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Fluid Flow and Heat Transfer in a Dual-wet Micro Heat Pipe
JIN ZHANG, Mech. Eng. Dept., LSU, STEPHEN WATSON, Math. Dept., LSU, HARRIS WONG, Mech. Eng. Dept., LSU — Micro heat pipes have been used to cool micro electronic devices, but their heat transfer coefficients are low compared with those of conventional heat pipes. In this talk, a dual-wet pipe is proposed as a model to study heat transfer in micro heat pipes. The dual-wet pipe has a long and narrow cavity. The bottom-half of the horizontal pipe is made of a wetting material and holds a wetting liquid, whereas the top-half is made of a non-wetting material and is filled with the vapor. As one end of the pipe is heated, the liquid evaporates and increases the vapor pressure. The higher pressure drives the vapor to the cold end where the vapor condenses and releases the latent heat. The condensate moves along the bottom half of the pipe back to the hot end to complete the cycle. Hence, the heat pipe is driven by the difference in equilibrium vapor pressure between the hot and cold ends, and not by the liquid-vapor interfacial curvature as is commonly believed. Our analysis provides an explanation for the comparatively low effective thermal conductivity in micro heat pipes [1].

[1] Zhang, Watson & Wong, J. Fluid Mech. (2007, in press)

Harris Wong
LSU

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