HAMMER-IMS

Export prize winner Hammer-IMS, the inventor of the M-Ray, introduces new digital technologies to boost textile quality control
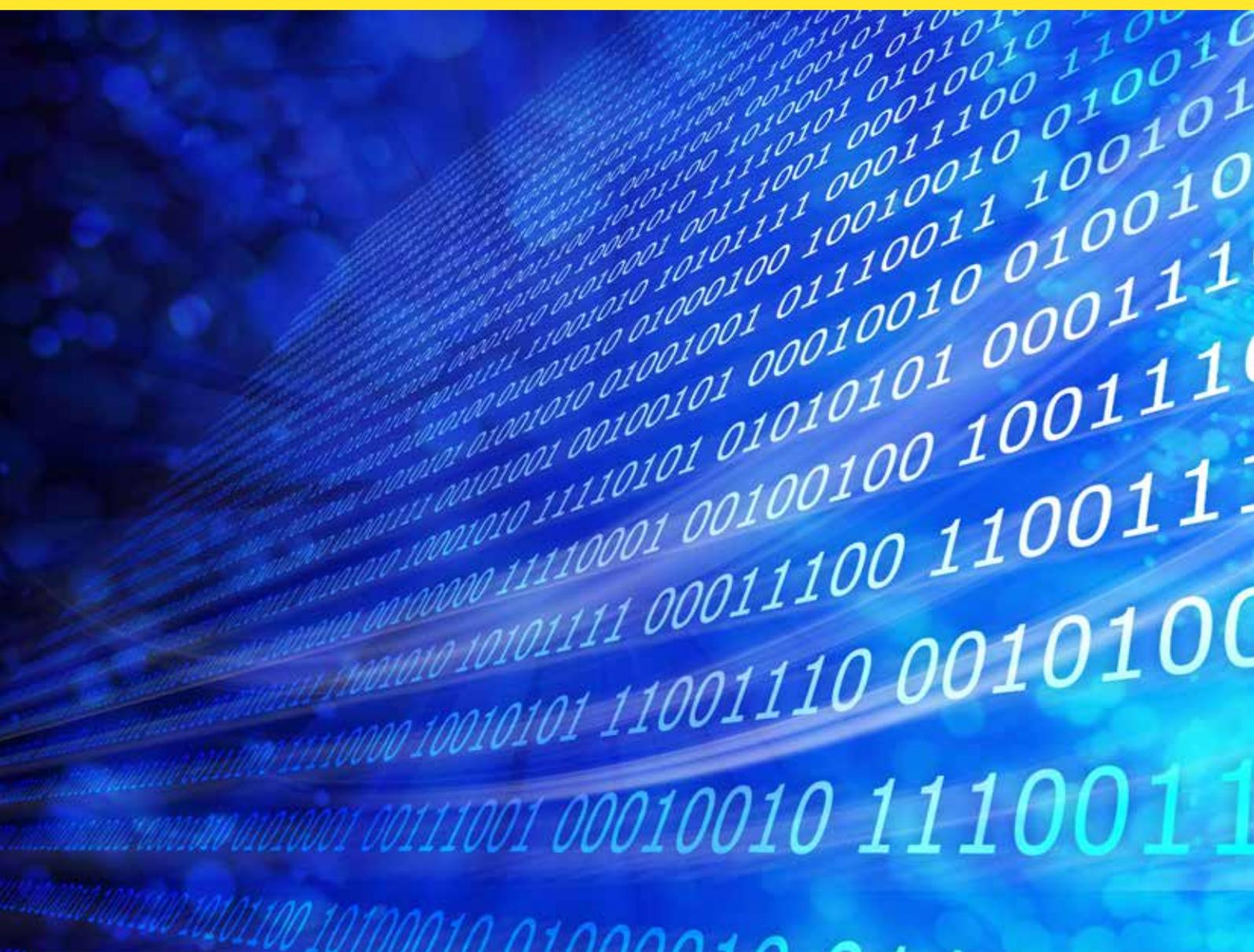
New C-Ray, U-Ray sensors and AI-driven vision technology drive quality control of advanced coated and multilayer textile manufacturing

Just recently, Hammer-IMS was awarded the VOKA Limburg export prize in Belgium. "We were able to scale geographically thanks to our non-nuclear M-Ray based systems for thickness and grammage measurement," says Tom Redant, CTO of Hammer-IMS. "At this stage we are extending our Marveloc sensor family with digital C-Ray and U-Ray sensors to drive more complete experiences in textile quality control. In addition, we are also developing powerful vision technology with smart machine learning to add complementary capabilities." Read more about what Hammer-IMS undertakes to increase the competitive edge of European textile and nonwoven manufacturers. Hammer-IMS is an example of how academic innovations successfully ripple through to commercially viable products.

Digitally measuring textile grammage is taking flight

Hammer-IMS, with its roots in KU Leuven University Belgium, successfully hit the market with its disruptive M-Ray technology back in 2016.

Originally started as a sensor-specialist, Hammer-IMS soon integrated its M-Ray technology, based on concepts similar to radar, into its own machines for inline quality control. In the meantime, the M-Ray based measuring solutions are perceived as a safe and environmental-friendly alternative compared to today's radioactive measurement systems.

"Low-defect operations and on-line quality control are essential to meet strict cost and quality requirements in textile manufacturing."

"Our non-radioactive solutions are unique, since they are able to measure the thickness of plastics just as easily as the grammage of coated textiles and nonwovens," says Noël Deferm, General Manager at Hammer-IMS.

Whereas traditional radar technology typically covers kilometer-wide areas, the Hammer-IMS specialists apply their digital M-Ray technology within a single-meter range. Consequently, this introduces tighter accuracy on micrometer level, which is roughly 50 times thinner than a human hair.

In recent years, radar technology has taken unprecedented steps towards miniaturization and affordability. The pinnacle would be that Hammer-IMS could integrate a dozen of smartphone-like devices - just as easy as that - in industrial measuring machines to make maximum use of internet of things (IoT) evolutions as shown on this conceptual picture.

Technically, the digital M-Ray technology combines electromagnetic waves with innovative algorithms. The M-Ray sensors emit high-frequency electromagnetic waves which slow down when passing through textiles. Continuous measurement of this time delay leads to accurate textile grammage measurements.

Many manufacturing companies, among which Low & Bonar (DE, UK), Silac Industrie (FR), Grandeco (BE) and Heimbach (DE), currently apply the M-Ray technology in their production or R&D divisions. Tom Redant, CTO at Hammer-IMS adds: "As they use Hammer-IMS systems to automatically measure textiles and nonwovens, they no longer need radioactive radiation-related licenses and specific training and production mechanisms."

The engineering expertise of Hammer-IMS ensures that installation projects are seamlessly executed from a to z. These customized solutions potentially include grammage or thickness sensing and in the future machine vision. In the end, Hammer-IMS provides machines that exactly match customers' needs: fulfilling all dimensional constraints, containing all relevant software features, and realizing the best measurement performance for the applications at hand.
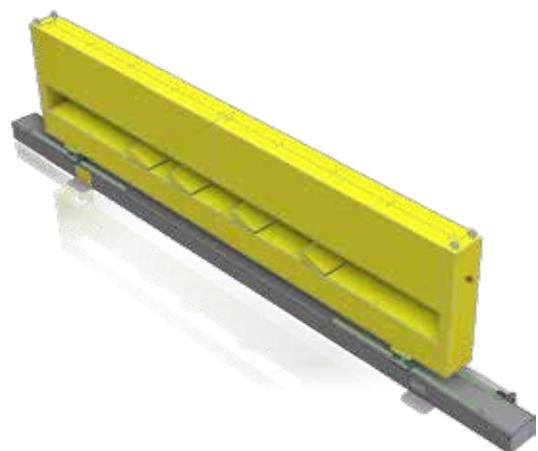
Digital technology innovation is critical for European textile and nonwoven production plants. Here's how Eulers-Hermes Global, an Allianz company and worldwide leader in trade credit insurance, sees the market evolve over the coming years: "Encouraging the adoption of (digital) state-of-the-art technologies would be beneficial to Europe's textile industry where SMEs dominate. In addition, a greener textile industry would place greater emphasis on quality rather than quantity."

"Bruised but not beaten, Europe's textile industry is a perfect candidate for a greener and digital recovery."

Technically, the M-Ray sensors emit high-frequency electromagnetic waves which slow down in speed when passing through textiles. Continuous measurement of this time delay leads to accurate textile grammage measurements. The digital M-Ray technology combines electromagnetic waves with innovative algorithms.

M-Rays in a compact box - As M-Ray sensors are gaining popularity, Hammer-IMS also made this environmental friendly measuring technology available for third parties. Its M-Ray OEM module enables manufacturers and integrators of inline quality control solutions to insert M-Ray sensing in a plug-and-play manner. Hammer-IMS also integrated this module into highly customized solution configurations for customers. OEM modules of other Hammer-IMS sensor types are likely to follow at later stages.

Extending its offering through digital innovations and internationalization

Currently, Hammer-IMS is growing steadily and is systematically internationalizing its activities, also with some first steps in the United States. "For this reason, Hammer-IMS received the 'Young Export Potential' prize of VOKA Limburg." At the same time, the company continues to sharpen its innovative digital M-Ray technology, making it also able to address heavy-weight carpets and thick bitumen products, for example.

"A new milestone for Hammer-IMS is the introduction of two new Marveloc sensing technologies, our C-Rays and U-Rays", marks Tom Redant. "A capacitive C-Ray sensor is ideally suited for compact, low-cost measuring applications in plastic film extrusion. We are also introducing a digital ultrasound U-Ray sensor. This has been accomplished by upgrading analogue ultrasound sensing with digital signal processing techniques (DSP) to enable ultrasound wave phase detection. The U-Ray sensor excellently fits solutions for battery film applications, thanks to its capability to measure through metallic materials."

As part of a Belgian funded research project, Hammer-IMS is further extending its M-Ray technology in the higher terahertz frequency-range. "As this introduces even higher measurement performance and accuracy, terahertz M-Ray, for which we have not introduced a fancy name yet, allows quality control on higher-grade products such as multilayers and composites," explains Noël Deferm. "These products will increasingly become part of the European production market. To strengthen their competitive edge compared to Asia, manufacturers in Europe aim to offer a unique value proposition by providing qualitative high-end products."

"Sensor-assisted production data collection (such as M-Ray based quality control solutions) will have the greatest effect on process efficiency and product quality in the textile industry."

By combining multiple technologies from the Marveloc line of M, C and U-Ray sensors, manufacturers are able to retrieve even more information from measurements taken with a single Hammer-IMS machine.

Machine-vision platform with step-up towards deep learning

"To add and accommodate machine vision, we developed our EDGE-VISION-4.0 machine vision platform roadmap," says Tom Redant. "The platform would flexibly deal with various accept/reject problems, and identify anomaly levels in products. The focus is on roll-to-roll processes involving nonwovens, textile coating and plastics extrusion." Concretely, we will have it installed in applications of detection of color variations (e.g. improper blending) and defects (e.g. holes, black spots, particles, and even insects) in the production of textile coatings, nonwovens and transparent films.

Important in this regard is the availability of 4K optical chips in medium-cost industrial cameras, which offer 4096 pixel lines with reasonably good light sensitivies. Noël Deferm: "The giant pixel array enables inline quality control by even applying a single camera across the entire production line width, detecting anomalies up to one hundred of a micrometer in dimension."

"The self-calibrating vision solution of Hammer-IMS is easily transportable," explains Tom Redant. "It can be flexibly moved to alternately operate in multiple production lines. For this reason, the business case for our innovative vision solution is quite appealing."

Tom Redant: "Recent advances in the domains of algorithmic programming and hardware-accelerator chip technology play a pivotal role in machine vision processing. These enable to automatically train and solve complex decision-making tasks, such as anomaly detection and feature extraction, quickly and responsively. Deep learning and artificial intelligence are essential in this regard. Developing these AI applications in house is part of our development roadmap and will be part of future generations of our EDGE-VISION-4.0 platform."

Digitally streamlining data transfer, analysis and decision making

Textile and nonwoven producers configure their measuring solutions by selecting the appropriate Marveloc sensors (M-Ray, C-Ray and U-Ray) or machine vision (EDGE-VISION-4.0) and mechanical platform. When the machine is performing its task in the field, it is both practical and productive for them to remotely monitor the production process. This is particularly useful in the COVID-19 era when traveling is limited.

"As a first step, an internet-wired machine enables Hammer-IMS to flexibly intervene from a distance," says Tom Redant. "Remote diagnostics, predictive maintenance and firmware upgrades minimize response times, machine downtime and service costs for our customers. For a number of customers, we take connectivity one step further. We interconnect multiple machines to centralize measuring data in a local database through Profinet or OPC UA field buses by means of our Data Connection Extension Module. Data monitoring and analysis on plant level allows product quality to be safeguarded more effectively and efficiently."

The summum is making measuring machines serve as smart devices interconnected in an intelligent network spanning multiple production plants. To manage huge amounts of measurement data in the cloud, Hammer-IMS is working with third-party software of the German company Inmation Software. It aligns with the Hammer-IMS's Industry 4.0 vision by bringing quality data to the cloud, securely and in real time. The platform enables production managers to see their industrial production data from anywhere in the world and share the well-structured data with various stakeholders to further optimize the quality of production batches.

The Data Connection Extension Module of Hammer-IMS, a configured PLC system supporting Profinet, USB or OPC UA.

After the adoption of it disruptive M-Ray measuring technology, Hammer-IMS innovates by developing and introducing new C-Ray, U-Ray sensors and AI-driven vision technology. Noël Deferm: "These digital technologies enable European manufacturers to stand out by delivering outstanding product quality, which in turn, strengthens their competitive advantage worldwide."