technology optimizes process quality

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By Del Williams

Real-time sensor calculations enable instant measurement and production line correction in pulp and paper

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In a world full of “smart” devices, such technology is increasingly entering pulp and paper processing in forms like condition monitoring, advanced robotics and Industrial IoT.

On the production floor, “smart” equates with the ability to continually monitor conditions such as product and input moisture content in real-time to optimize quality.

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

“Whether pulp and paper producers are mixing, blending, homogenizing, or

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drying, non-contact, smart inline technology enables the rapid, automatic measuring of moisture in 100 per cent of product or inputs, along with the ability to instantly fine-tune the process," says John Bogart, managing director of Kett US. "This can optimize quality as well as minimize waste and corrective re-processing."

Continuous moisture monitoring

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 products subject to variable, fast-changing conditions and processes.

Continuous moisture monitoring by such smart technology, which can be cost-effectively available for about $10-15 per month when leased, also allow the tracking of historical performance trends, cyclical rhythms and periodic failures, so corrective adjustments can be made to enhance production. Such capability also provides product quality and compliance documentation when required.

Using near-infrared measurement

Unleashing the full potential of smart manufacturing and process technology in terms of moisture measurement, however, is not possible using traditional techniques. Conventional testing methods that require weighing and drying are often too time- and labour-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 manufacturers are not measuring in real-time, inevitably there will be some variation in inputs, process and quality," says Bogart.

"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," says Bogart.

In response, industry innovation has developed smart inline technology that can rapidly measure moisture in samples multiple times per second. The approach uses near-infrared (NIR) light in a highly accurate, non-contact secondary measurement method that can deliver immediate, laboratory-quality moisture readings.

How NIR works

According to Bogart, NIR moisture meters allow very accurate instant measurement of solids, liquids and slurries without contact or sample preparation, so there is no contamination.

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,

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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,” says 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 uses smart sensor design and is approximately the size of a car battery, enables measurement without connection to controllers, PCs or other 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.

With a response time of 0.2 seconds, +/- 0.01 per cent accuracy, and a moisture measurement range of 0.00-100.0 per cent, the device can be used to assess extremely variable and rapidly changing products, as well as processes where quality is critical. It has been used in industrial production lines in various industries, including in pulp and paper.

Device in use

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.

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

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