SPECTRAL ENGINES

APPLICATION NOTE

SMART INDUSTRY

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, e.g. in drying processes. The moisture levels of raw materials have large impacts on many processes, so 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 moisture measurement itself is non-destructive and fast, normally taking only a few tenths of a millisecond per sample. Spectral Engines' spectral sensors are incorporated into a fully programmable device that enables you to optimize your measurements based on the application requirements. Potential applications can be found from process optimization in

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

Spectral Engines' technology offering

Spectral Engines has developed miniaturized near-infrared sensor products which can be used for moisture measurements and monitoring applications in various processes or portable instruments. Near-infrared technology has several benefits such as speed of analysis (less than a second), minimum sample preparation (process measurement possible) and accuracy (better than 0.1% for moisture in most of applications).

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- The benefits of Spectral sensors are:
- Fast and accurate moisture measurement
- Sensitivity to ultra-low concentrations

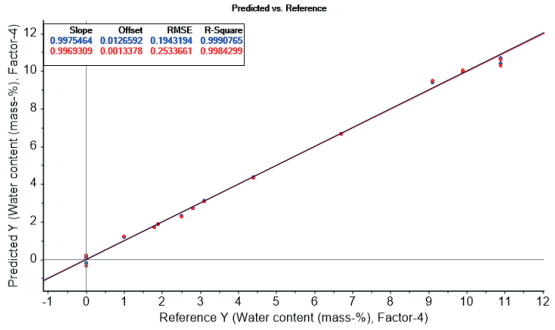
Easy-to-integrate in all processes using direct reflection geometry or combining sensor technology with fiber-optic probes

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 install and their affordable prices make it possible to use them in many measurement points. Thanks to the broad wavelength region of up to 2450 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

Flour obtained from different sources can vary considerably in its protein quality, protein quantity, ash, moisture, enzymatic activity, color, and physical properties. The purpose of the flour measurements is to detect the specific properties or characteristics of a flour, such as moisture. The results of these measurements affect the flour's performance in the food industry, and therefore these quality variations in the flour composition need to be detected.

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.

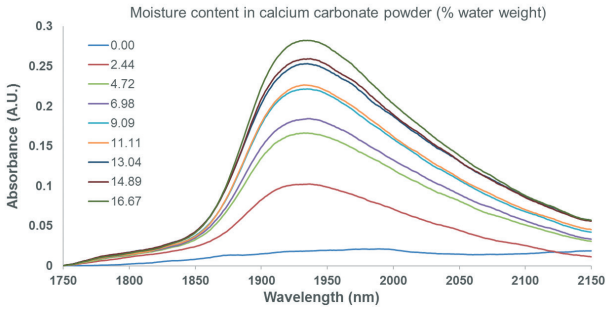


Predicted vs. Reference plot

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 NIR**ONE 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.

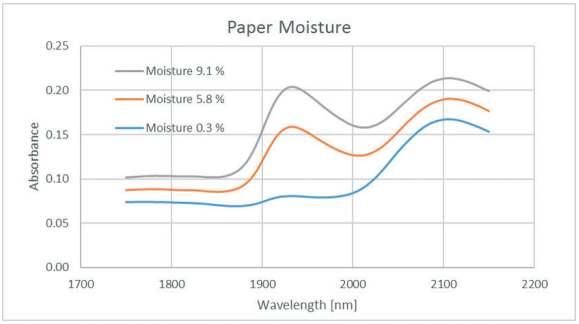
Moisture information is required in many process steps, such as those required by GlaxoSmithKline (GSK) for their process tableting pilot line. GSK is one of the world's largest pharmaceutical and health care companies and is also an industrial partner in the ProPAT consortium which is a 4-year EU-funded 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 the minimum of 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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