PRESS RELEASE

Film-Inspect

Optical sensor enables 100 percent quality control of ultra-thin barrier layers

A new type of sensor makes it possible to test functional barrier layers on plastic products during production for the first time. The Film-Inspect system was developed by the Fraunhofer Institute for Physical Measurement Techniques IPM in cooperation with plasma system specialist Plasma Electronic GmbH. The sensor uses infrared measurement technology to detect thin coatings with a thickness of less than 10 nm to 200 nm inline.

Plasma coatings are applied to plastic packaging, for example, to protect food. Here, a diffusion-tight layer, e.g. made of silicon oxide (SiOx) or aluminum oxide (AlOx), protects products such as coffee or nuts from harmful external influences or loss of aroma. Comparable thin coatings are also used in completely different areas – for example in pharmaceutical products, in household appliances, in fuel cells, on vehicle parts and in many other industries. They can be used to optimize wettability, adhesion properties or surface chemistry, or to protect against corrosion. Until now, it has not been possible to test the quality of plasma coatings inline and without damage. The state of the art is random quality testing using time-consuming laboratory procedures. The innovative sensor developed by Fraunhofer IPM now enables process-integrated 100 percent individual part testing in the production cycle – even for three-dimensionally shaped, complex surfaces such as those typically used for packaging.

Compact design enables easy integration into the line

The researchers use the infrared optical characteristics of the coatings for quality control: the chemical bond between atoms can be resonantly excited by infrared light of the appropriate wavelength. The coating thickness can be determined from the intensity of the reflected light. The choice of wavelength depends on the coating material and can be configured to suit the specific material. The compact sensor is only approx. 20 × 40 × 80 mm³ in size and can therefore be easily integrated into the production line. Several sensors can be coupled in production processes and communicate with the system control via Profinet and OPC-UA. A USB interface and evaluation software are available for simpler applications with individual sensors.

An array of eight sensors was successfully integrated into a plasma coating system and tested by project partner Plasma Electronic GmbH. In addition to the application shown

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there in a batch process, Film-Inspect can also be used in continuous processes. This also makes it possible to monitor a roll-to-roll coating system.

Fraunhofer IPM presents the Film-Inspect sensor at Surface Technology 2024 from June 4 to June 6, 2024 (WOTECH joint booth in Hall 1 H 16 "Surface Technology of the Future").

Project "O-KUBA – Optical process control for ultra-thin barrier layers"

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The compact Film-Inspect sensor checks the quality of ultra-thin barrier layers inline. For the first time, 100 percent individual part inspection is now possible – even on three-dimensionally shaped surfaces. © Fraunhofer IPM

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