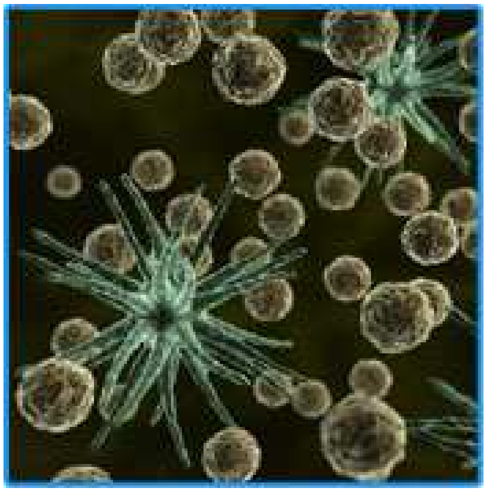
Controlling Particle Size for Successful Product Design

Material Flow Solutions, Inc.



Engineer and formulators want to ***control the breaking tendencies*** of bulk solids. Sometimes they wish to enhance or prescribe breakage events in the system of particles and sometimes they wish to prevent or mitigate the breakage. In either case, it is necessary to understand, from a mechanistic point of view, the causes of particle breakage so one can prevent or induce it. There is a linkage between particle breakage events and particle scale properties such as particle size, agglomerate binder strength, moisture content, particle porosity, surface roughness, and particle shape. Particle structure plays a significant role in particle breakage.

There is also a linkage between breakage events and interaction with a specific unit operation. A particular material may break due to impact events, causing fracture of particles. Placing this material in a unit operation where many impacts occur can lead to fracture of the particles. One approach to controlling breakage is to measure the key particle scale properties such as particle topography, particle size, hardness, and moisture content. It is also necessary to measure the breakage tendencies of materials when subjected to specific breakage mechanisms. Using population balance modeling one can relate how susceptible a given material is to breakage.

At Material Flow Solutions we identify the cause of breakage as well as the magnitude of those breakage events. We begin by measuring the particle scale and bulk material properties of the sample. Our models allow us to compute the stresses, strains, impacts, and tearing events that occur in many unit operations. These can be combined with experimental data, population balance model results, and particle scale properties to create more robust particles or to create a particle that will break in a prescribed manner. The advantage of approaching this problem in this manner is that the results are scalable to many unit operations and allow accurate prediction based on sound scientific principles.

PRACTICAL APPLICATIONS of ***controlling particle size*** include, but are not limited to:

- Optimize robustness of clay particles during handling and transport
- Selective breakage of catalyst particle in a particular fluid bed unit operation
- Compare breakage behavior of spray dried material in similar processes
- Identify key breakage mechanisms of granular and flake food particles for product optimization

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