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Investigation of Heat Transfer Efficiency using Zinc Oxide (ZnO) & Aluminum Oxide (Al2O3) Nanoparticles Based Fluid

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Abstract

Enhancement of heat transfer performance using zinc oxide (ZnO) and aluminum oxide (Al2O3)nanofluids were examined in this thesis. A purpose built heat exchanger system was designed and fabricated using a copper coil and polyvinyl chloride (PVC) cylinder housing.

Nanofluids containing different concentrations of nanoparticles were prepared and studied using different techniques (X-ray diffraction, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Zeta Potential, Particle Size Analysis). The relationship between the suspension properties of the nanoparticles in the base fluid and the heat transfer rate were established. Commercially available nanoparticles of ZnO and Al2O3 were used in this study with sodium dodecyl sulfate (SDS), polyvinyl alcohol (PVA) and 3-Trimethoxysilyl propylamine (TMSP) as stabilizing agents.

Results show an improvement of 29 % in heat transfer efficiency upon using nanofluids with particle concentrations of 0.02 wt% compared to deionized water. The maximum heat transfer amount provided by the nanofluid was 25.5 W, whereas deionized water led to amount of heat transfer of 17 W. It was found that the maximum heat transfer efficiency could be improved by stabilizing the nanoparticles with a surfactant (0.5 % wt of SDS) for 0.02 % wtZnO or Al2O3 nanoparticles nanofluid.