

多相流和计算流体力学

## 利用声发射技术测量搅拌釜的淤浆悬浮高度

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摘要

根据颗粒运动碰撞搅拌釜壁面产生声波的机理, 结合声信号的频谱分析、小波分解和R/S分析, 获得了代表颗粒运动的特征信号频段(d1、d2频段)。同时, 基于声波特征信号频段能量沿搅拌釜轴向的规律性变化, 提出了声波法测量搅拌釜淤浆悬浮高度的判据, 即当声波特征信号频段能量或声波特征信号频段能量比出现阶跃性变化时的高度为淤浆悬浮高度。以水-玻璃珠体系为例, 研究发现, 无论是盘式涡轮还是桨式叶轮的搅拌浆, 基于声信号测定淤浆悬浮高度的判据都能较好地得到验证, 与目测法相比, 其平均相对误差小于10%, 具有较高的精度。由此, 获得了一种简单快捷、灵敏准确、非侵入式的搅拌釜淤浆悬浮高度测量技术, 能够实现淤浆悬浮高度的实时监控。

关键词

[声发射](#) [淤浆悬浮高度](#) [小波分析](#) [R/S分析](#)

分类号

## Measurement of slurry suspension height in stirred tank by multi-scale analysis of acoustic emission technology

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### Abstract

The characteristic frequency band of acoustic emission (AE) in a stirred tank with respect to the behavior of particles movement was obtained by spectral analysis, wavelet transform and R/S analysis based on the mechanism of interaction between particles and the wall of tank. A criterion of slurry suspension height in the stirred tank was presented based on the relationship between the characteristic frequency band of acoustic emission from the particles-wall collisions with the height of the probing location in stirred tank. Slurry suspension height of stirred tank is the location where a sharp decrease of the AE energy on the characteristic frequency band or the ratio of the energy on the characteristic frequency band at one location to the average energy of the whole tank is observed. Experiments in the stirred tank with an inside diameter of 110 mm and different impellers in the system of glass beads and water showed that this criterion was useful for the online measurement of slurry suspension height. The average absolute relative deviation (AARD) was below 10% when the slurry suspension height determined with the AE technique was compared with ones by the method of visual observation. The criterion could meet the requirements of the online measurements of stirred tank.

### Key words

[acoustic emission](#) [slurry suspension height](#) [wavelet analysis](#) [R/S analysis](#)

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