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A STUDY ON THE START-UP, BLOCKING-UP AND OPERATING CHARACTERISTICS OF LOOP HEAT PIPE

Abstract

Ongoing research and development works suggest that the start-up and blocking-up characteristics impact the performance of loop heat pipe (LHP) greatly. In this paper, a LHP, which adopts a thermoelectric cooler and a gas pipeline heater as auxiliary measures for start-up, and a reservoir heater for blocking-up, has been configured, tested and analyzed. The contribution of the thermoelectric cooler to the start-up of the LHP has been compared with that of the gas pipeline heater. The start-up time, the temperature rise and the temperature difference between the evaporator and the reservoir during the start-up stage have been studied. The performance of the reservoir heater for blocking up the LHP has also been investigated. Besides, experimental investigations on the operating characteristics of the LHP have been performed in vacuum thermal environment under various conditions. The effects of heat source temperature and external heat flux have been analyzed. The objective of this paper is to obtain useful information for practical application of LHP in the aspects of the start-up, blocking-up and operating characteristics. It is found that both the thermoelectric cooler and the gas pipeline heater can start up the LHP effectively. The start-up time of the thermoelectric heater is less than that of the gas pipeline heater. Therefore, the thermoelectric heater is suggested to be the first choice for the start-up of LHP. When the reservoir heater is turned on, the LHP is blocked up rapidly, which is of great benefit to achieving active thermal management of spacecraft. The thermal performance of the LHP is better and more heat can be dissipated at relatively high heat source temperature. With the increase of the external flux, the heat dissipation potential of the LHP decreases. The temperature difference along the pipeline of the LHP is smaller under the condition of steady external flux in comparison with unsteady external flux.