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铜闪速炉数值仿真

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摘 要: 利用欧拉法求解气相方程, 利用拉格朗日法求解颗粒相方程, 并用PSIC法耦合气固两相方程. 通过仿真得到反应塔内部的流场、温度场、浓度场、燃烧释热场以及颗粒的轨迹与温度. 可视化结果表明: 闪速炉内部流场存在2个大涡; 闪速炉内部温度除喷嘴下部外, 基本分布均匀; 反应塔中含硫铜精矿在反应塔上部2 m处就基本反应完全, 在距离精矿喷嘴不到5 m处, 所有颗粒达到峰值温度; 反应塔内部温度场、浓度场、流场以及颗粒的轨迹表明反应塔内部的各种场并非轴对称, 不能将反应塔简化为二维轴对称来处理; 仿真结果和现场试验结果相符, 温度校验点的相对误差小于2%.

关键字: 仿真; 闪速炉; PSIC; 铜冶炼

Simulation of copper flash smelter

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Abstract: A mathematical model for simulating reactions of chalcopyrite and pyrite particles together with momentum, heat and mass transfer between the particle and gas in a flash smelting furnace is presented. In simulation, the equations governing the gas flow are solved numerically with a commercial package CFX, and the particle phase is introduced into the gas flow by particle source in cell technique (PSIC). Result data including the fluid flow field, heat distribution field concentration field of gas phase and the tracks of particle have been obtained by numerical simulation. The visualized results show that the particle's reaction is almost completed in the upper zone of the shaft within 2 m from the burner outlet. The simulation results are in good agreement with data obtained from a series of experiments and tests in factory and the error is less than 2%.

Key words: simulation; flash smelter; PSIC; copper smelting

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