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喷动流化床颗粒混合特性的三维直接数值模拟

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摘要
采用离散元方法，对喷动流化床内的颗粒混合特性进行了三维直接数值模拟。气相场采用欧拉方法，固相场采用拉格朗日方法；对每一个颗粒考虑了碰撞力、携带力和重力；颗粒碰撞采用软球模型。模拟喷动流化床上下两层颗粒的运动和混合过程，揭示颗粒的混合机制，同时提出表征颗粒混合质量的重要特征参数，并考察了喷动气速和流化气速对颗粒混合的影响。结果表明：由喷动气射流带动而形成的颗粒内循环是颗粒混合的机制；增加喷动气速度和流化气速度均有助于颗粒混合，使颗粒达到完全混合的时间减少且混合更均匀。

关键词 颗粒混合 喷动流化床 离散单元法 直接数值模拟

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Three-dimensional DEM Simulation on Particle Mixing Characteristics of Spout-fluid Bed

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Abstract
Numerical simulations on particle mixing characteristics of spout-fluid bed were carried out in three dimensional based on discrete element method (DEM). Eulerian method and Lagrangian method were employed to deal with the gas phase and solid phase respectively. Drag force, contract force and gravitational force acting on individual particle were considered. The collision of particles was modeled by soft-sphere model. The movement and mixing of particles in the up and down layers were simulated. The particle mixing mechanism was revealed. Characteristic parameters which characterized the particle mixing were proposed to study the effects of spouting and fluidizing gas velocities on the particle mixing characteristics. The results show that the particle internal circulation driven by the spout jet should be the mechanism of particle mixing. Increase in spouting and fluidizing gases are helpful for particle mixing, for the time for full mixing status decreases and particles are better mixed in these cases.

Key words particle mixing spout-fluid bed discrete model direct hydrogen production

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