POWDER JAM ON LINE 3 … STOP PRODUCTION!

"Quick, get the hammer. Hit the hopper until you can see the powder coming out again. Once you get it going, stay there for a few minutes in case it jams again. Check the fill level and make sure that we have plenty of powder in there. Let me know if you see anything else."

These words are spoken every day throughout industry when powder feed operations suddenly stop or behave erratically. The brute force solution to bash the hopper may ultimately work, but doesn't really get to the heart of the problem. Why does the powder stop flowing? Is there a way that this could be predicted beforehand?

Production supervisors know that things seem to start off ok when the hopper is full. But as the hopper empties, flow can become erratic. Is there something that causes things to change with how the powder flows?

Most hoppers operate in "core" flow, also known as "funnel" flow. (See Figure 1) The material at the topmost level in the hopper moves down through the center of the hopper and discharges before the material around the outside. This means that the last powder put into the hopper is the first to discharge. The material around the outside experiences some degree of compaction while it waits its turn to flow out. Sometimes, this compaction may be sufficient to prevent the powder from discharging when its turn finally comes to start flowing.

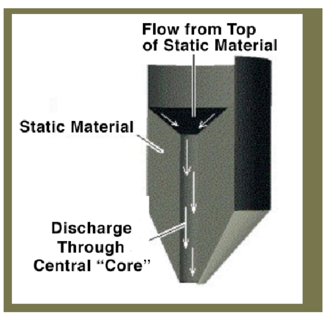

Figure 1
Illustration of "Core" Flow in Hoppers

The ASTM has established a scientific method, D6128, that can be used to predict the flow behavior of the powder. The type of instrument that can run this test (see Figure 2) uses a "shear cell" (see Figure 3) to compact the powder and then determine how much force it takes to flow the powder after compaction. The data produced by this test is called a "Flow Function" (see Figure 4) and tells how the compaction experienced by the powder in the hopper will affect its ability to flow.

Figure 2:
Brookfield Powder Flow Tester

Figure 3:
Shear Cell Being Loaded with Powder prior to Testing

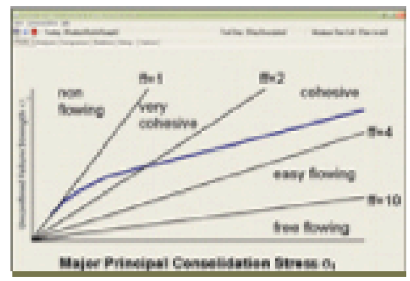

Figure 4:
Flow Function Graph for Powder

The critical number that results from the data analysis is the "arching dimension", which is a prediction of whether the powder has enough strength to bridge the hopper opening. This single number can be invaluable in determining whether the hopper will jam. Armed with this information, production supervisors now have a way to save themselves the grief of downtime by knowing beforehand whether the powder will flow.

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