CHAPTER 6

CONCLUDING REMARKS

The FC-72 saturated and subcooled flow boiling heat transfer performance and associated bubble characteristics on a heated micro-pin-finned silicon chip flush mounted onto the bottom of a rectangular channel have been experimentally investigated. The effects of the coolant mass flux, inlet liquid subcooling, and surface micro-structures of the chip on the flow boiling heat transfer coefficients and associated bubble characteristics such as the mean bubble departure diameter, bubble departure frequency, and active nucleation site density have been examined in detail. Furthermore, empirical equations to correlate the measured saturated and subcooled flow boiling heat transfer coefficients, mean bubble departure diameters, mean bubble departure frequencies, and mean active nucleation site densities are proposed. Major results presented in chapters 4 and 5 can be summarized as follows:

(1) Increase in the coolant mass flux delays the boiling incipience to higher surface heat flux. The temperature of chip surface is lowered by increasing the coolant mass flux in single-phase region, but it is only affected slightly in the two-phase flow boiling region. Besides, higher single-phase heat transfer coefficient is obtained but it has little effect on two-phase heat transfer coefficient. Moreover, it results in smaller mean bubble departure diameter, lower active nucleation site density but higher mean bubble departure frequency.

(2) Increasing inlet liquid subcooling also delays the boiling incipience to higher surface heat flux. The temperature of chip surface is lowered by increasing the inlet liquid subcooling in single-phase region, but it is only affected slightly in the two-phase subcooled flow boiling region. Besides, smaller two-phase heat

transfer coefficient is obtained. Moreover, it results in smaller mean bubble departure diameter, lower mean bubble departure frequency and lower active nucleation site density.

(3) Increasing the imposed heat flux raises the chip surface temperature in both single- and two-phase regions. Besides, it results in a higher two-phase heat transfer coefficient. Moreover, larger mean bubble departure diameter, higher mean bubble departure frequency and higher active nucleation site density are obtained.

(4) Adding micro-structures to the chip surface decreases the chip surface temperature in both single- and two-phase regions. It reflects the fact that the single- and two-phase heat transfer coefficients are increased and results in a lower boiling incipience wall superheat. Besides, smaller mean bubble departure diameter, higher mean bubble departure frequency and higher active nucleation site density are obtained.