8th International Workshop on Polymer Metal Nanocomposites

12th - 15th of September 2017, Prague, Czech Republic

Smart optical coatings and nanoparticles for energy saving, anticounterfeiting and more

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Optical coatings (OC) are of obvious interest for an increasing number of applications ranging from antireflective (AR) coatings for lenses to low emissivity (low-e) coatings for buildings and automobiles to color shifting pigments for anticouterfeiting. The need for enhanced performance and versatility has correspondingly stimulated the development of thin film materials with novel nanostructures and/or based on unconventional materials to supply them with new multifunctional properties.

In this talk, we will focus on our recent work on smart thin film devices that integrate active materials in passive OC systems, specifically: electrochromic (EC) WO_3 and thermochromic (TC) VO_2. In the context of VO_2 films, we will demonstrate how the use of High Power Impulse Magnetron Sputtering (HiPIMS) can help lower the deposition temperature and how the resulting films are more durable in stringent high temperature and humidity conditions than standard magnetron-sputtered films. We will also discuss the integration of such films into passive low-e type OCs to increase the luminance transmittance while maintaining the low and high temperature solar transmision variation with the added benefit of low emissivity properties.

On the WO_3 side, we have recently developed new filters where, by controling the porosity of the films, both EC as well as interference effects can be combined into a single structure. This offers the possibility to further control the transmittance and reflection spectra of such coatings for various applications such as color shifting active security devices, advanced glazings for architectural glass and more.

Finally, troughout the presentation we will also explore the present limitations of these materials and how they can possibly be alleviated by the integration of nanoparticles or even by the nanostructuration of the materials themselves.