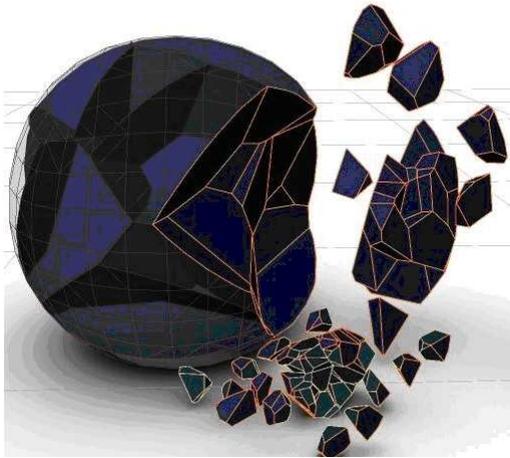


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## Solve Attrition Problems in Process Design

### Material Flow Solutions, Inc.

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Often designing a material to create a more free-flowing product creates agglomerates that are porous, but have larger particle size. The desire is usually prevention of particle breakage that may result in either segregation or poor flow properties. Each material is sensitive to different types of breakage. In some cases material may be sensitive to particles breaking in half, but insensitive to small attrition events where small particles break off larger ones. Particles may also break due to either stress-strain or impact events. Depending on the nature of the material, stress-strain events may cause more breakage than impact events. Some unit operations may induce agglomeration, enlarging particles and complicating the breakage analysis. Thus, the solution to an attrition issue

is to characterize breaking tendencies of material under conditions that may be present in the process. If the process unit operations induce impact, characterize the tendency of material to break under impact conditions. If the process has large stress and/or strains, then the breakage tendencies under stress strain events should be measured. Once breakage tendencies are measured, then the impact and/or stress-strain conditions must be quantified for all process equipment of interest. These breakage measurements are then used to estimate expected breakage in the handling system. Note that this is a systems analysis. Each process may be subject to both stress-strain events and impact conditions.

Consider the simple case of filling and then discharging a bin. Material can free fall into a bin and impact on the hopper section or on the material pile, causing breakage. Stress levels in a full bin can be large and the strains can cause breakage during the emptying process. Thus, particle breakage is the sum of all possible breakage events in the process. If attrition is due to stress-strain events, then load relief design and inserts can often help reduce the stress and limit the breakage. If impact is a major breakage issue, then let-down chutes and chutes designed to limit transport velocities can help reduce breakage. Controlling directional changes of particles during transport will also help reduce breakage.

In summary, it is critical to know the cause of breakage with a specific product and then analyze the process using a system approach to determine sensitive breakage areas. Once these are determined, retrofits can be implemented to attack each breakage mechanism that is effective. At Material Flow Solutions, we can help you characterize your material, analyze your systems, and suggest retrofits to minimize breakage problems.

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

- Maintaining product quality in processes
- Designing custom processes to meet specific product behavior parameters
- Achieving consumer acceptability
- Increasing the bottom line