International Fine Particle Research Institute

Project Brief

Multiscale Investigation of Fluidization-Induced Segregation in Fine Powders: From Lab Testing to Process Modeling

Fluidization-induced segregation affects the homogeneity of fine powders during filling and discharge of storage containers. It can have significant deleterious impact on product quality in industries where compositional uniformity is essential (e.g. food, pharma, consumer goods, chemicals). The extent and dynamics of segregation at industrial scale is still not well understood. The segregation effects often amplify with scale. There is a need for comprehensive experimental and modeling approaches to understand and mitigate the phenomena in real processing environments.

This project seeks to address this challenge through a combination of powder characterization, scaling experiments, and modeling, e.g.:

- Use lab scale testing to understand critical material parameters (size, cohesion, density, shape, permeability) affecting fluidization-induced segregation.
- Conduct experiments to quantify fluidization-induced segregation during container filling and discharge in different geometries and fall heights (without active pneumatic conveying) for fine powders and blends with different propensity to segregate
- Study the effect of scale up on segregation mechanism and severity
- Apply modelling to simulate the evolution of segregation during container filling and discharge.
- Exploring initial/boundary conditions around valve geometry and venting
- Combine experimental and modeling data to link material, process, and operation properties to the likelihood and extent of fluidization segregation.
- Propose and evaluate practical mitigation strategies (process (venting) and product)) to reduce fluidization induced segregation