

工程热物理

加热工况及倾斜角影响单环路脉动热管稳定运行的实验研究

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摘要:

针对单环路脉动热管建立实验平台, 实验中采用水浴加热及冷却方式作为热管运行测试的热工条件, 着重考察了单环路脉动热管在不同的加热工况(不同加热温度及加热水循环流量)及不同倾斜角度下(30°, 45°, 60°, 90°)的运行情况。主要通过传热量及运行热阻来评价热管的传热效果。实验结果表明, 蒸发段加热工况在大流量(40 g/s)和较高温度加热条件下会出现局部干烧现象, 且随着加热温度的升高干烧现象逐步加剧, 进而影响热管的稳定运行和传热效果; 蒸发段在较小热水流量(4 g/s)时保持稳定地运行; 重力因素严重影响到单环路脉动热管稳定运行, 垂直地面底部加热条件下运行效果最好。

关键词: 单环路脉动热管 稳定运行 加热工况 倾斜角度

Experimental Investigations on the Influence of Heating Condition and Inclination Angle on Stable Operation of a Single Loop Pulsating Heat Pipe

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Abstract:

An experimental setup based on a single loop pulsating heat pipe (SLPHP) was established and a series of experimental observations were conducted to study the operational performance in the tested SLPHP within water. Hot water bath and cold water bath were adopted as thermal conditions in the experimental investigations. The influence characterization was studied for the variation of heating condition in the evaporator section (different water bath temperature and different flow rate) and inclination angel (30°, 45°, 60°, 90°) of the SLPHP. The heat-transfer performance of the tested SLPHP was mainly evaluated by thermal resistance which related to temperature distributions of both evaporator and condenser sections of the tested SLPHP, also related to the heat transfer between the both sections. The results show that dry-out phenomena appears when the tested SLPHP operate under heating condition with large flow rate(40 g/s)and high temperature in evaporator section, and that more and more dry-out phenomena appear as the heating water temperature grow up weakened heat-transfer; SLPHP operates in stable under heating condition with lower flow rate (4 g/s); the gravity affects SLPHP very much, the tested SLPHP operates with lowest thermal resistance at vertical orientation.

Keywords: single loop pulsating heat pipe stable operation heating condition inclination angle

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