New System Utilizes EMF Technology to Measure Sheet Thickness, Temperature

An altogether different approach to in-line measurement is said to provide direct thickness measurement, is impervious to material density changes, installs quickly and does so without radiation.

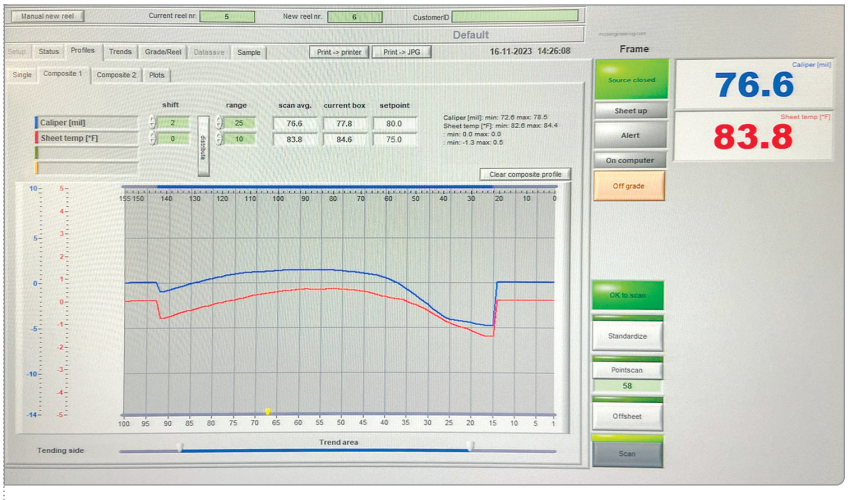
Mikros EMF system installed on a sheet line. The system uses no belts or vector drives and instead relies on an independent linear drive system on each head. The technology is nonnuclear, so no shielding is required. Source: Mikros LLC

By Jim Callari
Editorial Director

Flat film and sheet processors have a new way to measure thickness. A patent-pending system developed by MCS Engineering from the Netherlands in conjunction with Mikros LLC, Las Vegas, Nevada, utilizes electromagnetic field (EMF) technology to directly measure both web thickness and temperature while providing processors with an alternative to beta/X-ray gauges in a much lighter and smaller package, as it requires no shielding to guard against radiation.

Mikros was formed about two years ago by industry veterans with experience in web-thickness measurement. Bruce Johnson, the company's senior vice president, was formerly the president of Indev and Automation and Control, which Indev purchased in 2017. Johnson also owned Mikros' predecessor company Microspect, which was also in the business of system development of in-line control and measurement. However, Microspect's markets were far more varied — plastics, paper, steel, nonwovens, roofing shingles and more — whereas Mikros focuses specifically on web or coiled products.

The technology was developed by Wim Muller as president and lead developer of MCS Engineering in the Netherlands. For more than 20 years Muller was a senior development engineer for ABB Ltd.'s paper division in Europe. In 2023, he hired Francis van der Burgt as senior processor engineer at MCS. She is now general manager and supplies Mikros with the EMF sensor technology.



One reportedly novel feature of the EMF scanner is that it can measure both web thickness and temperature.

Johnson reports that MCS/Mikros has 15 EMF systems up and running in the U.S. (six) and Europe (nine). In addition to the MCS/Mikros measurement system being lighter than typical beta gauges, it uses independent linear drives, eliminating the larger AC drives and all the belts typically used in other scanners. This is said to expedite field installation to a few days and greatly minimize maintenance. "Maintenance personnel love the fact that there are no belts," he says.

Johnson explains the setup: "We scrap the entire belt system and vector drive approach, instead using independent linear drive systems on each head. Essentially there is a precision linear rail on the top and bottom of ►

the frame, with a motor/drive attached to each. These heads are about one-third the weight of those used in typical beta and X-ray systems because they require so much shielding. Heads are not connected with belts or shafts; they're independent, but because of the encoders, alignment is much more consistent than with a belt because belts can slip. If the heads ever do get out of alignment, you can basically send them both 'home,' where they auto align and continue measuring. If a drive were to go out, it's plug and play to replace."

The measurement algorithms are said by Johnson to be simpler as well, as the EMF system measures thickness directly and requires no basis-weight conversions or concerns about refractive indices. The system can measure web thicknesses ranging from 6µm to 0.7 inches and widths from 12 to 280 inches at ±0.02% repeatability. It is also set up to communicate with cast film and sheet lines that feature automatic die-bolt mapping and adjustment.

"This is a new idea in thickness measurement," Johnson says. "It's *direct* thickness measurement. We're using an electromagnetic field that we pass throughout the material itself. Beta or X-ray gauging systems do not measure film thickness directly. They measure basis weight and/or density, then use algorithms to correlate to thickness, which can vary widely based on deviation in the raw material."

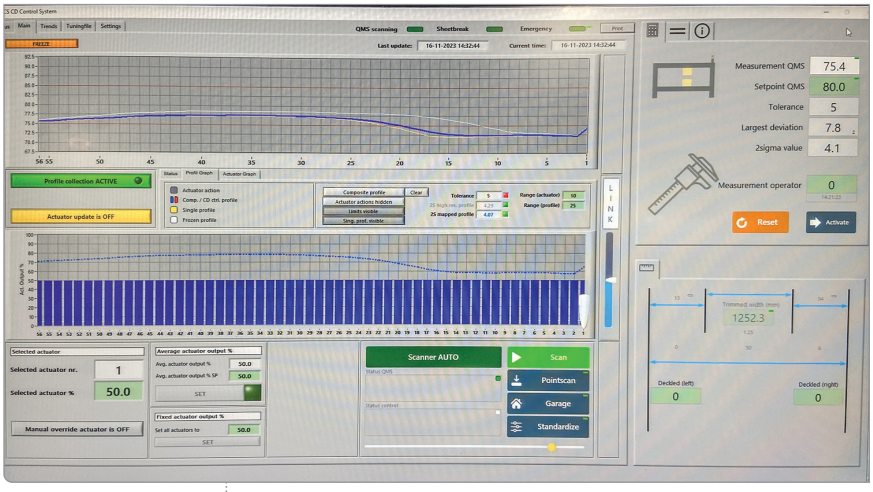
EMF technology is also almost entirely impervious to density variations in the material being measured. "That is why it does well with regrind and high loadings of calcium carbonate," Johnson says. "You could put in 100% reclaim and it doesn't care." One of its first installations involved sheet that was filled with metal for an undisclosed government project. Johnson recalls, "When you have metal inside of plastics, your densities are all over the place. Even though it uses EM field measurement, our system didn't care. It was able to get more than enough data to obtain very accurate thicknesses even with a large volume of metal inside."

The fact that MCS-Mikros EMF technology measures web temperature at the same time is an added and critical benefit, Johnson says. At one installation, he says the ability of the EMF scanner to map sheet "hot spots" and immediately identify quality defects helped avoid a potentially serious customer issue while significantly reducing the ROI.

He elaborates, "The first problem they solved using EMF technology measurement was hot spots on their chill rolls. This was happening intermittently and was being caused by small amounts of dust flakes that were slowly dripping above the line and building up on the rolls. They were chasing this problem for a long time, seeing spot thickness variations that came and went. Once they installed the EMF system and started measuring thickness and tempera-

ture across the web, they realized that these variations were not caused by process fluctuations or anything related to the die bolts or heaters. So, through process of elimination, they investigated the chill rolls."

During operation, a solid continuous gap of 5 mils is maintained between the web and each sensor head. A controlled stream of air is used to make sure that the distance from the surface of the web to the bottom of the EMF sensors stay stable. This provides what Mikros says is an extremely accurate and fast response to thickness changes within the sheet.



Operator interface of Mikros EMF scanning system.

Sensors remain noncontact, and with an independent sensor-servo control along with high sensitivity of the sensor heads, the slightest variation in electrical-magnetic field strength, thickness, temperature and even metal presence is detected quickly and accurately, Johnson states. Data is then relayed typically via OPC to PLCs, PCs and plant networks for analysis and closed-loop process control.

Profile measurements and trends are continuously mapped and displayed on the operator screens along with process system adjustments. Utilizing the cross-direction profile controller, MCS-Mikros can also provide a high level of extrusion die, nip roll and other process automation, all without isotopic radiation, Johnson says. He adds the technology costs about 5-10% above conventional systems but requires no external inspections or source disposals. PT