AN EXPERIMENTAL INVESTIGATION OF A METER-SCALE FLAT-PLATE OSCILLATING HEAT PIPE

Michael R. Wilson

Dr. Hongbin Ma, Thesis Supervisor

ABSTRACT

Ever-increasing demand for power in modern electronics presents challenge in thermal management. This paper shows the oscillating heat pipe (OHP) is considered a preferred solution for high heat application due to its heat transfer capability. The experimental investigation of a meter-scale (i.e., 0.915 m) interconnected layered flat plate oscillating heat pipe (FP-OHP) was carried out to determine the heat transport capability. The prototype was carefully designed to have 14 turns within a cross section of 31.75 x 6.35 mm^2 by embedding micro channels with a hydraulic diameter of 1.36 mm. The results show that the FP-OHP was able to transport a maximum power of 4.5 kW with a heat flux of 2.2 kW/cm^2. As the power becomes high, the oscillating motion becomes stronger resulting in a higher heat transport capability. When the power increases, the operating temperature increases which decreases the viscosity resulting in a decrease of pressure drop. At the same time, when power increases, the driving force increases, which directly enhances heat transfer. In addition, the FP-OHP is able to successively produce oscillating motion over a very large power range for this meter long OHP. It has been shown that FP-OHPs can achieve high performance over long transport lengths with kilowatt heat inputs.