

Inline monitoring of nanostructured coatings in industrial production

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Abstract: The performance of nano-enhanced materials, such as those developed for the OptiNanoPro packaging applications, depends on their tailored deposition. This is true of both the barrier properties of the nanocomposite microlayer, where nanoparticles are dispersed into a polymer matrix which require a constant thickness, and of the easy-emptying properties of the nano-deposited coatings which require a specific surface nano/micro texture. Therefore, two online monitoring systems were developed by IRIS, one to measure the thickness of the nanocomposite microlayer on a coating process line and one to monitor the nanoparticles layer deposited by the nano-deposition machine. In the latter case, the quantification of the layer by an absolute parameter is not straightforward due to the complex structures, therefore a quantified parameter correlated with the final effect on the surface polarity was identified instead. For monitoring of the microlayer thickness, a spectral reflectance technique was selected and the monitoring system developed before being integrated into the coating line. For monitoring of the nano-deposited layer, the approach selected takes advantage of the effect on light of the highly diffusive surfaces produced. Information about the amount and homogeneity of the nano-deposited structures were obtained by analyzing the laser diffraction patterns resulting from the scattering of the laser light by these structures and then related to process parameters and surface properties. The delivered systems are fully versatile and can be customized to different coating and surface treatment needs, substrates types, machine size and process configuration. In an industrial environment such systems can be key in supporting the process ramp up, reducing scrap, and reducing post-production quality control requirements while ensuring constant quality.