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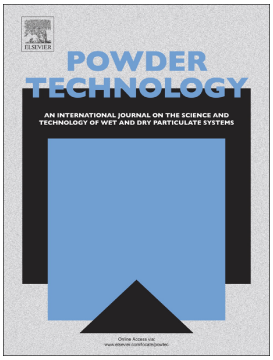

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Study on the grinding kinetics of copper tailing powder

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Abstract: Based on the laser particle size analysis and activity test results, the grinding kinetics of copper tailing powder has been studied with aid of Divas-Aliavden grinding kinetic equation, Rosin-Rammler-Benne (RRB), Swebrec distribution model, Fuller-curve packing model, fractal theory and gray correlational analysis. The results show that the grinding process of copper tailing powder follows well with the Divas-Aliavden grinding kinetic equation, and the grinding efficiency of copper tailing powder draws near to zero after ground 90 min. In addition, the grinding process can not only levigate copper tailing powder, but also narrow down and homogenize the Particle Size Distribution (PSD). The Equivalent Particle Size (EPS) shows a negative while the Specific Surface Area (SSA) shows a positive linear correlation to the double logarithm of grinding time. The PSD of copper tailing powder complies with both RRB and Swebrec models well, while the RRB model is still superior to Swebrec to describe the PSD of copper tailing powder in the full range of particle size. The incorporation of copper tailing powder, especially the finely ground one, makes the PSD of composite materials even close to Fuller-curve, and thus contributing to high packing density. The PSD of copper tailing powder show fractal features, and the fractal dimension increases but its growth rate tends to slow down with the grinding time. The activity index increases with the grinding time. According to the gray correlational analysis, the mass fraction of particles ranging 3-5 μm has a maximal positive effect on the activity index at all curing ages. As a result, 60 min is chosen as the optimal grinding time for copper tailing powder in consideration of economic and technical benefits.

Key words: Copper tailing powder; Grinding kinetics; Kinetic equation; Distribution model; Fractal theory; Gray correlational analysis

1 Introduction

Copper tailings are the byproduct of copper mining industry, and a kind of fine sand-like solid waste

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