Recent advances in technology allow measurement of unconfined yield strength of fine powders at very low stress levels.

**Measurement Methodology**

The test technique is to place a small quantity of material into an enclosed conical cavity; consolidate it using centrifugal force; remove the obstructions at the bottom of the conical cavity and use centrifugal force to cause material to fail, yield or extrude from the cavity. The process is summarized in steps 1 through 4 pictured below.

**Unconfined Yield Strength Measured by Traditional Methods**

There are several apparatus and methodologies available to measure material bulk strength. Most involve placing a material sample into a test cell, adding compaction pressure and rotating (or shearing) the apparatus until the material fails.

- Most bulk strength testers based on material shear require multiple tests to garner a single data point.
- Most bulk strength testers require 300 or more grams of material to produce a full flow function.
- Most bulk strength testers can measure only at pressures near or above 1KPa.
- Real process pressures are more on the order of 300-400 Pa.
- Extrapolation is messy – and does not correlate to small-scale geometries.
- Small-scale designs based on traditional strength test methods.

**Case Study – Comparison of New Method with Schulze Shear Method**

Figure 1. Comparison of BCR Limestone data generated from three different studies.

Figure 2. Comparison of BCR Limestone data generated from three different studies and new test technique (SSSpinTester).

Figure 3. Comparison of low stress level BCR Limestone data generated from three different studies and new test technique (SSSpinTester).

Figure 4. Comparison of the unconfined yield strength of Argo corn starch measured with the Schulze direct shear method and the new test technique (SSSpinTester).

Figure 5. Comparison of the lower stress level unconfined yield strength of Argo corn starch measured with the Schulze direct shear method and the new test technique (SSSpinTester).

**Conclusions**

- New test method can measure strength at low stress values comparable to those near small diameters hopper outlets.
- Can interpolate to get arching instead of extrapolate.
- Strength is measured with very little material: Good for expensive and hard to get materials.
- Low pressure strength can be applied to segregation on piles, capsule filling, tablet feed, fluidization, dispersion models and other low pressure unit operations or formulation needs.

**Fig 1** Comparison of BCR Limestone data generated from three different studies.

**Fig 2** Comparison of BCR Limestone data generated from three different studies and new test technique (SSSpinTester).

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**Fig 4** Comparison of the unconfined yield strength of Argo corn starch measured with the Schulze direct shear method and the new test technique (SSSpinTester).

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