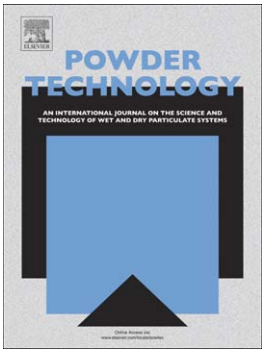

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Density segregation on a moving grate

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Abstract

We analyse numerically a density segregation of a monodisperse packed bed of particles with different densities on a forward acting grate. The motion of the particles was simulated using a discrete element method (DEM). The geometry of the grate simulates a pilot-scale furnace for thermal conversion of biomass. The particulate material consisted of spherical particles of which the densities varied by a factor of 2. Segregation was analysed for different grate kinematics meaning that both bar amplitude and frequency, i.e., the bar motion velocity, were subject to change. Based on statistical analysis, we derive mixing and segregation parameters along the coordinate axes, from which a global mixing parameter for the entire packed bed was derived that is dependent on the bar motion. Segregation through density is described by the same type of segregation parameter as in case of the size induced segregation investigated in an earlier study.

1 Introduction

Mixtures of particles having different properties have tendency to segregate when subjected to mechanical agitation, i.e., the particles with certain values of the respective parameters accumulate in localized areas. This phenomenon is observed in various physical setups, such as shear Couette flows [1], granular flow down an inclined chute [2], industrial processes, such as hopper discharge [3, 4], filling and discharge of silos [5], pressure filtration in production of ceramic cast from suspension phase [6] or die filling [7], as well as in many types of industrial equipment, such as blenders [8], moving grates in solid fuel furnaces [9, 10], vessels subjected to tapping or vibration [11], etc., and can influence the overall technological process. Segregation is undesirable in situations where a homogeneous mixtures of materials must be produced, e.g., preparation of construction materials, pharmaceutical industry, etc.; on the other hand, it is the process whereby different materials can be sorted, e.g., in mineral processing