Experimental Investigation on a Thermosyphon with Evaporators of Different Distributions

Author1, Author2, Author3

*Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China*

**Abstract**

Loop thermosyphon with multiple evaporators can transfer heat from several heat sources to a single cold source with no energy consumption, therefore it is ideal device in multi-source heat transfer. Existing studies mainly focus on its heat transfer and flow distribution at the steady state while the transient performance is lack of investigation. In this paper, the effects of heating power distribution and filling ratio on the startup process and operation fluctuation of a loop thermosyphon with dual evaporators are investigated experimentally, which are rarely included in previous studies.

*Keywords*: Multi-source heat transfer; Loop thermosyphon; Dual evaporators; Startup; Fluctuation

Multi-source heat transfer is widely needed in large-scale electronics and data centers [1,2]. As there are several heat sources in a single system, it is more compact and integrated to transfer the heat from multiple heat sources to a cold source by a single heat transfer system. Multi-source heat transfer devices based on air and water have been applied extensively, e.g., the cold aisle system and backdoor water coolers in data centers [3]. However, these heat transfer systems rely on fans and pumps to transport the cold fluid, which consume electrical energy and also, energy is wasted due to the relatively large temperature difference between cold and heat sources [4].

Loop thermosyphon with multiple evaporators is a thermally driven heat transfer device based on phase change, therefore it has good heat transfer performance and does not need external power input [5]. It is ideal for application in multi-source heat transfer occasions. As there are parallel flow channels and no external driving force, it has unique heat transfer and flow features.

The experimental setup is shown in Fig. 1. The loop thermosyphon consists of two evaporators and one condenser. Two electric heating plates are attached to the bottom of the evaporators as the heat sources and the heating power is controlled severally by a DC stabilized voltage source. A double pipe heat exchanger is used as the condenser and PTFE pipes are used as the connection pipes. A chiller is utilized to supply water of constant temperature to the condenser. The loop is all covered with thermal insulation material to reduce the disturbance of the environment. During the experiment, the temperature of the cooling water in the condenser is 15 ± 0.2 oC and the environment temperature is 26 ± 2 oC.



Fig. 1. Experimental setup.

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