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Experimental Investigation of Heat Pipe with Annular Fins under Natural Convection at Different Inclinations

Authors : Gangacharyulu Dasaroju, Sumeet Sharma, Sanjay Singh

Abstract : Heat pipe is characterised as superconductor of heat because of its excellent heat removal ability. The operation of several engineering system results in generation of heat. This may cause several overheating problems and lead to failure of the systems. To overcome this problem and to achieve desired rate of heat dissipation, there is need to study the performance of heat pipe with annular fins under free convection at different inclinations. This study demonstrates the effect of different mass flow rate of hot fluid into evaporator section on the condenser side heat transfer coefficient with annular fins under natural convection at different inclinations. In this study annular fins are used for the experimental work having dimensions of length of fin, thickness of fin and spacing of fin as 10 mm, 1 mm and 6 mm, respectively. The main aim of present study is to discover at what inclination angles the maximum heat transfer coefficient shall be achieved. The heat transfer coefficient on the external surface of heat pipe condenser section is determined by experimental method and then predicted by empirical correlations. The results obtained from experimental and Churchill and Chu relation for laminar are in fair agreement with not more than 22% deviation. It is elucidated the maximum heat transfer coefficient of 31.2 W/(m²-K) at 25˚ tilt angle and minimal condenser heat transfer coefficient of 26.4 W/(m²-K) is seen at 45˚ tilt angle and 200 ml/min mass flow rate. Inclination angle also affects the thermal performance of heat pipe. Beyond 25^o inclination, heat transport rate starts to decrease.

Keywords : heat pipe, annular fins, natural convection, condenser heat transfer coefficient, tilt angle
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