State of the art of UV – MIR spectral imaging: Innovated possibilities and applications

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From the first implementation a century ago, process analytics has grown into a well-established, very important and indispensable integral part of industrial manufacturing. Real-time analysis, monitoring, understanding and control of production have become a crucial part in every modern manufacturing facility ensuring product quality and process optimization.

Optical spectroscopy is one of the most important and extremely useful methods of analysis, providing fast, accurate, cost-effective, non-contact and non-destructive product quality control in manufacturing processes. Infrared spectroscopy merged with powerful imaging capabilities turned into fast growing Hyperspectral Imaging (HSI) technology sector, which plays an unchangeable role in applications where besides quantitative or qualitative chemical analysis or color measurements real-time spatially resolved product quality control is required.

There are four conventional ways to acquire spectral images: by snapshot, whiskbroom, staring and pushbroom methods. Each of the acquisition techniques has individual strengths and are widely adapted in various application areas. Line scan or pusbroom technology is well suited for conveyor belt or web applications and therefore most practicable in industrial manufacturing applications. In this way the whole production chain from incoming goods inspection, material qualification to product release can be controlled in both quantitative and qualitative manner in real-time.

Different markets have also different requirements on the measurement equipment. E.g., for HSI systems applied in process analytical applications, between the others, parameters like robustness, reliability, optical performance, acquisition rate, as well as affordable system price plays an important role.

Inno-spec provides innovative HSI solutions for process analytical applications that are able to meet the stringent requirements of challenging production environments and nevertheless provide precise and reliable measurement data. To reach unprecedented performance the whole system components are matched to each other and optimized, starting from camera, spectrograph and objective through the illumination unit and up to the data acquisition and processing software. Furthermore, imaging systems are designed to be seamlessly integrated into both in-line process control and laboratory measurements. Depending on the product and its properties that are to be monitored for process control, various spectral ranges can be selected, from deep ultraviolet (UV) to the mid-infrared (MIR) spectral range.

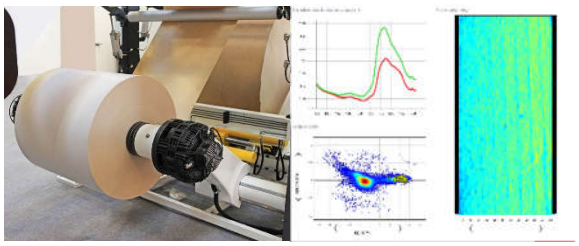

Fig. 1. Quantitative moisture profile mapping on paper rolls performed using RedEye HSI system in the 950 nm - 1700 nm spectral range.

Successful HSI system installations in food, wood, paper processing (Fig.1), sorting and other industries open up possibilities for real-time 100% production quality control.