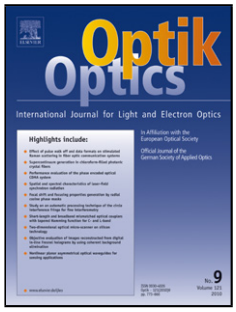

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Multilayer AR coatings of TiO_2/MgF_2 for application in optoelectronic devices

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Abstract

A multilayer system of 10 alternating TiO_2 and MgF_2 thin film was prepared on BK7 glass substrate by electron beam and resistive thermal evaporation techniques respectively. The substrate with 20 mm diameter and thickness of 1 mm were placed in a vacuum chamber at partial pressures of 10-5 mbar for TiO2 and 10-6 mbar for MgF2 film respectively. The as-deposited films were annealed at 400˚C for an hour in ambient environment. The structural, optical and morphological properties were studied by XRD, UV-VIS spectrophotometer, ellipsometery and scanning electron microscopy (SEM) respectively. The structural analysis confirms that all the thin films samples were polycrystalline in nature with tetragonal and rhombohedra phases. SEM analysis confirms the uniformity of surface and quite stable multilayer thin film structure without any micro cracks. Ellipsometery studies were carried out and refractive index and extinction coefficient as function of wavelength are obtained. The samples are found highly transparent in the range of 400-800 nm, whereas the overall absorption and reflection of the multilayer thin film was decreased for the annealed samples. It has been demonstrated that the residual reflectance of the AR coating can be significantly reduced by combining the multilayer systems with an outermost low index layer made of MgF_2. The realization of such hybrid multilayer systems are extremely useful as front surface of the photovoltaic cells, optoelectronic devices and front mirror for laser.

Keywords: Multilayer Coatings, TiO_2, MgF_2, Anti-reflection coatings

1. Introduction

Antireflection coatings have been in use since long to overcome the problem due to Fresnel's reflections, which significantly reduces intensity of transmitted light [1]. It is now established that the application of multilayer coating on the front surface of the photovoltaic cells or optoelectronic devices reduces the reflection of the incident light improving the device performance [2,3]. These coatings are widely used in solar cells, lenses, optical window for lasers and display windows etc [4]. Bruynooghe et al. [5] described the nature as an example of