing section is designed based on the actual size of the RBC. In the experiment, the RBC is cooled via forced exterior oil supply, and ring-shaped turbulence ribs of three aspect ratios are added to augment the heat transfer area, for discussing the axial temperature distributions at the top and bottom of the RBC. The experiment adopts major physical parameters within and to discuss the heat transfer effect in the interior rotary flow distribution groove of RBC in the four-wheel-drive (4WD) vehicle. Finally, based on the relevant experimental results, an empirical correlation is established for the reference of 4WD vehicle design.

Keywords : Rotary Blade Coupling, Heat Transfer, Taylor Vortices

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