THEORETICAL AND EXPERIMENTAL INVESTIGATION OF OSCILLATING HEAT PIPES

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ABSTRACT

A mathematical model describing the oscillation characteristics of slug flow in a capillary tube is presented. The model considers the vapor bubble as the gas spring for the oscillating motions in a capillary tube including effects of capillary force, gas spring constant, dimensions, gravitational force, and initial pressure distribution of the working fluid. Numerical results indicate that the isentropic bulk modulus generates stronger oscillations than the isothermal bulk modulus. While it demonstrates that the capillary tube diameter, bubble size, and unit cell numbers determine the oscillation, the capillary force, gravitational force, and initial pressure distribution of the working fluid significantly affect the frequency and amplitude of oscillating motion in the capillary tube. An experimental study of a five-turn closed loop oscillating heat pipe has been conducted The oscillating heat pipes charged with HPLC grade water, acetone and ethanol have been tested respectively. In a vertical orientation, the oscillating motion of the slug flow in the oscillating heat pipe has been observed.