

传递现象

加热上升管内过冷流动沸腾数值模拟

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摘要 采用计算流体动力学 (CFD) 程序CFX4.4对加热上升管内过冷流动沸腾工况下气水两相流动局部两相流参数 (空泡份额和汽泡尺寸) 进行了数值模拟。对数值差分方法、相关模型 (界面力和气泡诱导的紊流) 和汽泡尺寸进行了敏感性分析。空泡份额分布计算结果与实验结果比较表明, 在低空泡份额工况下, 两者符合较好, 在高空泡份额工况下两者存在一定偏差, 并且气相速度和汽泡尺寸的计算结果不理想。计算结果与实验结果之间的差异说明程序模型对于加热上升管内过冷流动沸腾模拟并不完善, 建立更为合理的汽泡尺寸模型, 考虑汽泡的合并和撕裂是必要的。

关键词 [CFX4.4](#) [过冷流动沸腾](#) [空泡分布](#) [两流体模型](#)

分类号

Simulation of vertical upward sub-cooled boiling flow in a pipe

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Abstract

Multidimensional modeling of vertical upward subcooled boiling flow was performed and the local two-phase flow parameters (void fraction and bubble size) were calculated by using the computational fluid dynamics code—CFX4.4, in which lateral interfacial effects based on a three-dimensional two-fluid model were accounted for. A sensitivity analysis of the difference method, interfacial force and bubble-induced turbulence and bubble size was made. The method of using the CFD code for prediction of sub-cooled boiling flow in a pipe was established. The predicted lateral distributions of void fraction showed excellent agreement with the measurements at low void fraction, but somewhat larger difference at higher void fraction in vertical upward sub-cooled boiling flow. The predicted lateral distributions of vapor velocity and bubble diameter were not satisfactory. The results showed that a reasonable bubble diameter model and modeling of bubble coalescence and tearing would be necessary for improving calculation accuracy.

Key words

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