Study of Heat Transfer Enhancement of Nanofluids in Rotary Blade Coupling

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ABSTRACT

This study adds CuO and Al2O3 nano particles and antifoam respectively into cooling engine oil. A comparison is made between their heat transfer performance and that of oil without adding such substances. The experimental platform is real-time four-wheel-drive (4WD) transmisson system. It adopts advanced rotary blade coupling (RBC), where high local temperature is easy to occur at high rotating speed. Therefore, it is imperative to improve the heat transfer efficiency. Any resolution to such problems requires a thorough understanding of the thermal behavior of rotating flow field within the power transmission system. The experiment measures the temperature distribution of RBC exterior at four different rotating speeds (400rpm, 800rpm, 1200 rpm and 1600 rpm), simulating the conditions of real car at different rotating speeds and investigating the optimum possible compositions of nanofluid for higher heat transfer performance. Experimental results show that Case I (CuO) has a better heat transfer behavior, Case II (Al2O3) is the next, no addition case is the third, and Case III (antifoam) conducts a lower heat transfer performance. The phenomena of Taylor vortex affect the axial temperature distributions in the study. In addition, an IR temperature sensitive technique is applied to access the surface temperature of RBC. Finally, based on the relevant experimental results, an empirical correlation is established for the reference of 4WD vehicle design.

Keywords : Nanofluid, Heat Transfer, Rotary Blade Coupling

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