

Correlation to Predict Thermal Performance According to Working Fluids of Vertical Closed-Loop Pulsating Heat Pipe

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Abstract : The objectives of this paper are to investigate effects of dimensionless numbers on thermal performance of the vertical closed-loop pulsating heat pipe (VCLPHP) and to establish a correlation to predict the thermal performance of the VCLPHP. The CLPHPs were made of long copper capillary tubes with inner diameters of 1.50, 1.78, and 2.16mm and bent into 26 turns. Then, both ends were connected together to form a loop. The evaporator, adiabatic, and condenser sections length were equal to 50 and 150 mm. R123, R141b, acetone, ethanol, and water were chosen as variable working fluids with constant filling ratio of 50% by total volume. Inlet temperature of heating medium and adiabatic section temperature was constantly controlled at 80 and 50°C, respectively. Thermal performance was represented in a term of Kutateladze number (Ku). It can be concluded that when Prandtl number of liquid working fluid (Pr_l), and Karman number (Ka) increases, thermal performance increases. On contrary, when Bond number (Bo), Jacob number (Ja), and Aspect ratio (Le/Di) increases, thermal performance decreases. Moreover, the correlation to predict more precise thermal performance has been successfully established by analyzing on all dimensionless numbers that have effect on the thermal performance of the VCLPHP.

Keywords : vertical closed-loop pulsating heat pipe, working fluid, thermal performance, dimensionless parameter

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