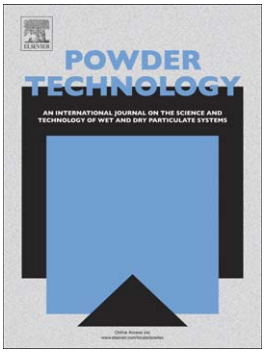

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Using a Freeman FT4 rheometer and Electrical Capacitance Tomography to assess powder blending

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Abstract

This study assesses the influence of mixing or segregation on flowability results from a Freeman FT4 powder rheometer as well as the use of Electrical Capacitance Tomography (ECT) to measure powder mixing and mixedness.

The blending (or otherwise) of two powders of different physical properties (particle size, density, basic flowability) and contrasting electrical permittivity was studied in a Freeman FT4 rheometer. Two initial arrangements were used: one with the heavier, smaller powder on the top that would be expected to mix readily; and the other, the inverse, that would be expected to be resistant to the axial blending mechanism prevalent in the FT4. The torque and thus flow energy were tracked through 30 cycles of the FT4 impeller passing into and back out of the powder layer. In one case, the FT4 data were seen to evolve towards a steady state comparatively quickly, while, in the other, relatively little change in the basic flow energy was observed. The change in the first case is attributed to mixing of the powder, and the lack of change in the latter case to the absence of mixing.

Simultaneous ECT measurements using a two plane sensing arrangement were taken. The reconstructed tomograms and the basic average permittivity data show clearly the mixing in the first case and the absence of blending for the latter. This confirms not only the sensitivity of powder flowability measurements to segregation of component powders, but also the potential of ECT as a measurement tool for powder mixing and segregation studies.

Key words: Discrete Element Method; DEM; Powder segregation; Powder mixing; Freeman FT4 Rheometer; Electrical Capacitance Tomography; ECT

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