International Fine Particle Research Institute

Project Brief

Adhesion of Dry Powders to Process Equipment Surfaces

Solid material build-up in industrial equipment, such as hopper outlets, screws in feeders and punch faces in tableting presses is a critical problem in many powder processing industries. It has been widely studied, but most studies are quite empirical and therefore difficult to apply generally.

The aim of the project is to study the underlying mechanisms of adhesion of particles and powders to (primarily) metal surfaces over a range of confining stress conditions corresponding to hoppers, screw feeders, and tablet presses. The project should apply the fundamental physics and chemistry of adhesion to develop pragmatic test methods for characterizing the "sticking propensity" of real powders with process equipment surfaces that can be used, at a minimum, to rank the risk of solid material build-up during processing.

Main objectives

- Identify underlying mechanisms for adhesion of different solid particulate materials and contact materials, depending on stress conditions and strain rate, temperature and atmospheric conditions for selected systems, and, if feasible, establish specific regime maps for selected systems
- Identify suitable test methods to identify and rank solid particulate material with respect to degree of sticking/adhesion propensity

Stretch objective

- Develop process model(s) based on physical and chemical principles to link materials, and stress, temperature and atmospheric conditions to the likelihood of sticking/adhesion

Scope of Project:

Non-agglomerated particles of organic crystalline, organic amorphous and inorganic materials between 10 and 500 microns in diameter. Model materials with well characterized morphology, mechanical and surface properties may be selected, as long as their properties cover a range relevant to materials commonly used in industry.

Temperatures from 10 and 60°C; relative humidity from 10 and 80%; air gas.

Stainless steel contact surface. Use of different grades is of interest as are coatings typically applied to remediate sticking.