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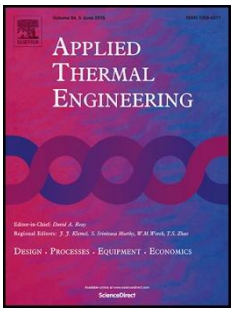

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Comparison of Flooding Limit and Thermal Performance of Annular and Concentric Thermosyphons at Different Fill Ratios

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Highlights

- Annular thermosyphon shows higher heat transfer compared to concentric thermosyphon.
- Annular thermosyphon requires new prediction model for flooding limit.
- Fill ratio of working fluid affects to the flooding limit of the annular thermosyphon.

Abstract

A passive in-core cooling system (PINCs) based on hybrid heat pipe can be adopted to enhance the passive safety of advanced nuclear power plants. A hybrid heat pipe is a heat transfer device that takes the dual roles of neutron absorption and heat removal by combining the functions of a heat pipe and a control rod. To observe the effect of neutron absorber material inside the heat pipe and fill ratio of the working fluid on the thermal performances of heat pipe including operation limit, an annular thermosyphon heat pipe (ATHP) that contains a neutron absorber inside a concentric thermosyphon heat pipe (CTHP) was experimentally studied in the condition of various fill ratios. The ATHP showed lower thermal resistances in the evaporator region with a maximum reduction of 20 % compared to those of a CTHP. In terms of the operational limits, the ATHP showed a lower entrainment limit than the CTHP due to a smaller cross-section for vapor path in the evaporator region, which resulted in high shear at the vapor-liquid interface. In addition, increasing the fill ratio enhanced the entrainment limit by 18 %.

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