Public Abstract

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Title:ENTROPY GENERATION AND THERMAL PERFORMANCE OF A PULSATING HEAT PIPE

A U-shaped pulsating heat pipe is an excellent heat transfer performance device. This study has been investigated step by step.

a) The entropy generation is based on the second law of thermodynamics. In the present study, the entropy generation in a U-shaped Pulsating Heat Pipe (PHP) is numerically investigated. The following five parameters, which are vapor mass, liquid temperature, latent heat, sensible heat, and friction, determine the entropy generation. The results show that the entropy generation is significantly affected by the initial temperature in the PHP. Particularly, the variation of the vapor mass is a primary factor of the entropy generation. On the other hand, the amplitude of the entropy generation is barely related with the pressure loss at the bend in the PHP. However, the frequency of the entropy generation with the pressure loss is faster than that without the pressure loss at the bend.

b) Pulsating heat pipe is a two-phase heat transfer device that transfers heat from heating section to cooling section via oscillatory liquid-vapor two-phase flow. The temperatures of heating and cooling sections are extremely important parameters, and play significant roles for the performance of pulsating heat pipes. The objective of this work is to study the effects of fluctuations of heating and cooling section temperatures on the oscillatory flow, temperature and pressure of the vapor plugs, as well as latent and sensible heat transfer of a pulsating heat pipe. The fluctuations of wall temperatures include a periodic component and a random component. The periodic component is characterized by the amplitude and frequency, while the random component is described by the standard deviation. The performance of the pulsating heat pipe is evaluated at various amplitudes, frequencies and standard deviations of the fluctuations.

c) A numerical study is performed to investigate heat transfer performance and effect of nanofluids on a pulsating heat pipe (PHP). Pure water is employed as the base fluid while Al_2O_3 with two different particle sizes, 38.4 and 47 nm, is used as nanoparticle. Different parameters including displacement of liquid slug, vapor temperature and pressure, liquid slug temperature distribution, as well as sensible and latent heat transfer in evaporator and condenser are calculated numerically and compared with the ones for pure water as working fluid. The results show that nanofluid has significant effect on heat transfer enhancement of the system and with increasing volume fraction and decreasing particles diameter the enhancement intensifies.