Optical systems and applications

Optical and electrical functional coatings: Successes, digitalization and visions for the future

What are the focal points of the department?

The department primarily focuses on the field of coating technologies for optical and electrical applications as well as the simulation of low-pressure processes and particles. With optical coatings, we address high-precision multilayer interference filters for various industrial applications. Functional coatings such as separating diaphragms for hydrogen or magnetic sensors form a further focus. The PIC-MC (Particle-in-Cell-Monte-Carlo) method for the simulation of plasma coating processes continues to be an important pillar of support."

What were the highlights in the reporting year?

In the current reporting year, we continued to research and develop precision optical coatings and were able to thereby achieve exciting new results. Several coating runs have now been carried out using our new OPTA-X sputtering system, including the deposition of notch filters with more than 500 layers and a layer thickness of more than 50 µm. The "Rainbow" project focused on the development of extremely steep gradient filters in which the position of a bandpass shifts in dependence on a spatial coordinate. We thereby succeeded in realizing a number of different gradients on one substrate with high precision (see Figure on the left). A further focus of our work was formed by the digitalization of process sequences. Most of the coating systems at the institute are already integrated into the database system, in which data are continuously collected for further evaluation and analysis."

What are the plans for the future?

Coating technology for precision optical coatings will continue to be developed further. As a result, new applications will be addressed, such as components for fluorescence analysis, machine vision or laser protection. New strategies for the monitoring of optical coatings are already being implemented and will be realized in the near future. In the field of electrical functional layers, hydrogen research is being intensified within the scope of the two new research projects "PureBio" and "HySecunda". One aspect of these projects is the creation of hydrogen separating diaphragms that can be used to convert pre-purified hydrogen into a high-purity form.

In the area of coating-process simulation, we will focus on further refining the modeling of plasma-supported processes in the future and, furthermore, will continue to work on the implementation of a user interface for the PIC-MC software in order to make the software accessible to a wider range of users. The PALADIN simulation software for the simulation of microparticles will continue to be expanded and investigated with regard to further application possibilities. In the "6Demo" project, for example, the dispersion behavior of emission-laden airflow is being analyzed with the aim of reducing particle pollution in mechanical machining processes."

#WeKnowSolutions

- Development of precision optical coatings from prototypes to pilot series
- Large-area optical, electrical and magnetic coatings
- Conducting of simulation studies by means of PIC-MC
- Studies for the simulation of dust exposure and particle movement in rooms and on surfaces by means of PALADIN
- Solutions for the controlling of coating processes, e. g. with the aid of the MOCCA+® monitoring software
- Production of large-area TCO coatings

Optical bandpass filter with a very steep gradient in the x-direction (from bottom to top in the illustration). The filter consists of more than 200 layers and has a thickness of approx. 20 µm.

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