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## Experimental Investigation of Thermal Performance of

## Metal Foam Wicked Flat Heat Pipe

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**Abstract**

Experimental investigations of thermal performance of a flat heat pipe (FHP) with and without wick columns were investigated. Copper metal foam fabricated by lost carbonate sintering process and characterized by Scanning Electron Microscope (SEM) was used as wick structure. The effect of heat input, cooling water flow rate, cooling water temperature and fill ratio on the thermal response of the FHP is presented. Results showed that the heat transfer coefficient increases with increased Reynolds number and cooling water temperature but decreases with increased heat input and amount of fill ratio. It was found that increasing the wick volume by inserting additional wick columns improves the FHP performance, due to the decreased thermal resistance with increased fluid movement in these additional wick columns. The experimental results were compared with that of analytical calculations at steady state and a good agreement was observed between them.

Key words: Flat heat pipe; Copper foam; Wick columns (WC); Evaporator; Condenser;

**Nomenclature**A area, m<sup>2</sup>

C specific heat, J/ (kg K)

h convection heat transfer coefficient, W/ ( m<sup>2</sup> K)

H height of flat heat pipe, m

k thermal conductivity, W/(m K)

L length of flat heat pipe, m

Q<sub>e</sub> heat transfer rate, WRe Reynolds number ( $Re = \frac{\rho v L}{\mu}$ )R<sub>t</sub> total thermal resistance (°C/W)

T temperature, K

V velocity of fluid, m/s

W width of flat heat pipe, m

x axial direction, m

y height direction, m

**Greek symbols**

φ Porosity

μ Viscosity, Pa s

ρ Density, kg/m<sup>3</sup>

σ Surface tension, N/m

θ Wetting angle

**Subscripts**

a adiabatic

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