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Heat Transfer Characteristics of Pulsating Heat Pipes with Asymmetric Channels

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Extended Abstract

This study presents the heat transfer characteristics of flat plate pulsating heat pipes with asymmetric channels, which induce pressure disturbances. Pulsating heat pipes have been studied extensively and used in various industries for their excellent thermal performance (Khandekar et al., 2003). The pulsating heat pipes were made of stainless plate on which square channels were grooved. The overall size of pulsating heat pipes were 70 × 120 mm^2. There were three different types of pulsating heat pipes, and each of them consisted of 4 kinds of channel designs which had different asymmetric ratios, respectively. The asymmetric ratios of channel widths were from 1:1 to 1:4. The depth of channels were 0.4, 0.6, and 0.8 mm, and the hydraulic diameters of channels were about from 0.5 to 1.5 mm. All the channels were designed to have same path length, internal volume, and heat transfer area. FC-72 was used as a working fluid due to the fluid characteristics of low viscosity and surface tension. The filling ratio of the working fluid was 50%. The filling ratio is defined as the volume of the working fluid divided by the total internal volume in the pulsating heat pipe. The oscillating motion of the working fluid was observed in a visualization device, and flow patterns were investigated. The effect of the channel asymmetric ratio on the thermal performance was analysed in various heat inputs. The results showed that the performance characteristics of the pulsating heat pipes with asymmetric channels were different with respect to working conditions. The hydraulic diameter, asymmetric ratio, and heat input power showed strong influence on the performance of the pulsating heat pipes.

Khandekar S., Dollinger N., Manfred G. (2003). Understanding operational regimes of closed loop pulsating heat pipes: an experimental study, Applied Thermal Engineering, 23, 707-719.