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多相流和计算流体力学

鼓泡塔反应器气液两相流CFD数值模拟

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摘要

对圆柱形鼓泡塔反应器内的气液两相流动进行了三维瞬态数值模拟，模拟的表观气速范围为0.02～0.30 m•s^{-1}；模拟采用了双流体模型，并耦合了气泡界面密度单方程模型预测气泡尺寸，该模型考虑了气泡聚并与破碎对气泡尺寸的影响。液相湍流采用考虑气相影响的修正k-ε模型，两相间的动量传输仅考虑曳力作用。模拟获得了轴向气/液相速度分布、气含率分布、湍流动能分布以及气泡表面面积密度等，对部分模拟结果与实验值进行了定量比较，结果表明模拟结果与实验结果吻合较好。

关键词

鼓泡塔 气液两相流 气泡模型 聚并 破碎

分类号

CFD simulation of gas-liquid flow in bubble column

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Abstract

Numerical simulations of gas-liquid flow in a cylindrical bubble column with two-fluid approach were conducted at superficial gas velocities varying from 0.02 m•s^{-1} to 0.30 m•s^{-1}.A single scalar transport equation which described bubble size changes characterized by bubble interfacial areas was also incorporated into the simulations.In the models，the effect of bubble coalescence and break-up was taken into consideration.A modified k-ε turbulence model was used to describe liquid phase turbulence in the simulations，by accounting for the pseudo turbulence due to bubbles，while the gas phase turbulence viscosity was estimated based on the Tchen’s theory. The simulations only adopted the drag force for phase momentum exchange.The time averaged axial liquid velocities，gas hold up and gas phase interfacial areas obtained from the simulations were compared with the available experimental results.It was demonstrated from the simulations that the modeling in this work can reasonably predict the gas-liquid flow in the bubble column.

Key words

bubble column gas-liquid flow bubble model coalescence break-up

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