Smart moisture measurement technology continually optimizes process quality

Instant measurement and production line correction are enabled, since calculations are performed in real time inside the sensor, and data is analyzed multiple times per second with integrated software.

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With Kett's KJT130 Handheld Portable Instant Moisture Meter, the user simply points the instrument at the product, and the moisture content is instantly shown on a digital display with results accurate to 0.01% in a 0 to 100% measurement range.

Courtesy of Kett

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For chemical processors involved with powders, pellets, blocks, chips, liquids, slurries, minerals in concentrates, and sludges, advances in smart moisture measurement can help continually optimize process quality as well as product.

In a world full of smart devices (i.e., smartphones, smart watches and smart appliances), such technology is increasingly entering processing and manufacturing in forms like condition monitoring, advanced robotics and industrial IoT.

For chemical processing, “smart” equates with the ability to continually monitor conditions such as product and input moisture content in real time to optimize

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quality. Assessing proper moisture level in processes and products is essential for many reasons such as meeting regulatory standards, ensuring proper chemical reactions and drying, maximizing shelf life, and increasing selling price and decreasing shipping cost.

“Whether chemical processors are mixing, blending, homogenizing or drying, non-contact, smart inline technology enables the rapid, automatic measuring of moisture in 100% of product or inputs, along with the ability to instantly fine-tune the process," said John Bogart, managing director of Kett US, a manufacturer of a full range of moisture and organic composition analyzers. "This can optimize quality as well as minimize waste and corrective re-processing.”

According to Bogart, the technology is smart because all the calculations are performed inside the sensor and measurements are sent on a 24/7 basis to smartphones, PCs and other devices without having to be connected. If desired, these instruments can prompt operators and managers with alerts as needed. He notes that smart technology enables taking multiple precise moisture measurements each second, sorted within integrated software. This enables not only real-time analysis and error detection but also more accurate results in processes and products subject to variable, fast-changing conditions.

Continuous moisture monitoring by such smart technology also allows the tracking of historical performance trends, cyclical rhythms and periodic failures, so corrective adjustments can be made to enhance production. Such capability also provides process quality and compliance documentation when required.

Breaking from conventional limitations

For chemical processors, unleashing the full potential of smart process technology in terms of moisture measurement, however, is not possible using traditional techniques. Conventional testing methods that require time-consuming weighing and drying are often too time and labor-intensive to be practical, and laboratory testing faces the same drawbacks.

“With typical testing, by the time results come back from the lab, any off-spec product can already be processed, packaged and shipped. If chemical processors are not measuring in real-time, inevitably there will be some variation in inputs, process and quality,” says Bogart.

Traditional data collection, in fact, is usually too slow, cumbersome and chained to cords and cables. Production floors are already crowded with equipment. So, dealing with bulky cords and connections to PCs, keypads and external switches to transfer data can be too restrictive.

“Fitting inline testing equipment into space-restricted production lines can be difficult when wires, cables, etc., must be run to a variety of peripheral instruments. In such cases, the cost of labor, installation and system integration can be as much as the device itself,” said Bogart.

In response, for chemical processors industry innovation has developed smart inline technology that can rapidly measure moisture in samples multiple times per second.

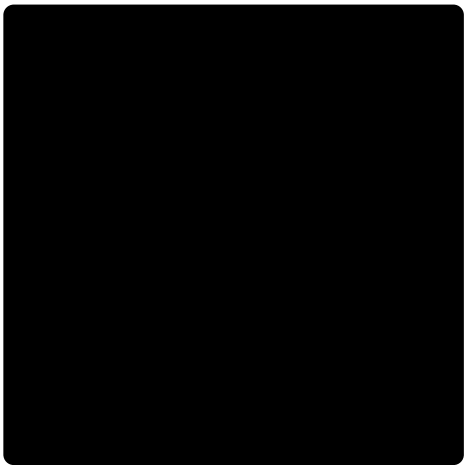
The approach utilizes near-infrared (NIR) light in a highly accurate, non-contact secondary measurement method that can deliver immediate, laboratory quality moisture readings without the labor, cost or delay of conventional techniques.

According to Bogart, NIR moisture meters allow very accurate instant measurement of solids and liquids without contact or sample preparation, so there is no contamination, who notes that this extends to chemicals in all forms (i.e., powders, pellets, blocks, chips, liquids and slurries) as well as minerals in various forms (i.e., powders, pellets, concentrates and sludges).

Once the meter has been calibrated against the lab or production standard, the calibration is stored in the device so no additional calibration work is required, and measurements are fully traceable to the original measurement method. Because the process is non-destructive, samples remain unaltered so they can be used for additional tests or put back into the product stream.

“NIR moisture and organic composition meters follow the principle that water and other organics absorb certain wavelengths of light,” said Bogart. “The meter reflects light off the sample, measures how much light has been absorbed, and the result is automatically converted into a moisture (or organic component) content reading.”

One example of such smart technology is the Kett KB30 in-line NIR moisture meter system. The device, which utilizes smart sensor design and is approximately the size of a car battery, enables measurement without connection to controllers, PCs or other cumbersome I/O devices. Its connections enable local process control and remote integration, and converters are available for wireless, IP, DeviceNet and other interconnection and communications protocols.



Handheld devices are now available that allow even less-skilled personnel to take lab-quality measurements.

Courtesy of Kett

Such connectivity not only cost-effectively eases installation, integration and maintenance but also enables moisture monitoring and necessary corrective action on 24/7 basis. The corrective action, according to Bogart, can be set up to be accomplished either automatically or via alert and action taken by chemical process plant operators, managers or engineers.

With a response time of 0.2 seconds, +/- 0.01% accuracy, and a moisture measurement range of 0.00-100.0%, the device can be used to assess extremely variable and rapidly changing chemical processes as well as products where quality is critical. The quick response time enables faster production line rates with superior moisture measurement. It has been used in various production lines to test chemicals, minerals, pharmaceuticals, foods, textiles, lubricants, pulp/paper goods and personal care products.

When its monitoring capabilities are integrated with accompanying Kett

Tracker data collection and analysis software, improved error detection, defect analysis and product quality result.

As an example, when two smart sensors were used to run different production lines at a manufacturer, the devices' real-time capability detected periodic, wildly fluctuating moisture values that caused their extrusion process to go out of control. After investigation, it was determined that the manufacturer's electrical circuits had not been adequately isolated from the effects of a nearby power plant's operation on shared power lines.

Because moisture control and temperature are closely linked, such smart moisture meters also have a temperature compensation loop on the instrument and provide local temperature as part of the data output, according to Bogart.

Where ambient temperatures change dramatically, this allows simultaneously monitoring of temperature and moisture content to see if process modifications are necessary, depending on daily (i.e., day/night) or seasonal changes (i.e., summer/winter).

"Ultimately, smart moisture measurement technology translates into superior chemical process control, quality and production without the inherent drawbacks of slower, labor-intensive lab or batch testing," said Bogart.

Smart devices already dominate the consumer market for good reason and have begun to gain prominence in processing and manufacturing.

So, it is now time for industry professionals to look into the significant benefits of smart moisture measurement technology for chemical processing – and gain the advantage – before their competitors do.

Del Williams is a technical writer based in Torrance, California.

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