Latest Technology in Thin Film Measurement

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In order to increase the productivity of the WEB coaters and to reduce scrap, a real time online monitoring system is required. Such a system will enable an operator to detect all quality relevant deviations in an accurate and immediate way. Thus necessary corrections can be accomplished and supervised without delay.

Today, most WEB coating machines are equipped with monitoring systems to measure and control the metal layer thickness and homogeneity. However, these systems usually measure the optical density or sheet resistance only at few fixed positions across the film width. In addition, the measurement frequency is low. Therefore, only little information is available to control the coating thickness homogeneity.
In the case of patterned capacitor films, none of the present instruments is truly capable of measuring the layer thickness reliably, if the structures become smaller than about 15 x 15 mm^2. Effects like e.g. banding or Al-dripping for example are not accessible by present measurement methods. Their oscillations are beyond the longitudinal resolution of the current sensors.

In case of capacitors the situation for the free margins is similar. Conventional systems measure the width of the free margin with a traveling sensor at several programmable positions. Therefore, the free margin and the homogeneity across the full web width can only be controlled at a very low frequency (several 10 seconds refreshing time corresponding to several hundred meters longitudinal resolution).

In order to eliminate the disadvantages of the existing measuring systems and to enable quick response times, Leybold Optics GmbH developed a new sensor shown in Fig. 1. The optical density of the metallization is measured with a high spatial density of sensors and a high speed of data acquisition. The layer thickness for active area and heavy edge is measured simultaneously. The uniformity of the layer thickness can be supervised across and along the web. The dynamic range for the layer thickness is 0 – 4 OD. The sensor allows the measurement of the layer thickness for patterned structures down to 3 x 3 mm^2 even for winding speeds of 20 m/s. A second line sensor is attached to measure all free margins simultaneously with the same refreshing rate. Thus the uniformity of the free margins can be controlled across and along the web. The resolution for the width of the free margins is less than 50 µ. Experimental results for the measurement of the free margins are shown in Fig.: 2 and 3.

The combination of both sensors opens new possibilities for online control: the alignment of free margin, heavy edge/ active area and pattern will be measured in real time.

With Leybold’s new sensor DISS a operator can

- Measure all free margins simultaneously
- Control layer uniformity across and along the web in real time
- Control layer thickness for patterned capacitor film online
- Reduce scrap by real time process control

Fig. 1: Mechanical design of the DISS sensor

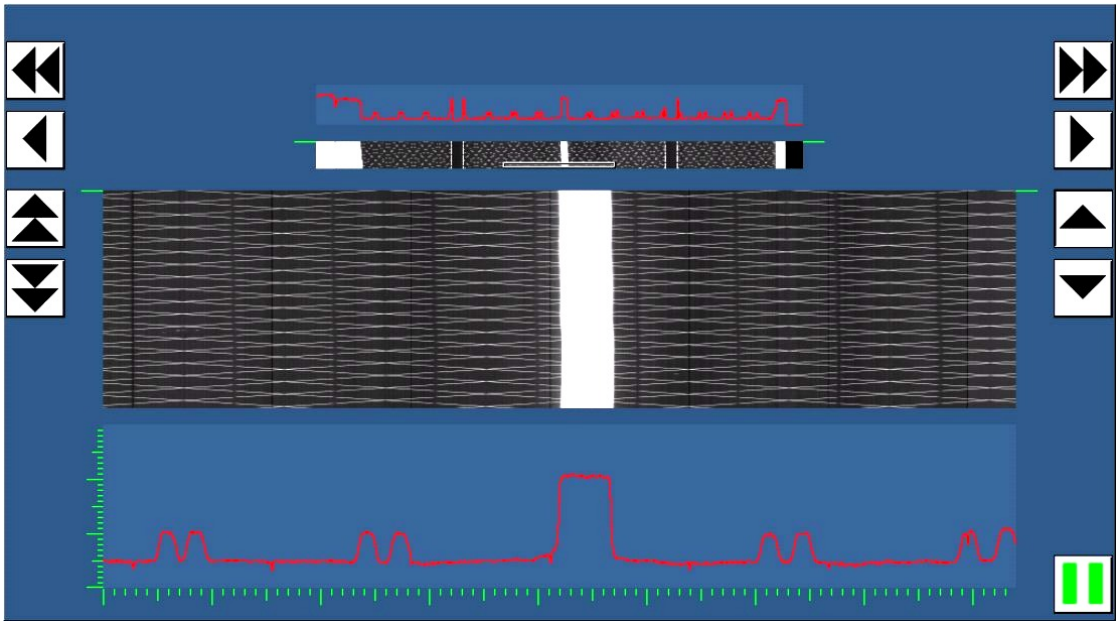

Fig. 2: Measurement of free margins for pattern film at a winding speed of ~ 18 m/s. Width of the free margin: 4mm; pattern size: 8 x 8 mm²

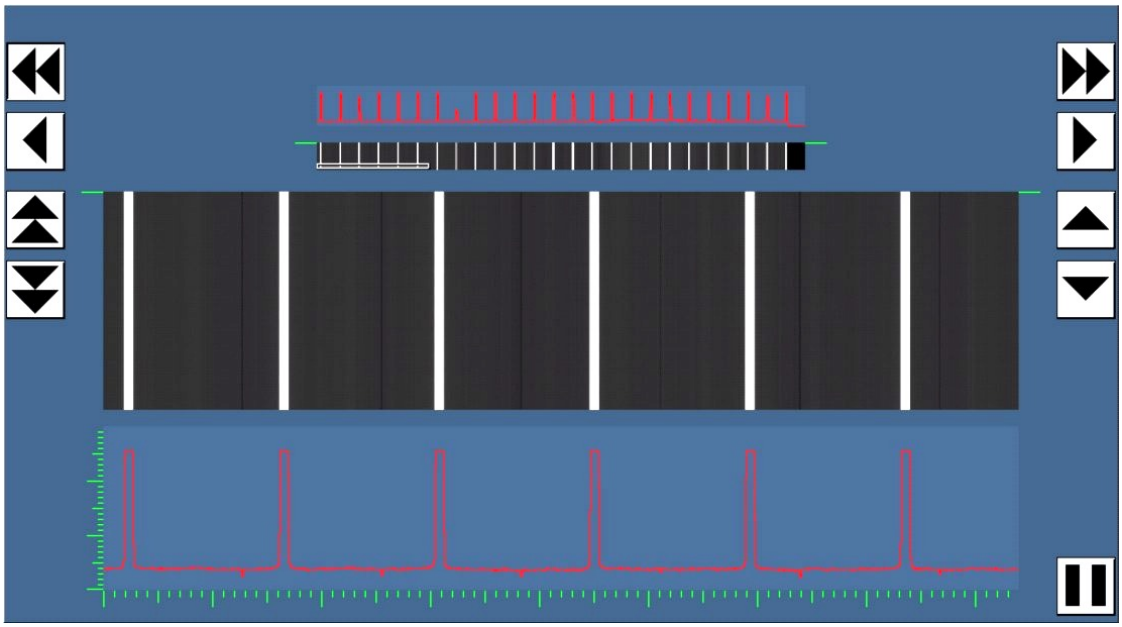

Fig. 3: Measurement of free margins. Pitch: 9 mm: Width of the free margin: 4mm