Mechanical Engineering Thesis Defense

Experimental Investigation of the Combined Effect of Al2O3 Nanoparticles and Ultrasound on Convective Heat Transfer under Laminar Flow Condition in a Circular Mini Channel Heat Sink

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Abstract

The colloidal solutions of nanoparticles have been seen as promising solutions for heat transfer enhancement. There has been an accelerated study on the effects of ultrasound on heat transfer enhancement in recent years. A few authors have studied the combined impact of Al2O3 nanofluids and ultrasound on mini channels. This study focuses on the combined effects of Al2O3 nanofluids and ultrasound on heat transfer enhancement in a circular mini channel heat sink. Two concentrations of Al2O3-water nanofluids, i.e., 0.5% and 1%, were used for the experiments in addition to two heat flux conditions, namely 40W and 50W. The effect on the nanofluids using 5W ultrasound was analyzed. Experimental observations show that the usage of ultrasound increased the heat transfer coefficient. The heat transfer coefficient also increased with increasing nanoparticle concentration and high heat flux. Also, interesting findings are reported with low heat flux with ultrasound vs. high heat flux without ultrasound. The heat transfer coefficient for 0.5% and 1% concentrations was 9.2% and 13.6% higher, respectively; this is considered the optimum case scenario with energy savings. Furthermore, the comparison between the extreme case scenarios (low concentration, low heat flux, without ultrasound vs. high concentration, high heat flux, with ultrasound) indicated an enhancement of 48.9%.

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Zoom Link: https://asu.zoom.us/j/3864847007