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Physical vapour deposition and plasma-etching of organic compounds for optical applications

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Optical interference coatings for the UV-NIR spectral range are typically made of inorganic oxides or fluorides. However, organic layers as a component of interference stacks could be beneficial for different reasons. A number of organic compounds exhibit interesting absorption characteristics especially in the ultraviolet region. That property could be used to protect substrates from damaging radiation. Moreover, organic films should be useful to balance the mechanical properties of a multilayer.
To get knowledge about film formation properties, optical properties and durability of an organic compound is essential for its application as an optical interference layer. In a first attempt compounds with attractive thermal behaviour and high transmission in the visible spectral range were investigated. Results for N,N´-di(1-naphthyl)-N,N´-diphenyl benzidine (a-NPD), 2,4,6-triamino-1,3,5-triazine (melamine) and the UV stabilizer 2,2´-methylene bis-[4-t-octyl-6-(benzotrilazolyl)-phenol] (Tinuvin® 360) will be presented. The compounds were deposited as thin films by thermal evaporation. Infrared and UV-VIS spectrometry were applied to control the chemical composition of the thin films and to determine the optical constants.
A basic requirement for most optical applications is the reduction of Fresnel-reflections. Besides of interference coatings, nanostructures with sub-wavelength size as known from the eye of the night-flying moth ("moth-eye structures") can provide antireflective properties. A convenient method to generate nanostructures on a polymer surface by using a plasma etching procedure has been developed at the Fraunhofer-IOF in Jena. This technique was now applied to the organic films. Nanostructures were obtained on all compounds. In some cases the deposition of thin initial layers prior etching was necessary. Organic layers with plasma-etched nanostructures are especially promising to provide antireflective properties to strongly curved glass lenses. An improved antireflection effect can be achieved by combining interference layer stacks with a structured organic top-layer.

Keywords
organic layers
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