

FROM THE SUPPLIER

Next Generation Optical Caliper Sensor Technology

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CALIPER MEASUREMENT AND CONTROL is a vital part of papermaking. But this measurement can be a challenge. Over the years, various mechanical and optical sensors have been invented to achieve the best combination of accuracy, no sheet damage and reliable operation. Traditionally, this has been achieved through the use of dual-sided, contacting caliper sensors. But some paper applications pose tremendous challenges for the contacting caliper skis.

ABB has introduced a new optical on-line measurement that measures caliper without two-sided contact of the sheet and without laser triangulation and its inherent inaccuracies. The new sensor uses a different optical approach which provides greatly improved measurement accuracy and stability. The sensor is ideal for applications where the sliding skis of traditional caliper sensors gives rise to problems.

The optics approach for our Optical Caliper Sensor is based on a confocal displacement method. The term "confocal" implies that one very small spot of the surface is in sharp focus for both source and detector by a shared lens and fiber optics delivery.

The measurement system analyzes the reflected light and the maximum detection peak is due to the light from the top surface, while all other reflections are out of focus and not detected. This technology has made recent advances for applications in microscopy, thin-film research and semiconductor manufacturing. It has also been demonstrated in research facilities for study of sub- μm paper surface topography.

As a result, this Optical Caliper Sensor senses the true paper surface, thereby vastly reducing the light penetration errors typical of laser-based caliper sensors. Individual fibers are always detected clearly and in sharp focus. The fiber translucency and related light penetration is not a problem for this technology.

A well-controlled sheet position is essential for any optical caliper measurement. The sheet in this sensor is positioned accurately and kept very flat by means of a sheet stabilizer in one sensor head. The stabilizer contains the optical target where the optics are focused. The sheet control is achieved by means of dual concentric rings with a very light vacuum. This will gently stretch the sheet and remove any wrinkles in the optical measurement zone. Super-smooth ceramic coatings and hard materials are used in the sheet stabilizer plate to prevent build-up and sheet marking, and to

provide excellent wear resistance. The large vacuum zones are designed to prevent accumulation of fillers and coating and reduce or eliminate the need for maintenance cleaning, without marking the sheet or allowing build-up of coating or contaminants. As a result, the Optical Caliper sensor is applicable to demanding grades such as newsprint, coated, super calendered, and fully-recycled grades.

The new sensor was first tested on a large, dual-side coated LWC machine. Exceptional agreement with the contacting caliper sensor. Figure 1 displays a high resolution CD profile comparison between the optical caliper (OC) and the contacting caliper sensor (GT). This profile was taken from inspection data during the test production period.

This machine produces a close to 10-m wide sheet running at more than 1,600 m/min, with inline multi-station coating. Despite the high speed, a thin sheet and considerable vibration, the optical caliper measurement agreement with the contacting sensor was excellent.

It can be seen that the profile deviation between the two sensors is typically better than 0.5 microns on this process. One can also see that the optical sensor detects small scale variability more clearly than the contacting sensor. One of the main concerns with this customer was potential sheet marking by the sheet stabilizer. The process was monitored daily for sheet marking. No marking was observed, due to the stabilizer's light sheet contact.

Another permanent installation is on a large, 100% recycled furnish newsprint machine. The machine produces a 9.3-m wide sheet running at 1,800 m/min. This process can pose problems for contacting sensors such as occasional build-up on the contacting sensors or other mechanical factors that may cause degradation in measurement or creating sheet handling problems. The profile deviation between contacting and optical measurement in this example is better than 0.5 microns.

The sensor has been used for CD control in this application since mid-February, 2009. Since then, the paper maker reports improved reel building, and profile variation is reduced compared to the results from the contacting sensor. Furthermore, the sensor has proven nearly maintenance-free on this process and does not require any special cleaning or periodic adjustments. Sensor profile agreement with the customer's laboratory has also been improved, with agreement better than 1 micron and very good long term sensor stability.

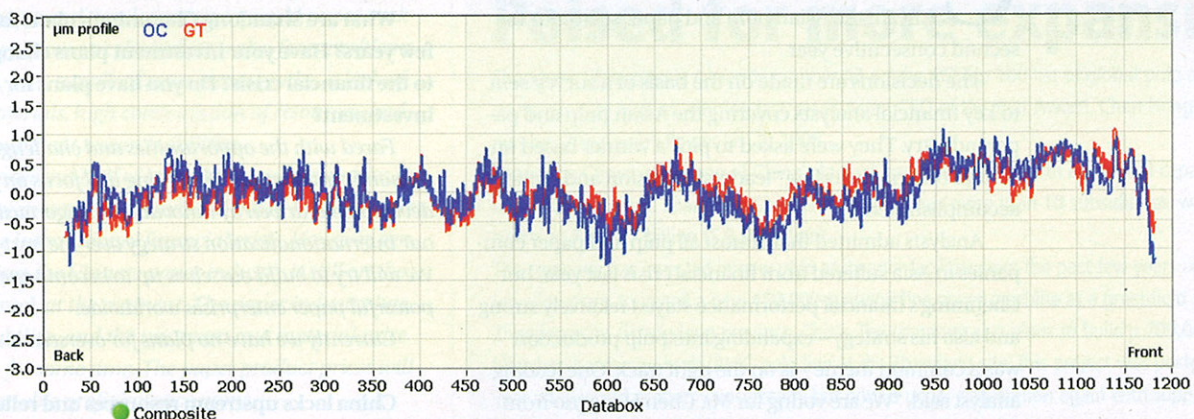


Fig. 1 - ON-LINE HIGH RESOLUTION COMPOSITE PROFILES ON DUAL-SIDE COATED LWC PAPER