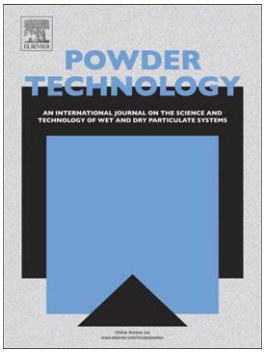

Energy-dissipation correlated size separation of granular matter under coupling vibration and airflow

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Energy-dissipation correlated size separation of granular matter under coupling vibration and airflow

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Abstract

Air was blown into a vertically vibrating three-dimensional bed from its perforated bottom to control the size separation of a binary granular system in experiment. We focused on the effects of dimensionless vibration acceleration Γ and air velocity u on the separating state. A model was investigated, in which energy dissipation was calculated and linked to the driving force exerted on particles. The acceleration difference of binary particles was calculated by the main parameters of vibration, airflow, and physics properties of particles. The particle motion and redistribution been been explained and predicted with the fundamental theory of dynamics. We noticed that Brazil nut (BN) separation was caused by vibration, and turned to its reverse, but with the stronger energy dissipation when Γ was increased. Reverse Brazil nut (RBN) separation was observed with a rising u, meanwhile the dissipated energy was declined. However, an improved Γ weakened the airflow-induced RBN separation. Various transitional forms between BN and RBN separations, such as uniformly mixed distribution, were obtained. In conclusion, the energy-dissipation correlated size separation can be controlled and predicted under coupling vibration and airflow.

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