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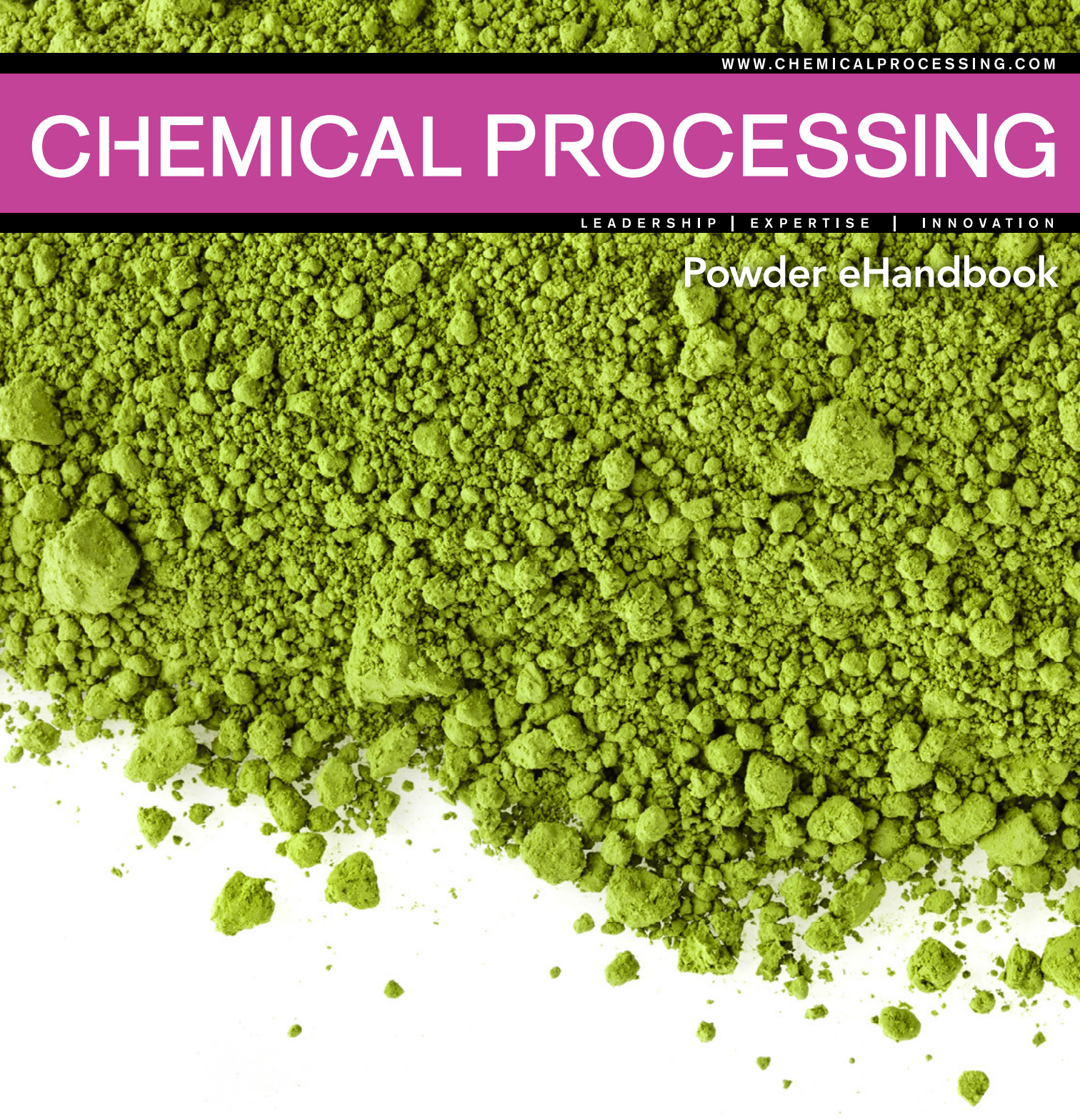

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Sensor Puts Sites on Powder Measurements

Overcome dust and topography challenges when measuring powders in silos and bins

By Jenny Nielson Christensen, BinMaster Level Controls

WHEN IT comes to measuring powders, the devil is in the dust. High levels of dust tend to diminish the performance of most non-contact bin measurement devices, rendering them inaccurate or ineffective — at least until the dust settles. Many plants run continuously on three production shifts and are constantly filling and emptying silos that contain ingredients for the manufacturing process. When facing production and shipping deadlines, there's no time to stop filling and emptying silos and wait until after the dust settles to measure material levels. Acoustic technology, as used in the 3DLevelScanner (see Figure 1), can measure accurately despite extremely dusty conditions because it operates at a very low frequency of 3 KHz to 10 KHz that allows the signal to penetrate dust and reach the material surface.

Figure 1. Acoustic technology can penetrate dust to reach the material surface, enabling more accurate measurements despite extremely dusty conditions.

POWDER CHALLENGES

Measuring powders has other challenges as well. Perhaps most troublesome is powders might not always flow freely, creating a highly irregular material topography in the silo. Combine clumping material with multiple fill or discharge points in the vessel, and the challenge is compounded. Material at one point in the vessel might be much higher or lower than other points in the vessel. In this case, a single measurement point may not be adequate in estimating inventory and the volume of material in the bin. A 3DLevelScanner has three transducers that continually measure the material surface in a 70° beam angle. Because it takes multiple measurements of the material surface, it can more accurately estimate the volume of material in the vessel and also provide minimum, maximum and average distances, versus a single measurement of a static location.

Irregular material surfaces and buildup are also problematic. Most devices can't tell you where the high and low spots are, or where there might be buildup. As the 3DLevelScanner identifies each measuring point as an x, y, z coordinate in the vessel, it is able to map the material surface. Advanced software can then generate a 3D visualization of the material surface. This information enables easy management of filling and emptying points and the scheduling of timely maintenance to remove buildup. With measurement history stored in a database, operations can learn more about the material's behavior by viewing 3D "movies" that document the vessel material in action over time.

The 3DLevelScanner has been installed in over 400 operations in North America and in some very challenging applications. Each and every installation has its own set of nuances, unique operational concerns, and data needs for decision making. While it can't solve every level measurement problem at every facility, the 3DLevelScanner has proven to work again and again where plants have found no other acceptable level and volume measurement solution.

ALUMINA POWDER APPLICATION

Alumina powder is an extremely dusty material with a bulk density of about 18 lb/ft^3. When the vessel is filled it generates huge amounts of dust that never settles as the operation runs continuously 24-7. The plant had tried many devices without success. The carbon steel and concrete bins were about 65 feet in diameter and about 70 feet tall with flat bottom and top. The bins are filled and discharged from the center, but the powder material was not flowing freely and behaved erratically. The 3DLevelScanner model MV with 3D visualization was mounted on the roof of the vessel. This vessel also had stiffening bars at the top of the vessel, so a special neck extension was used to ensure the scanner's transducers were mounted below structure that may create problems for the signals coming from the device (see Figure 2). The plant found it was the only device that could work reliably in the application.

Alumina powder can be stored in silos that reach 100 feet in diameter and up to 200 feet in height. In addition to the vast amount of material stored, these silos generally have multiple filling and emptying points, making it extremely difficult for end users to monitor the silo's inventory level and volume. For larger silos with more surface area to measure, the BinMaster MVL multiple scanner system can be used with two or more scanners. Depending on the vessel size and the desired level of accuracy, two scanners might be recommended for a 100-ft diameter vessel and four scanners might be appropriate for a 140-ft diameter vessel.

For process bins at an alumina operation, the HE model of the 3DLevelScanner has an operating temperature range of up to 250°F (120°C) to accommodate higher temperatures that may be present when material that has been heated in the production process. The 3DLevelScanner HE is designed to measure the level and estimate the volume in storage silos containing alumina and can also be used in other challenging materials such as clinker and fly ash. This HE model is ideal for use in the aluminum, cement, powder or any industry where there are multiple challenges such as dust or high humidity and very large silos where the material surface in the bin may be uneven and difficult to measure.

Figure 2. A special neck extension allows the scanner's transducers to protrude further into the vessel to reduce potential signal problems.

Figure 3. Here, a non-contact sensor sits atop a talc powder vessel to help avoid potential contamination.

TALC POWDER APPLICATION

Talc powder is primarily stored in smaller vessels ranging from about 20 to 30 feet in diameter and 60 to 80 feet tall. Most frequently, the vessels are center-fill, center-discharge and often have a cone bottom. Talc has a bulk density of about 35 lb/ft^3 and is excessively dusty and prone to clumping and buildup. The customer had been using a radar device, but it wasn't performing consistently in the harsh environment. A non-contact sensor was considered best for use in talc, an ingredient found in many personal-care products and makeup, to avoid potential contamination (Figure 3).

The 3DLevelScanner was able to provide accurate, real-time level and volume measurement with 3D visualization of the silo contents. The data is used to improve inventory management of the talc, while the 3D visualization detects buildup that can occur inside the silo from time-to-time. This is important for scheduling maintenance and cleaning when necessary, in order to help avoid interruptions in the filling and emptying processes. The customer commented that the 3DLevelScanner was the only device that would work in this material.

CARBON BLACK APPLICATION

Carbon black is dirty and generates excessive dust during the filling and emptying processes and tends to clump and adhere to silo walls creating buildup. This significantly challenged the plant's ability to accurately measure the level in a carbon black silo, which is especially important as the 50-ft tall, 13-ft diameter vessel must be emptied before becoming fully filled, or it could interrupt the production process. The 3DLevelScanner's unique dust-penetrating technology delivers accurate and reliable real-time measurements of the level and volume of carbon black even in this harsh environment, and also provides an optional 3D image of how carbon black is distributed inside the silo.

DETERGENT APPLICATION

Granular brightening powder used in detergents (Figure 4) was stored in carbon steel bins with a plastic lining. The high dust material was also potentially explosive, so the sensor had to meet hazardous location standards. With certifications to ATEX II 1/2D, 2D, Ex ibD/iaD 20/21

Figure 4. Granular brightening powder is a high-dust material that's potentially explosive, so sensors must meet hazardous location standards.

Figure 5. Silica used to make coatings can be difficult for some non-contact sensors to measure due to irregular particle shape which may deflect pulses and cause inaccurate measurements.

T110˚C, ATEX II 2G Ex ia/ib IIB T4 and FM Intrinsically Safe Class I, II, Division I, Groups C, D, E, F, G for both the United States and Canada, the 3DLevelScanner was able to meet regulatory requirements.

POLYURETHANE POWDER APPLICATION

Polyurethane powder is a badly behaving and difficult-to-manage material. A composites manufacturer supplying advanced roofing and waterproofing products wanted more accurate inventory management. They had been using a guided wave radar device in the 10-ft diameter, 36-ft tall silo. However, it was not providing the level of accuracy needed, likely due to buildup on the cable causing erratic measurements. In this instance the non-contact technology used by the 3DLevelScanner was able to deliver continuous, accurate volume measurement.

SILICA GRANULES APPLICATION

A cone-bottomed silo about 21 ft in diameter and 22 ft tall filled with silica granules was proving to be a problem child for a coating manufacturer (Figure 5). With the material weighing about 19 lb/ft^3 the vessel accounted for a large amount of inventory — almost 90 tons when full. However, the silo is continuously active, filling and emptying 24 hours a day, which made for full-time dusty conditions. Plus, silica can be difficult for some non-contact sensors to measure, due to irregular particle shape which may deflect pulses and cause inaccurate measurements. The 3DLevelScanner is able to continuously and accurately monitor the level and the volume of silica granules in the vessel in real time.

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