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Transient Modeling of Velocity Profile and Heat Transfer of Electrohydrodynamically Augmented Micro Heat Pipe

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Abstract : At this paper velocity profile modeling and heat transfer in the micro heat pipes by using electrohydrodynamic (EHD) field at the transient regime have been studied. In the transient flow, one dimensional and two phase fluid flow and heat transfer for micro heat pipes with square cross section, have been studied. At this model Coulomb and dielectrophoretic forces are considered. Coupled, non-linear equations governed on the model (continuity, momentum, and energy equations) have been solved simultaneously by numerical methods. Transient behavior of affecting parameters e.g. substrate temperature, velocity of coolant liquid, radius of curvature and coolant liquid pressure, has been verified. By obtaining and plotting the mentioned parameters, it has been shown that the EHD field enhances the heat transfer process. So, the time required to reach the steady state regime decreases from 16 seconds to 2.4 seconds after applying EHD field. Another result has been observed implicitly that by increasing the heat input the effect of EHD field became more significant. The numerical results of model predict the experimental results available in the literature successfully, and it has been observed there is a good agreement between them.

Keywords : micro heat pipe, transient modeling, electrohydrodynamics, capillary, meniscus
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