SUCCESSFUL CASE STUDY

COATING STREAK & SCRATCH DEFECTS ARE NO LONGER UNATTAINABLE!!!!!

R.K.B. OPTO-ELECTRONICS, INC., (or RKB®) was contacted by Reno de Medici Ibérica s.l., (Reno) sited in Almazán, Soria (Spain) to help solve the companies problematic and costly coating streak and scratch defect phenomenon commonly found in most coated material processes. RKB was to provide a reliable, accurate and consistent solution to detect, classify and eliminate these defects subsequent to shipment. Reno is Europe's second largest manufacturer of high-quality coated white lined, grey back, kraft back, white back, and bleached (220gsm to 500gsm) boards, and was established in 1967 in Milan, Italy. Reno has developed a reputation of providing extremely high quality coated products with a capacity of over 950,000 tons and a market share in Europe of 20%. In a concerted effort to maintain this leadership role, Reno set out to combat one of the most virulent defects that can dramatically affect the quality of coated products and damage highly sensitive conversion processes that use their coated products for various high end printing and packaging commodities.

Jesús Simon, Director Técnico of Reno, involved in the project from the beginning to end, explains the success of RKBs innovative solution this way. *"We are highly satisfied with the performance of this system since it was installed. It can detect every kind of defect: spots (any grade of shade), holes, non-coated areas and coating streaks and scratches (even when these streaks are very, very narrow) .we chose it among other suppliers because it was the only system that could detect coating streaks from the very beginning until the end."*

HIGHLY ADVANCED STREAK ENHANCMENT TECHNOLOGY

Since all inspection solutions require a transmission of luminance and a collector of that luminance (i.e., light to camera) of some form to operate, these lighting and sensor techniques and types are very critical to a successful detection system. The system RKB provided Reno consists of two configurations, one for discrete defects such as small dirt and one for subtle continuous defects such as coating streaks. A schematic of the system used for discrete defect detection is described in *Figure 1*.
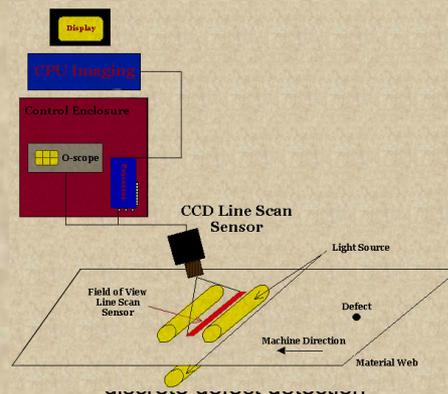
Figure 1 – Diagram of RKB system for hole/ spot defect detection

The RKB system for discrete defect detection can work both with reflective and transmissive light for defect detection, classification and mapping. The principle of this part of the system is as follows: a lens is imaging periodically a line across the web surface into a linear array of CCD (Charged Coupled Device) pixels (photosites, photodiodes). The quantity of light collected by each pixel is independent from the other. An increase or a decrease of the energy collected by a pixel above or below a fixed threshold indicates that a hole (light or bright spot) or a dark spot is present on the web surface. If more than one-pixel experiences an increase or decrease of energy at the same time, then the defect can be, and is, classified into three main categories (small, medium or large), depending on the number of pixels affected.
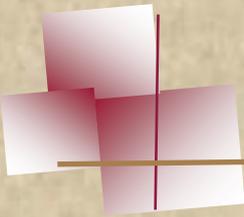
A schematic of the system used for subtle continuous defects such as coating streak detection, using the same frame, cabinet, and computer, but different sensors, lighting techniques and electronic processing techniques , is shown and described in *Figure 2*.
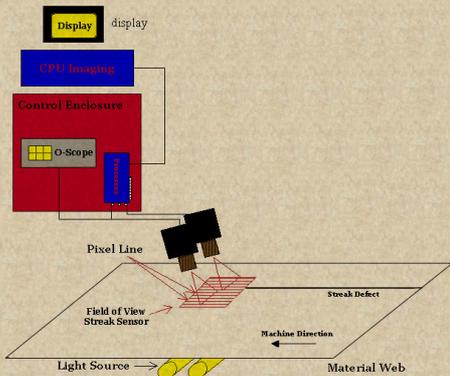

Figure 2 – Diagram of RKB system for subtle continuous defect detection

As shown in *Figure 2*, transmissive light can be used for the detection of subtle continuous line defects using RKBs OPTO-TEK II® Streak Cameras developed and patented by RKB. This detection technique, as with the technique used for discrete defects, can use reflective, transmissive or both lighting techniques for reliable, consistent and accurate detection.   In this installation, standard type reflective lighting was used for illumination. The principle of this part of the system, however, is confidential and proprietary. Nonetheless, similar to the discrete defect detection, the absence or increase in light plays an important roll in the overall detection capability. Of course, the signal processing, especially that designated for noise reduction is one of the main operational aspects of the ability to detect subtle continuous line defects.

Figure 3 – Sensor Station

Figure 4 – Lighting

Figure 5 – Processing Station

Figures 3, 4 and 5 show the control, sensor, lighting and interface sub-units of the system in greater detail. These sub-units are designed with flexibility in that, they can deal with the detection of holes only, dirt only, hole/dirt, streaks only or all defects that can occur during the process of coated and non-coated material manufacturing. The lighting and the sensors are attached on the same frame.

Since material base colors and coating colors are generally similar in appearance as a coating streak defect, the streak or scratch generally does not facilitate a significant increase or decrease in energy (luminance) received by a sensor. Therefore the electronic noise level appears the same or similar to the actual material in which the defect is present. In most cases, light present at the streak edges where coating has furrowed is more widely tried by "line scanning" system integrators and suppliers in an attempt to detect the defect. Notwithstanding a slight signal at the edges of streaks, the process of furrowing in many cases does not provide for adequate signal strength where one might see a thicker accumulation of coating – *Figure 6 & 7 & 8*.

Figure 6 - Coated White Board – Reflective Lighting Technique Coating Streak 0.25" (6.35mm) wide
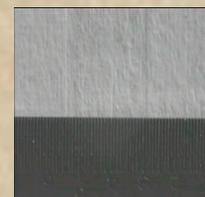

Figure 7 – Figure one streak defect magnified Scale shown 100ths (inch)
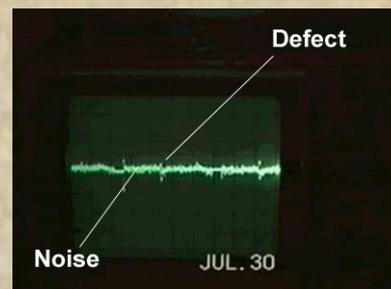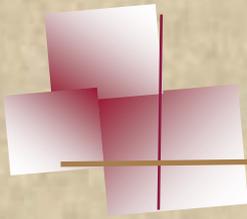

Figure 8 – Signal to noise of streak using line scanning techniques

Depending on the type of material (OMC, Supercalender, Paper, Film, Metal Board, and their associated basis weights), the variations in surface transmission or reflectance can produce a great amount of electronics noise in the initial raw data (signal) out of the sensor – *Figure 9*.

Figure 9 – Initial Raw Data

Thus, inherent high background noise makes detection of very subtle streaks or narrow scratches, much more difficult. To compensate for this problem, RKB designed proprietary noise reduction circuits that work with any color, weight or material equally and reliably. The result is a very clean, consistent signal that can be detected on a ratio as small as 1.5:1 or 200% higher than standard line scanning techniques (*refer to Figure 10*),
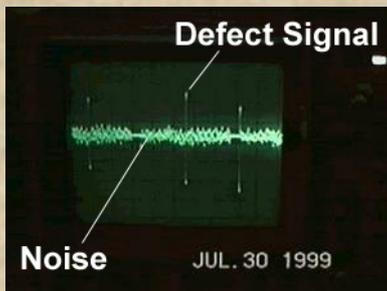

Figure 10 – Electronics Signal after RKB noise reduction

Based on various installations, system evaluations (i.e., The Institute for Paper Science and Technology) and overall sample evaluations from thousands of samples of coated materials, RKBs coating streak detection technology detects 99.9% of all streaks and scratches for which the solution is designed for. This means rejects due to streaks (varies from mill to mill) can be eliminated prior to product shipment, and in fact, eliminated from being produced all together when properly implemented on coating process machines such as off machine coaters, on machine coaters, laminators and supercalender machines.

POWERFUL PROCESS INTELLIGENCE

Once one has reduced the noise level and stabilized the raw data (signals), the systems process intelligence controls take over. Once the electronic noise has been "squashed" the process control circuitry takes the resultant defect signal and further filters and amplifies it prior to digitization and outputting. This ensures that there is a solid, reliable and consistent signal to work with. If digitization was done prior to filtering and amplification, the signal would become unstable and potentially break up (i.e., those fortunate to have digital cable at home will notice the picture transmitted too their television breaks up or freezes from time to time).

Once the defect has been processed and digitized, the output is then sent to audio/visual alarms and the main systems quality assurance management system called QAMS®. QAMS will report the type of defect, length, start and stop times and footage, exact location cross direction and machine direction, as well as many other features required for accurate data logging and historical purposes – *Figure 11*.


Figure 11 – Reno personnel utilizing QAMS.

BENEFITS GAINED

Obviously the first and foremost benefit gained by using the RKB Streak Detection Solution is the ROI and annual savings in lost profits due to rejects, customer complaints and the impact from lost business with customers. Additional benefits gained are:

- Streaks Detected – RKB's streak detection system can detect coating streaks and scratches as small as 1 micron wide at any known production speed – GURANTEED!!!
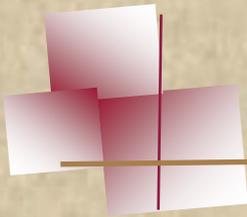
- Fewer Machine Stops – less scheduled and un-scheduled stops to clean the coating station(s) representing thousands of dollars saved.
- Optimized quality and pricing – a very important factor, both duringsaturated or under-saturated market conditions.
- Product Grading – Although many product runs are manufactured to order, roll quality data as provided by the streak detection solution can be very advantageous.
- Elimination of streaks and savings in the tens of thousands of US Dollars per annum.

IMPRESSIVE MAINTENANCE

When RKB installed and started up this unit, it was estimated that maintenance costs would be mid range in the area of USD 10,000.00 per annum. After careful analysis of maintenance costs over a number of years, costs for maintenance including spare parts has not exceeded USD 6,700.00 total for the ten years of data collecting. An astounding statement of system capability, accuracy and reliability.

RKB does have a service contract with Reno to provide bi-annual preventative maintenance, calibration and performance verification.

WORKING FOR YOU

For more information on RKBs coating streak and scratch detection solution, please visit our web site at www.rkbopto.com. If you have an immediate application that requires reliable detection or your companies "Line Scan" system just does not deliver, call RKB and invest in technology that truly is a quantum leap in the art of subtle defect detection.

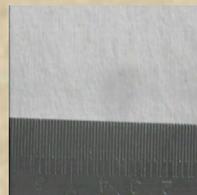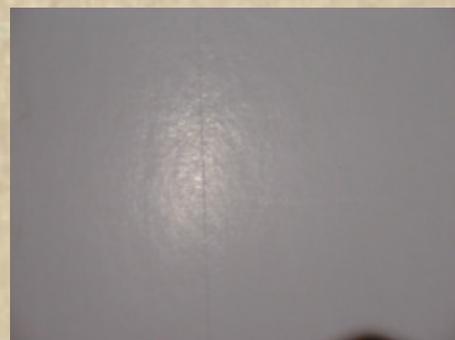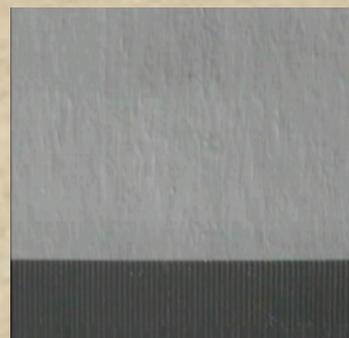## SOME OF THE MANY TYPES OF DEFECTS DETECTED
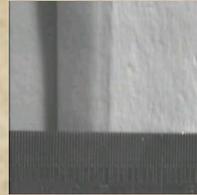
Bad Edge

Coating Skip

Coating Void

Fiber Clump

Light Spots

Oil Spots

Coating Scratch

Coating Streak

RKB System Installed at
Reno de Medici s.l.