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Transition process leading to microbubble emission boiling on horizontal circular heated surface in subcooled pool[1] ICHIRO UENO, JUN ANDO, KAZUNA HORIUCHI, TAKAHITO SAIKI, TOSHIHIRO KANEKO, Tokyo University of Science — Microbubble emission boiling (MEB) produces a higher heat flux than critical heat flux (CHF) and therefore has been investigated in terms of its heat transfer characteristics as well as the conditions under which MEB occurs. Its physical mechanism, however, is not yet clearly understood. We carried out a series of experiments to examine boiling on horizontal circular heated surfaces of 5 mm and of 10 mm in diameter, in a subcooled pool, paying close attention to the transition process to MEB. High-speed observation results show that, in the MEB regime, the growth, condensation, and collapse of the vapor bubbles occur within a very short time. In addition, a number of fine bubbles are emitted from the collapse of the vapor bubbles. By tracking these tiny bubbles, we clearly visualize that the collapse of the vapor bubbles drives the liquid near the bubbles towards the heated surface, such that the convection field around the vapor bubbles under MEB significantly differs from that under nucleate boiling. Moreover, the axial temperature gradient in a heated block (quasi-heat flux) indicates a clear difference between nucleate boiling and MEB. A combination of quasi-heat flux and the measurement of the behavior of the vapor bubbles allows us to discuss the transition to MEB.

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