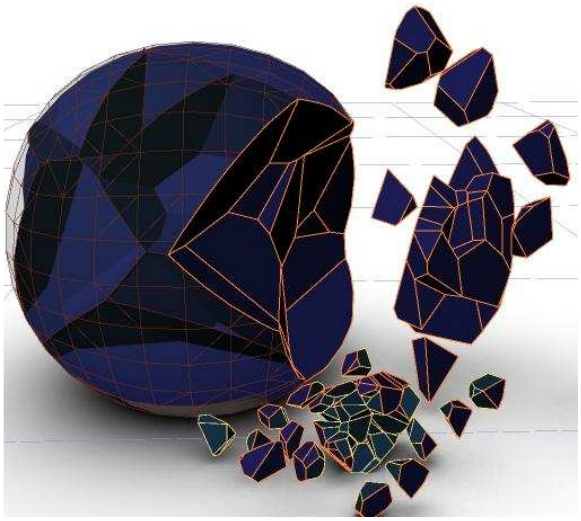
Attrition Prevention and Control for Product Design

Material Flow Solutions, Inc.



Optimal product design is often based on the particle size of the individual ingredients in the mixture. Much can be done from a product point of view to mitigate particle breakage in processes and handling facilities. Particles break due to fracture during impact events as a result of fatigue cause by repeated stress/strain or impact occurrences. Particles might also break by abrasion as particles slide on surfaces or impact at oblique angles. Finally, particles may reduce in size due to tearing or cutting action. Identifying the cause of particle breakage is critical in order to mitigate and ***prevent particle attrition***.

At Material Flow Solutions we perform particle breakage (attrition) tests that isolate each mechanism and allow us to quantify the breakage due to various causes. Coupled with surface images and section views of particles, this topographical particle data allows us to estimate the robustness of the particle to various breakage events. In general, the more porous a particle the less robust it is. However, some porous structures can have sufficient strength to decrease particle breakage. For example, a layered particle may have significant resistance to breakage across the grain, but be more susceptible to breakage along the grain. Thus, it is critical to know the voidage or pore size distribution, as well as the primary particle or structure orientation, in the agglomerated or crystallized particles. Our texture analysis of particles is used with particle degradation tests to develop robust breakage models and allow prediction of breakage in many systems. Since breakage rate due to small or large changes to these systems can be predicted, particles are developed robustly enough to withstand breakage events. Alternatively, this same approach can help predict the breakage pattern during processing allowing prediction of particle size distributions due to milling or handling.

PRACTICAL APPLICATIONS of ***attrition control*** include, but are not limited to:

- Maintaining product quality in processes – design of product particles to reduce breakage during transport
- Creating quality product design – designing custom product to meet specific behavior parameters
- Determining optimal binder addition to agglomeration unit operations to create robust particles
- Determining optimal moisture content to maximize the robustness of product particles
- Achieving consumer acceptability
- Increasing the bottom line

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