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C3Or2B-04: Experimental Study on the Pool Boiling Heat Transfer of Slush Nitrogen

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Slush nitrogen is the cryogenic two-phase fluid with small solid nitrogen particle suspended in liquid nitrogen, which can be potential coolant for high-Tc superconductor thanks to its high density and large heat capacity. The present work focuses on the heat transfer of slush nitrogen. A visual experimental apparatus was built for studying the pool boiling of slush nitrogen. The freeze-thaw method is used to produce slush nitrogen and the capacitance-type density meter is adopted to measure the solid volumetric fraction of slush nitrogen. The steady-state boiling conditions were obtained by the heat flux control method. The experimental results show that the heat transfer characteristics of slush nitrogen are comparable to typical nucleate boiling heat transfer. The heat transfer of slush nitrogen can be enhanced by increasing the solid fraction. The applicability of Rohsenow equation to the nucleate pool boiling heat transfer of slush nitrogen is also analyzed, and then a modified heat transfer correlation for nucleate pool boiling heat transfer of both liquid nitrogen and slush nitrogen, considering the effect of solid volumetric fraction, has been summarized.

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