EFFECT OF ALUMINA NANOFLUIDS WITH DIFFERENT VOLUME FRACTION WITH DIFFERENT FILL CHARGE RATIO ON THE HEAT TRANSFER PERFORMANCE OF SELF OSCILLATING MULTI HEAT PIPE

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ABSTRACT

This experiment study was performed to investigate the effect of different volume fraction of alumina (Al_2O_3) with different fill charge ratio to the heat transfer performance of a self-oscillating multi heat pipe at different constant heat flux. Working fluid employed was alumina (Al_2O_3) with 0.1%, 0.5%, 1.0% and 5.0% volume fraction. The fill charge ratio f_{cr} was varied from 50% to 100% at 10% interval. Heat pipe is consisted with an evaporation section, a condenser section and an adiabatic section. Evaporation and condenser section have the same size and are connected by four circular parallel tubes. External dimension of evaporation and condenser section were a 45mm of length, a 45mm of width and a thickness of 8mm, also the internal dimension were 42mm, 42mm, and 5mm respectively. Adiabatic section (four circular parallel tubes) with a length of 45mm long, an inner diameter of 5mm and an outer diameter of 6mm was employed. The constant heat flux applied to the evaporation section for each different volume fraction and fill charge ratio was 5W/cm^2 to 30W/cm^2 at 5W/cm^2 interval. 5 temperature measurements, 4 at the corner and center of the evaporation section and 3 temperature measurements at along the center line of condenser section were employed. 15°C of cooling water were supplied to the condenser section (to cool) in water tank at rate of 3.5l/min. A 7400Pa vacuum pressure was maintained to create self-oscillating heat transfer. The thermal performance of higher volume fraction of nanofluids was enhancing compare to lower volume fraction.

Keywords: nanofluids, self-oscillating multi heat pipes, effective thermal conductivity