

流体力学与传递现象

液体中气泡上浮与传质过程的耦合模型

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摘要

针对液体中气泡上浮与传质这一非稳态、强耦合过程,分析气泡的受力情况,考虑到非恒定Basset力的影响,得出了气泡瞬态加速度模型;利用绕球流动传质边界层模型,并引入非平衡传质理论,构建了气泡的瞬态非平衡传质模型;进而依据气泡质量变化率将两模型耦合,以此构建了完整描述这一过程的耦合模型。计算实例表明,Basset力对难溶性气泡的运动过程无明显影响,但对易溶性气泡影响显著;传质条件则对两类气泡都具有重要影响,且该模型中引入非平衡传质理论后,计算值与难溶性气泡的实验结果吻合更好。

关键词

[气泡上浮](#) [气液传质](#) [耦合模型](#) [非平衡](#) [Basset力](#)

分类号

Coupling model for bubble rise and mass transfer process in liquid

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Abstract

The rise and mass transfer process of bubbles in a liquid presents a non-equilibrium and strong-coupling characteristic. To predict this process more accurately, a transient acceleration model of bubbles was obtained according to the analysis of forces, especially the Basset force on a rising bubble. Meanwhile, a model for transient and non-equilibrium mass transfer of bubbles was formulated based on the boundary layer mass transfer model around a sphere and non-equilibrium mass transfer theory. These two models were coupled with the gradient of bubble mass to describe the whole rising and mass transfer process of bubbles. Two examples presented showed that the Basset force and non-equilibrium mass transfer would lead to different calculation results for soluble and sparingly soluble bubbles. The calculated values were in better agreement with the experimental data of sparingly soluble bubbles, by utilizing the non-equilibrium mass transfer theory in the coupling model.

Key words

[bubble rise](#) [gas-liquid mass transfer](#) [coupling model](#) [non-equilibrium](#) [Basset force](#)

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