

反应堆工程

低压下水欠热流动沸腾的两相CFD数值模拟研究

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摘要 采用两流体(汽相和液相)基本数学模型, 结合汽相和液相之间的界面传热、传质和动量交换封闭模型、气泡平均直径模型、气泡脱离直径模型、气泡成核模型、气泡脱离频率模型、欠热沸腾起始点模型和壁面热流密度分配模型, 在CFD软件CFX4.4中采用用户自定义函数将相变引起的传热、传质和动量交换作为源项分别添加到汽相和液相的能量、质量和动量守恒方程中, 对低压下内管加热外管绝热的环形通道内的欠热沸腾进行了数值研究, 得到了欠热流动沸腾下汽相体积份额、液相速度、汽相速度分布等。采用Lee等的环形通道内低压下欠热沸腾体积分额实验数据对计算结果进行了验证, 吻合良好。

关键词 [欠热流动沸腾](#) [两流体模型](#) [多相流](#)

分类号

CFD Investigation of Subcooled Flow Boiling Model Under Low Pressure

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Abstract Two fluid model integrating a set of closure relationships (such as inter-phase heat transfer model, interphase mass transfer model, inter-phase momentum transfer model, mean bubble diameter model, bubble departure diameter model, bubble departure frequency model, onset of nucleate boiling model, wall heat flux partition model) was applied to solve the local flow and heat transfer of subcooled flow boiling under low pressure. The inter-phase mass and momentum energy transfer due to the phase change were added to the mass, momentum and energy conservation equation for liquid phase and vapor phase respectively using the user defined function in CFX4.4. And the subcooled flow boiling was researched in annular channel with inner tube heated uniformly and adiabatic outer tube under low pressure and local flow parameters such as volume fraction, liquid velocity, vapor phase etc. were obtained. The subcooled flow boiling results predicted in this paper were compared to the subcooled flow boiling experimental results of Lee etc., and they agree well.

Key words [subcooled](#) [flow](#) [boiling](#) [two](#) [fluid](#) [model](#) [multiphase](#) [flow](#)

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