Experimental study on heat transfer Characteristics of a nanofluid TiO_2 and Ethylene Glycol used in an automobile radiator

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ABSTRACT

This study focuses on enhancing heat transfer efficiency in car radiators using nanoparticle-dispersed coolants. By integrating nanoparticles into coolants, radiators can become more efficient and compact. The research employs a numerical analysis to assess the impact of different base fluid and mixture ratios on heat transfer coefficients and flow characteristics of nanofluids. These nanofluids consist of Titanium dioxide (TiO2) nanoparticles suspended in an Ethylene Glycol (EG) - Water (W) mixture at a 60:40 ratio. The investigation considers a wide range of nanoparticle concentrations, from 0.3% to 1.5%, and bulk temperatures varying from 30°C to 80°C, all within the turbulent Reynolds number range. The study reveals how concentration and temperature influence heat transfer coefficients. Interestingly, at lower inlet coolant temperatures, the water/ Ethylene glycol mixture exhibits superior heat transfer rates compared to the nanofluid coolant. Maximum achievable heat transfer enhancements are estimated at 1% concentration and 3% concentration for 30°C and 80°C, respectively, both falling within the turbulent range. The analysis also demonstrates that heat transfer coefficients increase with higher nanoparticle concentrations but decrease with rising temperatures.

Keywords: Titanium dioxide, ethylene glycol, Nanofluids, properties of nanofluids and turbulent region