ABSTRACT

Cooling is one of the most important technical challenges faced by numerous industries such as automobiles, electronics and manufacturing. New technological developments tend to increase the thermal load and thereby require faster cooling. The conventional methods in increasing the cooling rate (fins and microchannels) are already stretched to a great extent. The heat exchangers have an important role in its weight and also in the design. Hence, there is a need for fresh and innovative coolants to attain this high performance cooling. Thermal conductivities of conventional heat transfer fluids, such as engine coolants, lubricants and water are very low. With increasing global competition, industries have the necessity to develop energy efficient heat transfer fluids.

The new coolants with higher thermal performance will decrease the overall size of the heat exchanger and also improve performance and decrease the vehicle fuel consumption.

Enhancing heat transfer using Nanofluids is a novel concept. Nanofluids are a different class of solid–liquid colloidal mixture containing nanometer sized (<100 nm) solid particles dispersed in heat transfer fluids such as water, ethylene Glycol. Choi et al. [1] revealed that Nanofluids have the potential to be the next generation of coolants for thermal management due to their higher thermal conductivities. Several published literatures show that the convective heat transfer coefficient increases significantly for Nanofluids, when compared to their respective base fluids.

Hence, Nanofluids have great potential for heat transfer enhancement and are highly suitable for practical heat transfer processes. This offers a great chance for engineers to develop extremely compact and effective heat transfer equipment.

A comprehensive understanding of the trends and the dominant factors affecting the heat transfer and transport process in Nanofluids is essential for design and development. A comprehensive correlation is necessary for accurate predictions. Hence a close and intensive study of convective heat transfer characteristics of Nanofluids is inevitable. A comparative study on the convective heat transfer...
characteristics of Titanium oxide nanoparticles with different volume concentrations suspended in water will be the aim of this study.

Nanofluids are used to increase the performance of heat exchanger through improved form of working fluid, whereas tube inserts are another method which is used to increase the performance through flow variation and geometrical modifications.

The swirl flow devices act as turbulator in the heat exchangers. These devices are mainly used in tube heat exchangers. Helical screw tapes, wire coil inserts, conical ring, small strip and the screw tape inserts with various geometrical considerations were used in tube exchanger as swirl flow devices.

The swirl flow devices or tube inserts are used to reduce the boundary layer thickness along with the creation of turbulence in the flow field. The turbulence is created due to separation and reattachment mechanism made by the tube inserts. The simultaneous use of Nanofluids and tube inserts cause the random movement of particle in the flow field. Increase in random movement interrupt the thermal boundary layer near the wall and increase the performance of the system.

The combined study of Nanofluids along with the tube inserts attracted the researchers few years ago. Tube heat exchanger fitted with inserts increases heat transfer rate tremendously when compared to the plain tube. The heat transfer rate is further increased by the use of Nanofluids.

The main aim of this research is to conduct convective heat transfer characteristics study on TiO$_2$/Water Nanofluids in a tube heat exchanger fitted with staggered and non- staggered conical strip inserts for cooling application.

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