"Know Floe's Korner"

Top Ten Tips to Minimize Attrition

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1. Attrition occurs due to fracture of particles or abrasion of particle surfaces. Identify the primary bulk behaviors responsible for attrition in a given process. Typical behaviors are: sliding, dilated flow, bulk shear, impact and particle trapping.

2. Identify relevant particle properties affecting attrition in the process or unit operation under consideration. Important particle properties include shape, particle size, particle size distribution, particle density, porosity, surface texture & hardness, elasticity, plasticity, brittleness and imperfections (e.g. cracks).

3. Bench top tests must emulate the primary bulk behaviors responsible for attrition. When evaluating attrition in a process, pay close attention to sampling technique and errors due to sampling.

4. Attrition can be minimized either through ***Particle Engineering*** (i.e. modification of particle properties to make a robust particle) and/or ***Process Engineering*** (i.e. controlling primary flow behaviors to minimize particle fracture and abrasion).

5. Minimize free fall and impact frequency. Employ spirals or cascades to reduce impact forces during loading operations. Use broad, deep and slow feed streams on chutes. Try to ensure contact velocities are low, oblique to contact surfaces and employ resilient contact materials to reduce sharp, concentrated loads.

6. Avoid shearing the bulk in confined or high stress conditions. Allow room for local expansion when shearing a settled powder bed. Reduce contact pressures and strain rate as far as practical.

7. Allow generous working clearances that will not trap or wedge particles.

8. Minimize overpressures on extracting devices in hoppers. Move the material slowly wherever possible, and expand the flow channel at changes of flow direction.

9. Converge a flow stream gently in dilated low velocity conditions by way of smooth contact surfaces. Avoid slip on rough surfaces, past flow obstructions or surface irregularities.

10. Choose dense phase (low velocity) pneumatic conveying as compared to dilute phase (high velocity) pneumatic conveying whenever possible. Pay particular attention to the conveying line layout to minimize bends or elbows.