SPECTRAL ENGINES

Solution for ultra-low moisture analysis in smart process industry

Moisture is a critical parameter in industrial processes

Moisture is an important parameter in the quality control of several products. By knowing the moisture concentration during production, both the storage and the quality of stored materials can be optimized and energy savings achieved for example in drying processes. The moisture levels of raw materials have large impacts on many processes and for this reason it is critical to adjust process control systems based on this information.

The use of Near-infrared (NIR) spectroscopy to carry out moisture content analysis without any sample preparation is already well established in laboratories, but there is still a clear need for cheaper, more compact and robust sensor solutions. Typical applications of moisture measurement are found in industrial manufacturing processes, such as pharmaceutical manufacturing, food processes, and paper production. NIR spectroscopy moisture measurement is non-destructive and fast, normally taking only a few tenths of a millisecond per sample. Spectral Engines' spectral NIRONE™ Sensors are incorporated into a fully programmable sensor that enables you to optimize your measurements based on the application requirements.

Potential applications can be found for process optimization in:

· Pharmaceuticals
· Food processing
· Paper manufacturing
· Bioenergy production
· Extrusion processes

Spectral Engines' solutions

Spectral Engines has developed miniaturized near-infrared NIRONE™ Sensors which can be used for moisture measurements and monitoring applications in various processes or portable instruments. Near-infrared spectroscopy has several benefits such as fast analysis (less than a second), minimum sample preparation and good accuracy, better than 0.1% for moisture in most applications.
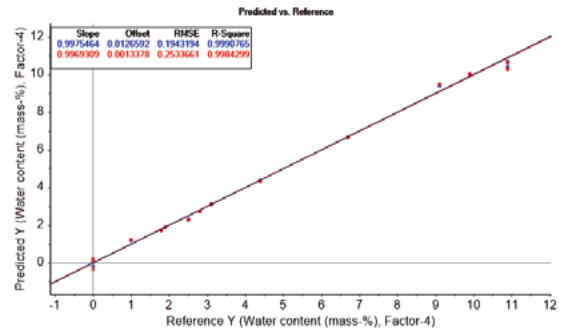
Benefits of Spectral Engines' sensors:

· Fast and accurate moisture measurement
· Sensitivity to ultra-low concentrations
· Easy-to-integrate in all processes using direct reflection geometry or combining sensor technology with fiber-optic probes.

Spectral Engines' spectral sensors can be used as stand-alone reflection sensors or they can be combined with off-the-shelf fiber-optic probes. Sensors are easy to use and their affordable price makes it possible to use them in many measurement points. Thanks to the broad wavelength region of up to 2150 nm and the high signal-to-noise ratio, sensors can provide high sensitivity and accuracy even for ultra-low moisture concentrations down to 0.01%.

Moisture measurement in flours in the milling industry

The protein, moisture, ash and enzyme content as well as other physical properties of flour can vary considerably. The purpose of flour measurements is to detect the specific properties or characteristics of a flour, such as moisture. Different elements in flour composition affect the flour's performance in the food industry, making it important that these quality variations are detected early on.

Spectral Engines' sensors offer excellent sensitivity and stability in milling process applications. For the 0–10% moisture range, the RMSECV (Root Mean Square Error of Cross Validation, 2sigma) value is approximately 0.50%, requiring only a one-second measurement time.
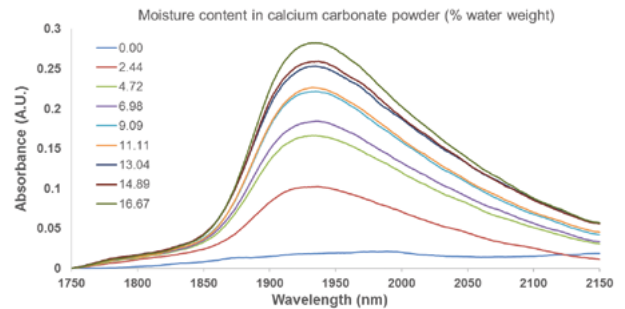

Predicted vs. Reference plot

Ultra-low moisture analysis of pharmaceutical tablets

The University of Leeds has examined the feasibility of Spectral Engines' sensors to detect moisture content. The moisture content of calcium carbonate powder was determined using the Spectral Engines NIRONE Sensors 2.2 with integrated light source operating at 50% of the light intensity, using an immersion NIR reflectance probe (50 scans averaged, 0.2 ms integration time, 1 nm resolution). The water–calcium carbonate mixtures were prepared in-situ using a fluidized bed. The moisture varies from 0 - 16.67%. Moisture concentration was tested successfully while extremely good stability was observed.
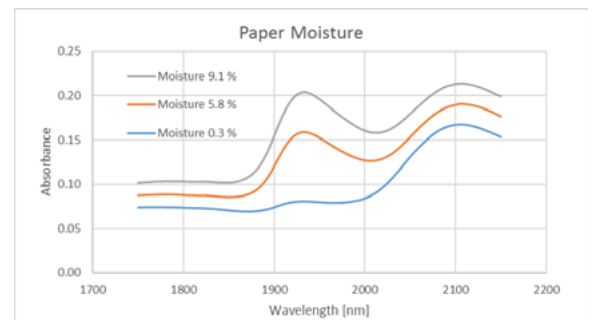
Moisture information is required in many process steps, such as those required by GlaxoSmithKline (GSK) for their process tableting pilot line. GSK is one of the world's largest pharmaceutical and health care companies and is also an industrial partner in the ProPAT consortium which is a 4-year EU-funded research program related to novel sensors and IoT solutions

Measurement of paper moisture

Moisture content is one of the most critical parameters in paper production. Moisture management has an impact on product quality, while moisture information is also used to optimize the drying process with minimal energy consumption.

Moisture content was analyzed from paper samples. The level of moisture varied from 0.1-10.1%. Even low moisture concentrations were easily detected with high accuracy. Based on these results, Spectral Engines' sensors have been demonstrated to provide an accurate and fast analysis method for low moisture concentrations in paper production. Measurements were carried out in collaboration with Valmet Automation, a leading-edge company in paper production lines and sensors.

Conclusion

Spectral Engines' compact and cost-effective spectral sensors enable fast, non-destructive, high performance ultra-low moisture content measurements in real-time process-monitoring applications. The affordable price point and small size makes it possible to integrate Spectral Engines' technology into demanding process devices or lightweight portable analyzers.

FOR MORE INFORMATION:

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