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微气泡发射沸腾形成机理

Formation mechanism of microbubble emission boiling

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英文关键词:critical heat flux microbubble emission boiling subcooled boiling marangoni convection collapse of film

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中文摘要:

为了探究具有超高换热性能的微气泡发射沸腾现象的形成机理，采用FLUENT软件对加热面上单个气膜周围的速度场进行数值模拟，并与实验结果进行对比.实验结果表明，对于水，微气泡发射沸腾现象发生时，加热壁面上会出现气膜破裂的过程，并且过冷度和壁面过热度的升高会加剧这一过程.对于酒精，微气泡发射沸腾现象很难发生.计算结果表明，在过冷条件下气膜周围存在marangoni对流，对于水而言，过冷度和壁面过热度的升高会增强气膜周围的marangoni对流过程，而在酒精气膜周围 marangoni对流相对较弱.因此由气膜周围强烈的marangoni对流过程引起的气液界面上的扰动可能造成气膜破裂，这可能是微气泡发射沸腾现象形成的原因之一.

英文摘要:

In order to explore the mechanism of microbubble emission boiling with high heat transfer performance, numerical simulations were conducted for the velocity field around a single film on the heating surface with the software of FLUENT, and then compared with experimental results. Experimental results indicate that there exists the collapse of film on the heating surface as for water when microbubble emission boiling occurs, and the increase of subcooling and wall superheat would enhance the collapse of film. However, as for ethanol, microbubble emission boiling hardly occurs. Simulation results indicate that there exists marangoni convection around the film under subcooled condition. Moreover, increase of subcooling and surface superheat could enhance marangoni convection around film of water. However, marangoni convection is rather weak near the film of ethanol. Therefore, the disturbance caused by strong marangoni convection near the film at the interface of air and liquid may lead to the collapse of film. This may be one of the reasons triggering microbubble emission boiling.

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