Advantages of automated surface inspection

There has always been a great demand for metal manufacturers to deliver high-quality aluminium products, and this has only increased in recent years. As techniques and applications grow ever more complex, end-users require increased productivity and aluminium that is certified defect-free.

To ensure optimal quality and yield from aluminium production processes, a flexible, fully customisable surface inspection is essential.

That’s exactly what California-based AMETEK Surface Vision seeks to accomplish with SmartView, a market leader in surface detection platforms for the metal industry. Combining synchronised camera technology, high-intensity lighting and state-of-the-art software to capture defect images across multiple inspection angles, SmartView is continually evolving to meet new market needs.

The system examines surface condition similarly to how a person would: Studying the area and comparing it against expectations and past experiences. SmartView, however, operates much faster by providing immediate results. The system consistently reports on surface quality per a configurable classification scale that measures defect type and severity.

Using a modular, highly flexible approach, SmartView systems can be configured to meet the precise needs of individual processes, providing a unique, tailored solution. Powerful LED lights illuminate the metal surfaces uniformly to ensure the cameras can produce accurate, high-quality images across the process. This inspection data is then captured and analysed through high-performance servers and processed by sophisticated software tools for classification, control and reporting.

One of the elements that makes SmartView unique is AMETEK Surface Vision’s decision to use the best hardware for each application, rather than impose own-brand products that may not suit the intended use or keep pace with the latest developments.

For example, when selecting cameras to monitor the process, the resolutions and optical technologies that best fit the application can be used. The system’s architecture allows for the quick, seamless addition of cameras, allowing easy, modular upgrades to take advantage of advances in camera technology. Charge coupled devices and complementary metal oxide semiconductor cameras are both compatible with SmartView.

Lowering defects for manufacturers

The can stock market is notoriously known as one of the most-demanding packaging markets in the world. Semi-fabricator Hulamin has maintained a significant market share, providing its global customers with products of consistent high quality by using SmartView.

Historically, a significant number of surface defects would appear during the manufacturing process, from the hot and cold rolling mills to the finishing machine centers. The material inspections were carried out manually at each machine center via physical sampling. These defects can originate in the raw material (ingot phase) or be created during the rolling or coating processes. This leads to coils having to be scrapped completely or finishing with low yields.

Taking advantage of SmartView’s flexible, scalable nature, the solution was installed...
over several years, allowing Hulamin to spread the capital expenditure cost over that period.

Having installed the system, the operating team saw multiple benefits: 4% yield increase over four years while also seeing an increase in customer satisfaction, despite producing more complex products.

Hulamin Surface Engineer Dominic Moreno noted: “The SmartView system has exceeded our expectations. Its real-time information has proved invaluable for problem solving. By eliminating the reliance on post-production physical strip inspection, we were able to overcome our most significant hurdles.

“For example, on-line inspection allows us to monitor and troubleshoot our strip in mid-production, so the hot rolling mill can now be stopped after the second coil. This is because the process demands that the mill has to finish the existing coil and the next coil, which is already prepared – removing the sub-standard coil from the process at an early stage.”

The installation currently provides high-quality automated monitoring from the hot strip mill all the way down to the slitting and coating lines.

Information, saved in a SQL database, allows post-production tracking using AMETEK Surface Vision’s Production Quality Advisor software suite. The system is now fully-integrated with Hulamin’s in-house data management software to ensure seamless data connectivity and exchange. The streaming video software also allows Hulamin to review a coil at any time without uncoiling and recoiling the material – a big time-saver when checking product quality.

Moreno added: “Now integrated into our production process, troubleshooting and efficiency are at the heart of our operations. This neatly positions us to produce more-demanding products.”

Key features

Ideally suited to flat-rolled metals processing, the SmartView system offers slit inspection capabilities for automatic surface quality inspection of products at the slitter line. This allows the tracking of defects on both sides of multiple coil slits, even at line speeds of greater than 1,000 feet per minute.

Because it offers a complete, high-resolution surface inspection at full line speeds, delivering immediate feedback, the operator can react swiftly to limit waste, increase yields, and safeguard product quality.

As both sides of the metal strip are scanned simultaneously, fast slitter line speed is maintained. In addition, accurate mapping and reporting for each coil means there is no need to unwind the coil again to investigate quality issues. Consistent, reliable records are produced that can be used in supply chain management or quality assurance and archived for claim resolution.

When a surface inspection system is commissioned, a customisable defect library is created, providing a reference structure that quickly becomes filled with data relevant to the process. As the process runs and defects are identified, a library of detection thresholds and inspection parameters is formed. This library is easily configured to deliver the required level of detection classification and visualisation of surface defects.

One of the key features of SmartView is SmartLearn, the patented multi-step classification tool set which is supplied with each solution as standard. This software suite combines self-learning classification capabilities with expert
knowledge, creating multiple classification engines that can be perfectly tailored to each process and its unique requirements.

By ensuring the correct defects are identified and classified according to type and severity, the software maximises the potential for improved product quality, higher production yields and fewer customer returns.

Another important and powerful feature is streaming video functionality. This captures all image data for the inspected metal at the full camera resolution, using memory-based or disk-based image capture and display.

Using this feature, operators can view and review a continuous, real-time video display of the metal’s surface using standard cameras and lighting, without having to unwind or reroll the coil.

**Modular software additions**

Future-proofing is a key aspect of AMETEK Surface Vision’s approach. This makes it easy for operators to start with a basic system and expand it as the process grows and budget allows, creating highly-sophisticated inspection capabilities.

This modular method also applies to the SmartView software platform, which offers a range of extensions and updates that build upon the basic package. Through this, operators can create a customised inspection and analysis solution on-demand.

Among the additions offered are packages for coil grading, line synchronisation and system status monitoring. Other examples include:

- The Inspection Stacking package identifies and maps the locations of machine-induced defects from the last stage of processing. Last-stage defects may be difficult to uncover, but with Inspection Stacking’s ability to deliver statistics over a larger number of coils, it becomes easier to identify clusters of these defects.
- Parallel Classification is a function that enables up to four different classifiers to be run on an inspection file to check if they improve the identification of surface defects. This allows a user to set up test classifiers in parallel with existing versions, ensuring that defect detection is not affected or interrupted while the new classes are developed and refined.
- The Production Quality Advisor (PQA) suite provides advanced data analysis and display tools for current and historical production quality data, using surface system archives stored on SmartView servers. This allows reviews and comparisons to improve the understanding of product quality across single production lines or the entire mill.

**Simple integration, easy operation**

All SmartView software is Windows based, providing seamless integration into existing systems, straightforward system start-up, and operational flexibility.

It provides the user with total control of the interface, using intuitive dropdown menus and customisable windows to help narrow down results with precision. The high level of control permits an immediate response to worsening conditions, which helps reduce scrap product in the event of a process issue.

SmartView’s software is regularly updated, and the latest upgrade provides the user with a synchronised web viewer, which allows multiple viewers to be opened. This enables different process views, or the same view with a variety of queries applied.

Video file system enhancements now make handling large numbers of inspection files more efficient, and there is improved support for PDF report printing.

Long-term use of SmartView maximises results from the factory floor to the front office, with customisable user interfaces and reports.

SmartView is designed for the metals industry, providing reliable surface inspection and full process visibility that helps aluminium producers meet their quality and yield optimisation goals.

This product also brings the benefits of AMETEK Surface Vision’s expert application support, which helps deliver the optimal combination of lighting, cameras and other hardware to suit each customer’s unique situation.

Technical back-up is provided via phone, email and direct remote access, with options available for on-site engineering visits and training courses.

**Future Aluminium Forum**

Visitors to the Future Aluminium Forum 2019 in Warsaw, Poland, can meet team members from AMETEK Surface Vision to learn more about the latest developments in surface inspection and monitoring systems for the aluminium industry.

The experts will be at stand A06 from May 22-23 to answer questions about how automated inspection solutions can increase efficiency, streamline operations, improve product quality and reduce both costs and waste.

Full details of AMETEK Surface Vision’s solution for fast, accurate inspection of metal surfaces can also be found in the company’s new metals brochure, which can be downloaded from www.ameteksurfacevision.com.