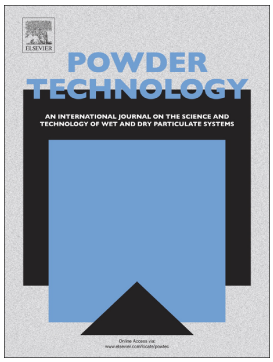

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Discrete-element simulations of comminution in rotating drums: effects of grinding media

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Abstract

By means of Discrete-Element simulations with Bonded-Cell method for particle breakage, we investigate the evolution of crushable granular materials in a 2D rotating drum partially filled with heavy balls and powder grains. The grinding process with balls of different sizes or numbers is analyzed in terms of grain size and specific surface. The grinding rate is an increasing function of the number of balls, but, as a result of increasing energy dissipation by inelastic collisions between the balls, the process becomes energetically less efficient for larger number of balls. When the total volume of balls is kept constant, the ball size has generally little influence on particle breakage. We also introduce a model for the evolution of three size classes by accounting for the cushioning effect and transition rates between the classes. This model predicts an exponential decrease of the volume of large particles at the beginning of the process.

Keywords: Granular materials, Grinding, Ball mill, Discret-Element Method, Bonded-Cell method, Contact Dynamics Method

1 Introduction

Ball mills are widely used in agronomy, mining and pharmaceutical industries. The mixture of crushable particles with heavy balls introduced in a rotating hollow cylinder evolves by continuous

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