

How a new spectroradiometer drastically improved filter quality

Together with partner CEC (Cutting-Edge-Coatings GmbH) Admesy helped to improve the accuracy of demanding filter coatings deposited by its ion beam sputtering machine by a large margin

Spectroradiometers, colorimeters and light meters are used in large volume 24/7 production testing, as well as in smaller volume niche system manufacturers. One example is the successful cooperation now started between Admesy and Cutting Edge Coatings GmbH (CEC).

CEC is a spin-off company of world-renowned Laser Zentrum Hannover, Germany. Since 2007, CEC focuses on developing ion beam sputtering (IBS) deposition systems.

CEC's Navigator IBS deposition system is designed to achieve the highest quality coating processes, ranging from high performance coating equipment for R&D, to high capacity coating machines for industrial mass production, and covering optical wavelengths from deep ultraviolet and visible to infrared. Combining 30 years of IBS coating experience from Laser Zentrum Hannover and CEC, the Navigator IBS system can produce coatings

for very high performance laser components and various optical filters, such as HR coating, AR coating, complex filters and different kinds of other coatings.

A key advantage of CEC's IBS coating systems is a spectral thin film thickness control system, called broad-band optical monitoring (BBOM). This system relies on spectral transmission measurements to monitor and control the process in real time.

Manufacturing interference filters

Highly accurate interference filters, such as those used in the Admesy Prometheus colorimeter series, are produced by applying alternating thin-film layers of oxide materials onto a transparent wafer substrate. These alternating thin-film layers have high and low refractive indices. A cleverly designed software algorithm puts the Fresnel equations to practice and will calculate an optimal receipt for these layers. The algorithm optimises the receipt to realise the target filter characteristics defined by the user.

The deposition of the correct thickness of each layer is essential to achieve a high accuracy of the final filter. With CEC's IBS coating system the layers are applied in atomic layers. This process takes several hours and needs to be controlled constantly. Here the aforementioned BBOM system comes into play.



Admesy's Neo spectroradiometer platform helped CEC to improve the accuracy of demanding filter coatings

Excellent linearity

At the beginning, a baseline measurement is carried out without any thin-film layers applied. Then, during the growth of the thin layers, the change in transmission needs to be determined continuously. These measurements serve a double function.

First, the thickness of the current layer built up is calculated. This is possible because the transmission is a material related constant. In that way the process is monitored. Nonetheless, the actual layer thickness can vary slightly from the calculated target thickness. This is due to slight, but unavoidable, inhomogeneities in the layer material, which have an effect on the material constants. As the amount and type of contamination is not known this would negatively affect the final filter performance.

To counteract those small unwanted deviations, the filter receipt is dynamically optimised, so that subsequent layers will take care of, and correct for, the actual conditions. This is the second reason why accurate spectral measurements are key to realising the highest possible filter quality.

The accuracy and the repeatability of the spectroradiometer has a direct influence on the final quality achieved. Besides a perfect dark current and wavelength calibration, the linearity of the spectroradiometer is especially a key factor here.

The reason is that during

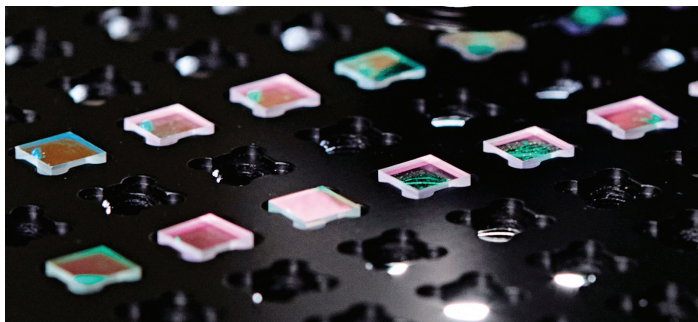
the coating run the absolute transmittance of the layer stack – the filter in the making – will continuously change with each layer applied. Therefore, it is important to have a reliable and predictable linear response from the spectrometer, even at low transmission values. Otherwise a change in transmittance will result in higher uncertainties of the measurements, which in turn will influence the accuracy of the calculated layer thicknesses.

Introducing the Admesy Neo series spectroradiometer platform

When CEC started to work together with Admesy, a solution to this challenge was found in using the new Neo spectroradiometer platform. The filters produced meet much tighter tolerances now. Neo's well thought-out optical and mechanical construction assures the highest optical performance for this and similar applications. The unique industrial-robust coupler and the supplied SDK make hardware and software integration into commercial solutions like the CEC coating machine a breeze. **EO**
www.admesy.com

Need more help in selecting the right spectroradiometer?

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