Optical Properties of SiO_2:HfO_2 PEALD Composites for Functional Coatings

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High power laser optics rely on optical functional coatings with minimal absorption and scattering losses towards improving their laser induced damage threshold. Additionally, there is an increasing interest in the functionalization of strongly curved optics such as lenses, cylinders, freeforms to achieve more compact and stable optical systems. Atomic layer deposition (ALD) is a promising technology to grow conformal coatings with precise thickness control at nanoscale on such steeply curved optics [1,2]. Binary oxides and more complex oxides are readily available with a precise composition control. Based on the cyclic, self-limiting surface reactions of the ALD processes, typical growth rates are in the range of 1 Å/ cycle [4,5], and atomic level mixtures and superlattices are possible [6].

Here, we report on the plasma enhanced ALD (PEALD) processes of HfO2 and SiO2 binary oxide thin films with precise control of their ratio. The thickness of the individual components has been systematically varied from approximately 2 nm to a few Å. The engineering of the refractive index and optical bandgap of these mixtures is discussed. These binary oxides are applied in antireflection coatings for 355 nm and 1064 nm wavelength and their laser induced damage threshold is presented.

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