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反应堆工程

竖直矩形窄缝通道内近壁汽泡生长和脱离研究

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摘要 可视化研究窄缝通道内汽泡生长和脱离对于揭示窄缝通道内的沸腾传热机理具有重要意义。本文采用高速摄影仪从宽面和窄面可视化观察了常压条件下矩形窄缝通道内汽泡核化生长和脱离规律。研究结果表明，汽泡在核化点生长时，汽泡底部与加热面存在一小的接触面，总体而言，汽泡在生长过程中基本呈球状。在相同热工参数下，不同核化点处汽泡生长规律基本相同，但汽泡脱离直径相差较大。窄缝通道内汽泡生长速率小，脱离时间较长，可采用修正的Zuber公式预测窄缝通道内汽泡生长直径。在同一拍摄窗口内，统计分析了热工参数对汽泡平均脱离直径的影响规律。随热流密度的增加，汽泡平均脱离直径减小；随入口欠热度的增加，汽泡平均脱离直径减小；随主流速度的增加，汽泡平均脱离直径减小。

关键词 汽泡生长 汽泡脱离 汽泡直径 矩形窄缝

分类号

Study on Bubble Growth and Departure Near Wall in Vertical Narrow Rectangular Channel

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Abstract It is very important to visually study bubble growth and departure for better understanding of boiling heat transfer in a narrow channel. Bubble growth and departure in a narrow rectangular under atmosphere pressure were visually observed by the wide and narrow side of narrow rectangular channel using high speed digital camera. There is a small interface between the bubble base and heated surface when the bubble is growing in the nucleate site, and the growing bubble shape is almost spherical. The bubble growth laws in different sites are almost uniform under the condition of the same thermal parameters, but bubble departure diameters are obvious distinct because of different sizes of nucleate sites. The bubble growth rate in a narrow rectangular channel is small, and the bubble departure time is long, the bubble growth diameter can be predicted using the amendatory Zuber expression. The effect of thermal parameters on bubble departure diameters of the mean was statistically analyzed in the camera view. Bubble departure diameters of the mean decrease with increasing heat flux, bubble departure diameters of the mean decrease with increasing inlet subcooling, and bubble departure diameters of the mean decrease with increasing bulk velocity.

Key words bubble growth bubble departure bubble diameter narrow rectangular channel

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