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### Taylor-Couette流场数值模拟及絮凝效果研究

### Numerical simulation and flocculation efficiencies of Taylor-Couette flow

关键词: [絮凝](#) [Fluent](#) [湍动能](#) [有效能耗](#) [Taylor-Couette流](#)

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摘要: 通过流体力学中的Fluent软件模拟了Taylor-Couette反应器的速度矢量分布、湍动能分布和有效能耗分布,同时实验研究了Taylor-Couette反应器不同内筒转速下三氯化铁对高岭土悬浊液的絮凝效能.结果表明,内外筒间隙间存在亚微尺度的涡旋,当转速为 $30\sim 60\text{ r}\cdot\text{min}^{-1}$ 时,涡旋形状闭合完整,相互分离,涡旋内部速度梯度较小,湍动能 $k$ 在 $0.00010\sim 0.00023\text{ m}^2\cdot\text{s}^{-2}$ 的范围内,有效能耗 $\epsilon$ 在 $0.00057\sim 0.00189\text{ m}^2\cdot\text{s}^{-3}$ 的范围内,絮凝效能达到最大(80%以上),湍动能和有效能耗过大或过小均不利于形成完整闭合的涡旋,絮凝效能较差.

**Abstract:** Based on Fluent technology, the numerical simulation of Taylor-Couette flow was performed, and the flocculation efficiencies were also obtained in the same Taylor-Couette flow at the different inner cylinder rotational speeds. The results indicated that the vortices of submicroscopic size were formed in the annulus gap as shown in the velocity vector map, and the velocity gradient inside the vortices was lower than outside vortices. When the inner cylinder speeds changed from  $30\text{ r}\cdot\text{min}^{-1}$  to  $60\text{ r}\cdot\text{min}^{-1}$ , the flocculation efficiencies reached the maximum values (above 80%), the turbulent kinetic energy was in the range of  $0.00010\sim 0.00023\text{ m}^2\cdot\text{s}^{-2}$ , and the available energy dissipation rate was in the range of  $0.00057\sim 0.00189\text{ m}^2\cdot\text{s}^{-3}$ . Excessively high or low turbulent kinetic energy and available energy dissipation rate were not favorable for the formation of integrated and closed vortices, leading to lower flocculation efficiencies.

**Key words:** [flocculation](#) [Fluent](#) [turbulent kinetic energy](#) [available energy dissipation rate](#) [Taylor-Couette flow](#)

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