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传递现象

“Ω”形轴向槽道热管的流动和传热特性

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摘要

建立了“Ω”形轴向槽道热管内流动和传热特性的理论模型，并计算了其最大传热能力。模型综合考虑了气-液交界面的剪切力、弯月面毛细半径变化以及接触角的作用。分析讨论了热管结构尺寸对流动特性的影响、热负荷对蒸发段端口毛细半径的影响、吸液芯结构尺寸对热管传热性能的影响，给出了气液两相压力、平均速度以及毛细半径的沿轴向分布。并且，将计算得到的不同工作温度下最大传热能力与Chi模型预测值进行了比较。同时，实验也验证了本模型的正确性。

关键词

槽道热管 传热传质 最大传热能力 毛细力

分类号

Flow and heat transfer characteristics of heat pipe with axial “Ω”-shaped grooves

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Abstract

A theoretical model for fluid flow and heat transfer in a heat pipe with axial “Ω”-shaped grooves was developed and solved numerically to propose the maximum heat transport capability. The model included the effects of the liquid-vapor interfacial shear stress, variation of meniscus radius and contact angle. In the present work, the effect of geometry structure on fluid flow characteristics, the effect of heat load on capillary radius at evaporator end cap, and the effect of wick structure and size on heat transfer performance were analyzed and discussed. The axial distribution of capillary radius, fluid pressure and mean velocity was also proposed. In addition, the calculated maximum heat transport capability of heat pipe at different working temperatures was compared with that from the Chi’s model, in which interfacial shear stress was neglected. And the accuracy of the model was also verified by the experiment.

Key words

grooved heat pipe heat and mass transfer maximum heat transport capability capillary pressure

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