Proceedings of the Korea Nuclear Society Spring Meeting
Pohang, Korea, May 1999

An Observation of Single Bubble Growth and Departure on a Microscale Heater Array

Sungwon Bae[2], Jungho Kim[1], and Moohwan Kim[2]

[1]University of Maryland
Department of Mechanical Engineering College Park, MD 20742, USA, Phone: +1-(301) 405-5437

[2]Pohang University of Science and Technology
Department of Mechanical Engineering, Pohang City, Kyungbuk, 790-784 Korea, Phone: +82-(0562)-279-2165

ABSTRACT

The objective of this work is measure space and time resolved heat transfer variations during nucleate pool boiling of FC-72 using a micro-scale heater array in conjunction with a high speed CCD. The feedback loops used in this work are vast improvements over those used in previous work, and are described here in detail. The heater array is constructed using VLSI techniques, and consists of 96 serpentine platinum resistance heaters on a quartz substrate. Electronic feedback loops are used to keep the temperature of each heater in the array at a specified value, and the variation in heater power required to do this is measured. Data are obtained with the bulk liquid subcooled by 2 °C at a system pressure of 0.8 atm. Isolated bubbles are obtained at a wall superheat of 29 °C. One nucleation site occurred in the middle of a 2 x 2 array of heaters and at least three heater lengths away from other bubbles. The heat transfer variation vs. time from the four heaters directly around this nucleation site is plotted and correlated with images of the bubble obtained using the high speed CCD. It is revealed that there are other major heat transfer mechanisms in addition to the microlayer evaporation, which has been thought to be the dominant heat transfer mechanism in saturated pool boiling. The purpose of this paper is to provide a description of the experimental technique and demonstrate the technology.