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基于单气泡非稳膜机理的相际传质模型

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摘要 A gas-liquid mass transfer model based on an unsteady state film mechanism applied to a single bubble is presented. The mathematical model was solved using Laplace transform to obtain an analytical solution of concentration profile in terms of the radial position r and time t. The dynamic mass transfer flux was deduced and the influence of the bubble size was also determined. A mathematical method for deducing the average mass transfer flux directly from the Laplace transformed concentration is presented. Its accuracy is verified by comparing the numerical results with those from the indirect method. The influences of the model parameters, namely, the bubble size R, liquid film thickness δ, and the surface renewal constant s on the average mass trannsfer flux were investigated. The proposed model is useful for a better understanding of the mass transfer mechanism and an optimum design of gas-liquid contact equipment.

关键词 薄膜理论 气体 液体 转移模式 表面恢复理论 渗透理论 扩散

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A Mass Transfer Model Based on Individual Bubbles and an Unsteady State Film Mechanism

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Abstract A gas-liquid mass transfer model based on an unsteady state film mechanism applied to a single bubble is presented. The mathematical model was solved using Laplace transform to obtain an analytical solution of concentration profile in terms of the radial position r and time t. The dynamic mass transfer flux was deduced and the influence of the bubble size was also determined. A mathematical method for deducing the average mass transfer flux directly from the Laplace transformed concentration is presented. Its accuracy is verified by comparing the numerical results with those from the indirect method. The influences of the model parameters, namely, the bubble size R, liquid film thickness δ, and the surface renewal constant s on the average mass trannsfer flux were investigated. The proposed model is useful for a better understanding of the mass transfer mechanism and an optimum design of gas-liquid contact equipment.

Key words film theory; Laplace transformation; mass diffusion; penetration theory; surface renewal theory

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