나노유체를 이용한 소형 히트파이프에서 작동 특성에 관한 연구

박기호†(에너지연) · 이석호*(충북대) · 신동륜*(충북대) · 이욱현 · 백일현(에너지연)

Study on the Operating Characteristics in Small Size Heat Pipe Using Nanofluids

Ki-Ho Park, Seok-Ho Rhi, Dong-Reun Shin, Wook-Hyun Lee and Il-Hyun Baek

Key Words: Heat pipe(히트파이프), Nano particle(나노입자), Heat transport capability(열수송력), Heat Transfer performance(열전달 성능), Nanofluids(나노유체)

Abstract : This paper is to research the operating characteristics of the copper heat pipe using nanofluids. The nanofluids with Ag nano particle was used for the working fluid. At the inclination angle 90° in bottom heat mode, Nanofluid has much higher thermal transfer performance than the conventional fluids, water. Experimental results showed heat pipe with 10,000 ppm Ag nanofluids had the high heat transfer performance. The thermal resistance of the heat pipe with nanofluids was 0.36 ℃/W. Heat transfer performance of 10,000 ppm Ag-distilled water naofluid is 10% higher than that of the distilled water heat pipe. In case of nanofluid with 10,000 ppm Ag content, characteristics of temperature stabilization is relativelybetter than the other condition.

고온용 원관형 히트파이프의 열적 특성에 관한 실험 및 모사

윤여훈† (한국항공대 원) · 부준홍*(한국항공대)

Experiment and Simulation on the Thermal Performances of a High-temperature Cylindrical Heat Pipe

Yoon, Y.H., Boo, J.H.

Key Words: High-temperature heat pipe(고온 히트파이프), Sodium(소듐, 나트륨), Thermal performance(열적 특성), Effective Thermal Conductivity(유효 열전도도)

Abstract : High-temperature cylindrical stainless steel-sodium heat pipes were fabricated and tested for transient and steady-state operations. Total length of the heat pipe was 1 m and the diameter was 25.4 mm. The thermal performance of each heat pipe was tested up to 2-kW thermal load (heat flux of 4.2 kW/m2). Thermal performance was investigated experimentally by changing internal wick structure as a function of the input thermal load and working fluid charge ratio. Thermal resistance and average heat transfer coefficients in evaporator and condenser sections were analyzed and discussed. Based on the experimental results, a commercial numerical tool was employed to simulate the characteristics of the high temperature heat pipe. Calculated temperature distributions of the heat pipe were compared with those of experiment. Effective thermal conductivity of a heat pipe was introduced in modeling or performance estimation of which the values varied from 1,200 to 3,090 W/m · K depending on the input thermal load.