Editorial

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An optical system is unimaginable without optical coatings. In optical systems, the shape of the surfaces is designed so that the location and direction of the deflection of the light or the beam are being optimized. Apart from these purely geometrical aspects, however, there are the equally important physical properties, which are essentially determined by the coating. The immense increase in optical applications is continually creating new demands on the performance of the optical coating. In addition to complicated optical performance parameters, the coating also needs to demonstrate other properties, such as radiation stability and environmental resistance. Although there are advanced techniques available for layer design and layer fabrication, skill, experience and a basic understanding are still a prerequisite for the production of efficient coatings.

Coating technologies belong to the basic technologies in optics that directly determine the function and performance of optical systems. Optical coatings are typically multilayer systems used to adjust the desired transmission, reflection and absorption of surfaces. Their function is based on the intrinsic properties of the materials (e.g. metal reflectors) and/or on interference effects. Optical coatings offer the opportunity to develop the properties of surfaces to meet the diverse needs of a wide range of applications in modern and future optical technologies. Coating technologies are atomically exact additive nanotechnologies per se. Subtractive nanotechnologies for the atomically exact functionalization of surfaces, e.g. plasma and ion etching, have the same fundamental importance for optics as the coating technologies. Especially the combination of both methods is important. The term functionalization of optical surfaces combines additive and subtractive methods. Furthermore, lithographically structured metal-dielectric optical surfaces, often summarized under the term metamaterials, belong to the surface functionalizations.

In addition to the direct adjustment of the spectral transfer function, surface functionalizations are used to optimize a variety of other surface properties, including, for example, environmental stability, abrasion resistance or self-cleaning effects. The new generation of optical surface functionalizations will go even further and combine optical properties with other sophisticated features, such as sensory functionality or active control of selected transmission parameters. This is where the term smart optical surfaces comes in.

Surface functionalizations can already be found in every technical device, from eyeglass lenses to mass products, such as smart watches, smart phones, tablet computers, touch screens and laptops, up to high-end products with complex optical systems for basic research, information and laser technology and quantum technologies. In many high-technology sectors, the quality of the available surface functionalizations defines the technical limitations of optical systems and the efficiency of related applications. A prime example are the wafer steppers, undoubtedly the most important machines in the world, as all integrated circuits (ICs) are being produced by them. Therefore, surface functionalizations are one of the key enabling technologies that will drive further progress in many future developments and applications. The most important pacemakers are information technology, semiconductor lithography, medicine, new laser applications, and life sciences. They are pushing the boundaries of thin-film optical technology far beyond the current capabilities of established deposition processes and production strategies.

The present collection of papers is a small selection from what is a continuously expanding and developing subject. The editors hope that they will convey the excitement, interest, enthusiasm and drive of the optical coating community that is constantly innovating and responding to new, often formidable, challenges.

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