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# Film Boiling Heat Transfer Properties of Liquid Hydrogen in Natural Convection

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In operating superconducting devices cooled by liquid hydrogen (LH2), joule heat caused by normal conducting transition sometimes results in film boiling which prevents the effective cooling and leads to the rapid temperature rise of superconducting devices. Knowledge of heat transfer in film boiling is important for using superconducting devices cooled by LH2 safely.
In this study, film boiling heat transfer properties at pressures of 0.1, 0.4, 0.7 and 1.1 MPa for various bulk-liquid temperatures of LH2 were measured by applying electric current to give an exponential heat input ($Q=Q0\ \exp(t/\tau)$) to a test wire submerged in LH2. The bulk-liquid temperature was set to 21 ˜ 32 K by the sheathed heater equipped at the bottom of the cryostat. The exponential period $\tau$ was constant ($\tau$ = 10 s). The heat input was increased exponentially until the temperature of the test wire rose by about 400 K and then reduced exponentially to zero. The test wire was made of PtCo with the diameter of 1.2 mm and the length of 120 mm. The test wire was set to be vertical to gravity. The temperature of the heater was obtained by a resistance thermometry by four-terminal method. The heat transfer coefficient h in the film boiling region was higher for higher pressure and higher subcooling. The experimental results were compared with the equation of pool film boiling heat transfer presented by Sakurai et al. [1]. It was confirmed that the pool film boiling heat transfer coefficients in LH2 were expressed well by the equation.
[1]A. Sakurai, M. Shiotsu, and K. Hata, 1990, "A General Correlation for Pool Film Boiling Heat Transfer from A Horizontal Cylinder to Subcooled Liquid", Trans ASME, Series C, vol.223, pp430-440

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