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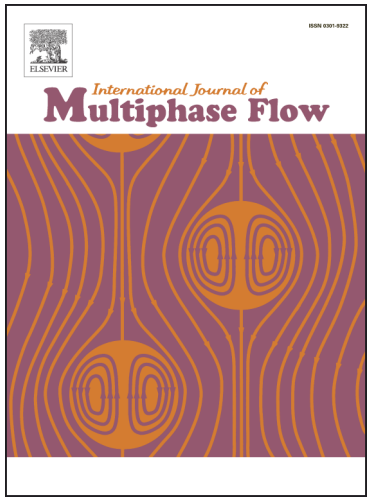

Ultrasonic enhancement of subcooled pool boiling of freely oscillated wires

G. Hetsroni, L. Moldavsky, M. Fichman, E. Pogrebnyak, A. Mosyak

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Ultrasonic enhancement of subcooled pool boiling of freely oscillated wires

Hetsroni G*., Moldavsky L., Fichman M., Pogrebnyak E., Mosyak, A.

Faculty of Mechanical Engineering, Technion, Haifa, Israel

*E-mail : hetsroni@tx.technion.ac.il

This paper is dedicated to Professor Goeff Hewitt, on the occasion of his nth birthday.

ABSTRACT

New methods for cooling of microelectronic elements have been recently developed, including application of ultrasonic fields, which can enhance the heat transfer in two-phase cooling. Here we deal with ultrasonic enhancement of heat transfer from wires in subcooled water pool boiling at subcooling of 80 K. The main purpose is to find the effect of wire diameter on the heat transfer coefficient. The wire heaters were used as a source of constant heat flux, and as a thermometers. The experiments were carried out using wires of different diameters: 20, 50, 90, 200 and 0.250 μm, submerged in a bath of water. The frequency of the ultrasonic field was 40 kHz and the intensity was 0.5 W/cm^2. The wire wall temperature was measured as a function of wire surface heat flux. The effect of acoustic field on heat transfer was measured by the change in the average surface temperature of the heater. When the ultrasonic field was applied, the wall temperature decreased depending on wire diameter and heat flux.. Video images of vapor bubble dynamics within the sound field aided in the analysis, and are presented here. The highest heat transfer augmentation was registered for the heated wire of diameter 200 μm during pool boiling in the ultrasound field.

Keywords: subcooled boiling, ultrasound, wire diameter, heat transfer augmentation.

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