

Optical coating systems from Leybold Optics

Highest process stability and accuracy for the precision optics

Leybold Optics is developing and producing vacuum coating systems for optical applications for more than 40 years. We are operating worldwide with daughter companies in Europe, Asia and the USA. We are not only producing the coating equipment, but also developing our own components, optimised to achieve the best performance. Besides the hardware development, we are also focusing on the coating process. To provide the best solutions for our customers, we will utilize our experience in coating process development and adapt our components to the requirements of the process technology.

SYRUSpro Family

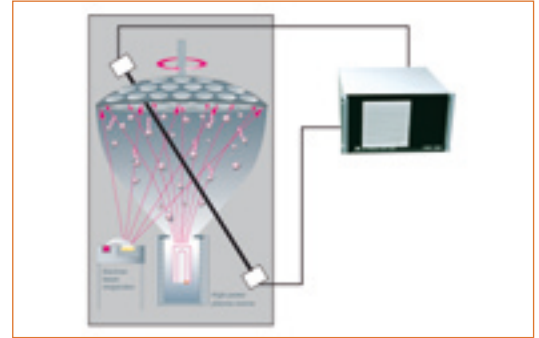


'SYRUSpro' is the name of a unique system family which easily satisfies all the demands arising in the field of precision optics. All of its systems are equipped with a controlling system which combines maximum automation and flexibility. The systems are available in different sizes with chamber diameters between 700 and about 1,500 millimeters and are suitable for clean room use. For coatings of large size substrates Leybold Optics also offers chamber sizes of 1900 mm and 2800 mm.

From the efficient compact model (SYRUSpro 710) to the powerful workhorse for mass production on a 24-hour basis (SYRUSpro 1510): the SYRUSpro system family offers the right solution for every field of application. Shorter pump times and high deposition rates guarantee low costs of production. The focus for all the members of the family has been the perfect balance between production capacity, performance, and high process stability.

OMS 5000 – direct monitoring on the calotte

To match the increasing demands for accuracy and to achieve the optical performance required, it is necessary to measure the optical thickness of the coatings directly during the deposition process. Up to now, the measurement has been performed on stationary test



slides. Now the OMS 5000 system presented by Leybold Optics offers monitoring of optical thin film layers directly on the calotte with high repeatability, supported by high signal resolution, low signal noise and multi-wavelength capability. The test slide for measurement of the layers is located directly on the calotte of the vacuum system. This allows for a more straightforward set-up of the coating system runs. Calibration batches can widely be avoided, i.e. it is possible to change the machine from one design to another very quickly. As a result, sophisticated filter designs, such as multiple-cavity filters, narrow-band-line filters and others, can now be achieved on the calotte.

Helios – and Heliospro sputtering systems



Leybold Optics has now introduced the Helios sputtering system for optical coatings into the market. The next step in the innovation was to scale up the coating system to increase the production capacity without any compromise on the accuracy: the Heliospro. The Helios coating system is designed for up to 16 pc substrates or substrate holders of up to 100 mm in diameter. Two dual magnetron sputtering cathodes and one plasma source can be installed. The Heliospro coating system allows the installation of up to 12 substrates or substrate holders with a diameter of up to 200 mm. At the same time up to 3 dual magnetron cathodes and one large plasma source can be installed. The deposition chamber is kept under vacuum all the time while the substrates are handled by an automatic single-substrate load-lock system. This load-lock system is flexible in handling various thicknesses of the substrates or substrate holders and enables short loading and unloading times.

The stability of the sputtering process is excellent; the majority of standard filter coatings can be done by time control only. For high-end filter coating applications, Helios is equipped with the in-situ optical monitoring system OMS 5000. The measurement is done directly on the substrate, in transmission or reflection. A breakthrough in accuracy is achieved by direct intermitted measurement on the substrate. The accuracy-limiting tooling factor which is typical for stationary test-slide changers is eliminated by the direct measurement. Measuring directly on the substrate not only provides highest accuracy but also avoids lengthy calibration batches and allows changing from one difficult design to the other.

Here are only a few examples of the large variety of filter coatings: narrow-band pass filters, rugate-type filters, laser mirrors, non-polarizing beam splitters, color filters, UV/IR cut filters, and much more. The Helios – Family is already successfully introduced in the industry. What seemed to be achievable only in the R&D department years ago, has become now standard in production today.

LION 300, the new ECRW – Plasma Source for large chambers



The new LION 300 RF ion source is based on the Electron Cyclotron Wave Resonance principle (ECWR). The source is designed to allow easy maintenance and to have low operating costs in production. The only consumable part is the single grid mesh, which needs to be exchanged regularly. The source is dedicated for our large coating systems, the SYRUSpro 1350 and SYRUSpro 1510 to allow the production with high layer quality on large scale.

Excellent layer qualities and various coating processes and designs can be realised in VIS- and NIR – spectral range, for example laser coatings, polarisation beam splitter, Narrow Band Pass filters, UV-IR cut filters and more. Coatings can be undertaken on mineral glass as well on plastic substrates.

With the LION 300 – source high refractive indices and excellent uniformity over large substrate holder areas can be achieved. The LION 300 – source enables the achievement of significant low losses and low

scattering. One excellent example is an UV – IR – cut filter with AR – coating achieving 99 % - average transmission over the visible spectral range. Due to the stable and controlled operation of the LION – source even difficult filter specifications can be performed in production. This is especially possible in combination with in situ optical monitoring system, our OMS 5000 with direct measurement on the calotte.

Nessy II, the dedicated sputtering system for EUV applications,



Nowadays the state of the art in photolithography is to use light at 193 nm in DUV – wavelength range. To achieve higher resolution and smaller structures, and by this also a higher packing density of transistors and other units on a chip the development is underway to use X – rays with wavelength of 13,4 nm in EUV – range. The necessary components for the photolithography units are collector mirrors which are able to achieve high reflectance at 13,4 nm, have a long life time in operation and can withstand temperatures over 600° C. Leybold Optics has developed a unique sputtering system for this application, the Nessy II. The coating system can be equipped with up to 6 sputtering cathodes to coat the Mo – and Si – layers for the mirror coatings. Other materials can be used for inter - diffusion barrier layers and capping layers to achieve a long life time and high temperature stability. Curved substrates with up to a diameter of 660 mm can be coated with highest accuracy. Special velocity profiles for the rotation of the substrates will be applied to achieve the necessary high uniformity also on the curved collector mirrors. The machine is equipped with a load lock chamber, while the sputtering chamber is all the time under vacuum with base pressure below $1 \cdot 10^{-8}$ mbar. Special sputtering cathode configurations has been developed to be operated at sputtering pressures below $1 \cdot 10^{-3}$ mbar to achieve high purity of the coated material. Reflectance values of more then 65 % at 13,4 nm has been achieved already. The layer systems consist of more then 100 layers with individual layer thicknesses of few nanometres. This requires a high precision, high stability and repeatability of the coating process. Leybold Optics succeeds to develop and to introduce this unique sputtering system already to the market, prepared for the next generation EUV – Lithography.