Dokumenttyp: Konferenzbeitrag

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Titel des Beitrags: Thermo- and Hygro- Tunable Nanoparticle-Based TiO2/SiO2 Bragg Stacks

Abstract: We propose a thermo- and hygro- tunable optical filter based on the nanoparticle-based TiO2/SiO2 one-dimensional photonic crystals, dubbed Bragg stacks. The tunability is achieved by the utilization of 1D Bragg structures as optical filters capable of changing their refractive properties when in contact with an analyte of interest or when exposed to external stimuli such as temperature, humidity, etc. The change can be detected by measuring the reflection or transmission of different kinds of light sources, including monochromator, LED or OLED, that is integrated with the Bragg stack. The proposed sensing concept has been tested in thermo-optical sensing applications. The transmission spectra obtained for the temperatures between 15 °C and 60 °C show the spectral shifts of different magnitude at various relative humidities. We can significantly enhance the value of the shift by increasing the relative humidity of the environment. The simulations of the wavelength shift based on the measurement of the effective thermo-optic coefficient of the nanoparticle-based TiO2 and SiO2 films at ambient conditions closely correspond to the experimental values. The
modulation of the intensity of transmitted light for the external light source can be used for a temperature or the humidity read-out. Therefore, under constant humidity or constant temperature conditions, we expect that the proposed nanoparticle-based Bragg stacks have the potential to be used as temperature or humidity sensors, respectively.

Stichworte: tunable photonic crystals, Bragg stacks. thermo-optic coefficient

Kongress- / Buchtitel: TechConnect World Conference & Expo 2011

Kongress / Zusatzinformationen: Boston MA USA, June 13 - 16, 2011

Jahr: 2011
Quartal: 2. Quartal
Jahr / Monat: 2011-06
Monat: Jun
Sprache: en

Occurences:
- Einrichtungen > Fakultäten > Fakultät für Elektrotechnik und Informationstechnik > Lehrstühle und Professuren > Nanoelektronik (Prof. Becherer komm.) > 2011

entries: