"A 100 percent success"

Reliably recognize markings even on difficult material

It is not easy to reliably recognize codes on different glass materials for tracking in production, as a manufacturer of special glass had to learn. However, with powerful camera sensors and adapted lighting technology, the problems, which were always associated with production stops, could be solved sustainably.

Not all glass is the same, and coatings just a few nanometers thick can significantly change its material properties and functions. Peter Röhlen, Managing Director of Prinz Optics GmbH based in Stromberg (Hunsrück), has a lot of interesting things to say about this. "Not many people do what we do. That alone is due to the dip coating in the very rare sol-gel process. We are one of the few companies in the world to apply this on an industrial scale."

Proven products with great future potential

This process can be used to create a wide variety of products using different coating materials without any major retooling. "The process is always the same: You dip glass into a specific coating liquid and pull it out again at a defined speed," explains Röhlen. This is how Prinz Optics creates color effect glass, optical filters and, most recently, coatings of glass, plastic and metal surfaces with nanoparticles, which create antimicrobial surface structures, among other things (see box).

The optical filters from Prinz Optics have long been in demand in industry, medical technology, research and development and lighting technology, for example. Nevertheless, new fields of application are constantly opening up, e.g. for 3D printers in which polymer mixtures are cured with UV light. "We supply special anti-reflective glasses for this purpose so that the UV light penetrates the polymers well and they cure well," says Peter Röhlen.

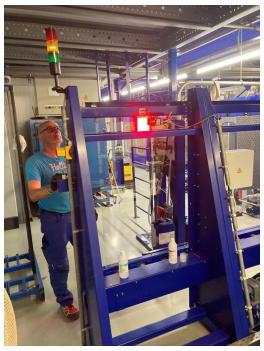
Layer by layer to a high-end product

Like all products, the optical filters are also manufactured in a dip coating system. After basic cleaning and a multi-stage cleaning and drying process, the glass panes used for this, known as "substrates" in technical jargon, are transported on a single conveyor line into a clean room, where they are positioned in a coded workpiece carrier. A robot then transports the slices to one of four coating chambers. After coating, the robot repositions the panes in a workpiece carrier.

The coating is then cured at approx. 480° C in a roller hearth oven. The substrate is then usually fed back into the process for subsequent coatings. Peter Röhlen explains: "This is a chaotic production process, with certain substrates for special UV filters going through the process up to 22 times, which takes several days. As the layer thickness inevitably changes due to the many oven runs, the substrates are also repeatedly certified in between."

Secure tracking via the entire process

Given the variety of products of varying complexity that are in the system at the same time, reliable tracking is essential. For example, the robot in the clean room must know which position to move to on the workpiece carrier so that it transports the correct sheet to the correct coating chamber. For this reason, each substrate is marked with a 2D code before being fed into the system for the first time and verified directly via a camera system. Another camera is installed before the refeed for products that have already been coated. The third camera system is located in the clean room before the infeed into the workpiece carrier. All devices are integrated into the Profibus DP installation via fieldbus nodes.



A total of three cameras are installed in the system. The illustration shows the infeed area. Here, the substrates are marked with a 2D code and verified directly via a camera system. (Prinz Optics GmbH)

Many reasons for error detection

The system has been in operation since Prinz Optics was founded in 2008 and is always kept up to date with the latest technology. The cameras with integrated incident light illumination have also been in use since then. However, in recent years there have been repeated problems, as Röhlen reports: "The substrates of different thicknesses with differing optical properties are sometimes not always at right angles to the camera system on the conveyor line. This sometimes led to unwanted reflections, meaning that the cameras were unable to capture the 2D code. We have also added new glass materials to our product range in recent years. The cameras also had problems with this because, for example, the material hardness can have a negative impact on the marking result."

Loss of time not only due to production stops

An incorrect reading of the code led to an instant interruption in production. If the camera in the cleanroom was the cause of this, it became particularly problematic, according to Peter Röhlen: "An employee then had to change completely, enter the cleanroom, write down the 22-digit code and then manually transfer it to the process visualization. This not only cost a lot of time, but also always harbored the potential for errors, e.g. because the code was written down incorrectly or not entered correctly." When the camera manufacturer then discontinued the systems and stopped maintaining the parameterization software, an adequate replacement had to be found.

Camera sensors with powerful software

Peter Röhlen turned to ipf electronic because the sensor specialist was working with the **OC53** high-performance camera sensors in its portfolio. The company from Altena ultimately recommended a solution in combination with a homogeneous area light that works using the transmitted light method.

The series **OC53** series consists of a range of variable camera sensors in various versions, from compact devices with lens, image sensor and illumination to devices with C-mount lens connection and integrated flash controller for illumination control for a high degree of flexibility. The powerful parameterization software for the camera sensors offers a wide range of graduated feature checks and enables the devices to be used in a variety of applications with very different tasks.

The OC53 series consists of a range of variable camera sensors, from compact devices with lens, image sensor and illumination (left), to devices with C-mount lens connection and integrated flash controller for illumination control (right). (Image: ipf electronic gmbh)

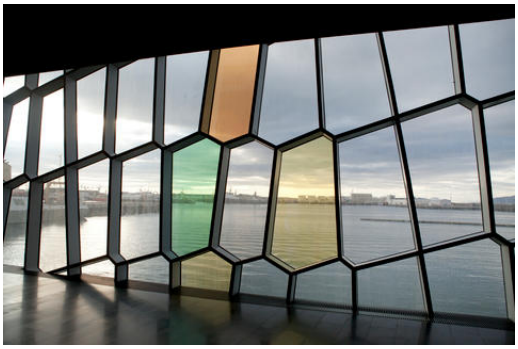
Reflection-free detection and part location

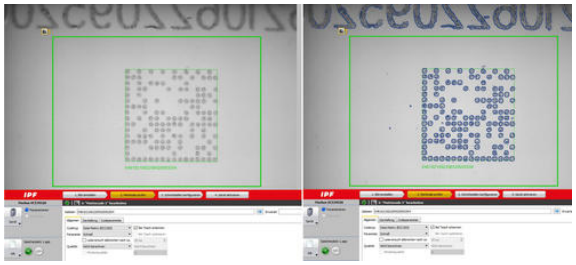
The first system from ipf electronic was installed in the clean room at Prinz Optics in 2019. The change in lighting technology with transmitted light alone led to more reliable detection of the 2D code, as a slight tilt of the panes and the quality of the marking no longer play a role. Added to this is the large image field with improved part location, which also has a positive effect on the recognition of the code. Part location is one of the powerful features of the parameterization software for the **OC53where** the position and rotational orientation of a product, text or code, for example, can be determined using contours, edges, circles or rows. All subsequent feature checks, in this specific case the detection of the 2D code, are aligned with the determined object position.

One of the cameras in use. Thanks to transmitted light as the lighting technology, interfering reflections or the quality of the labeling are no longer relevant for reliable recognition. (Image: ipf electronic gmbh)

More than just glass fascination

Prinz Optics has been coating glass made of different materials and in different thicknesses since 2008. Color effect glass, optical filters and nano-coatings are created using the sol-gel process with various coating materials. Color effect glass is appreciated for its fascinating play of color and light, e.g. in architecture, art and lighting design (illustrations). Optical filters, on the other hand, are in demand in industry, medical technology, research and development and lighting technology, for example. For example, such filters and certain light sources can be used to simulate sunlight via the entire wavelength range in order to test specific material properties. A new development at Prinz Optics is the coating of glass, plastic and metal surfaces with nanoparticles. The coatings with an antibacterial effect enable long-lasting disinfection, e.g. of touch screens in public spaces or glass used in refrigerators.

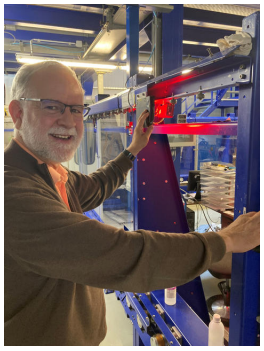




Layer tracking means that the marking is always reliably recorded and the code identified.(Image: ipf electronic gmbh)

Many problems permanently eliminated

Peter Röhlen has to admit that he had some concerns about the reliability of the new camera based on his experience with the old systems alone. As it turned out, the worries were ultimately unfounded: "The recognition works perfectly. Since the system from ipf electronic has been in operation, nobody has had to go to the cleanroom because of a false detection. We have been able to permanently eliminate the problems with recording the markings, the associated effort and, above all, the production downtimes. Due to the consistently positive experience, we also replaced the two other cameras at the initial and reintroduction points with the OC53. In this respect, this is a 100 percent success for us."



Peter Röhlen, Managing Director of Prinz Optics: "We were able to permanently eliminate the problems with the detection of the markings, the associated effort and, above all, the production downtimes with the camera sensors." (Prinz Optics GmbH)