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Prediction of Critical Heat Flux in Highly Subcooled Flow Boiling with High Mass Velocity and Small Tube Diameter

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Abstract

A phenomenological model based on wall-attached bubble coalescence, previously developed by the authors, was applied to predict a critical heat flux (CHF) in highly subcooled water flow boiling with high mass velocity and small tube diameter. A mechanistic approach to evaluate the profiles of flow quality and void fraction in the subcooled flow boiling was employed to take into account the enhanced condensation due to high subcooling in small diameter tubes. Comparison of the model predictions against 2938 subcooled water CHF data showed relatively good agreement over a wide range of parameters for fusion reactors operating conditions.