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Inhomogeneous interference filters. A promising deposition technique

Traditional optical interference filters have been manufactured with discrete thicknesses since the 1930s, when anti-reflection coatings were first introduced in Zeiss microscopes. In most standard applications, the theoretical calculation of the optical response of a given filter is achieved by propagating electromagnetic waves through a continuous medium, a procedure known as analysis. However, when more stringent requirements are imposed to achieve a complex transmittance filter profile, a synthesis process becomes necessary. Various approaches exist to address this challenge.

In this study, we focus on the approximate Fourier Transform method to determine the index profile for a specified transmittance. The resulting rugate filter exhibits a smoothly varying refractive index as a function of thickness. The challenge lies in growing and controlling these index variations. In this contribution, we utilize reactive sputtering controlled by optical emission spectroscopy (OES). We detail the entire process, including the synthesis of the filter, the cleaning and calibration procedures using spectral ellipsometry, and the deposition and characterization of the resulting filter. This work is part of a Cátedras CONAHCyT project, which encompasses designing and assembling the deposition chamber, integrating the ellipsometer, creating the OES system, designing the electronics control, developing the programming for each stage, and studying the physics behind target poisoning, spectral line intensity ratios, and their relationship with the refractive index of the film to be grown. The ultimate objective is to acquire knowledge and technology that can be transferred to the industry. We present here our initial, promising results.

Keywords

Rugate lters, Optical Emission Spectroscopy, Ellipsometry

Reference

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Author approval

I confirm

Author will attend

I confirm

Author: Dr MACHORRO MEJÍA, Roberto (Centro de Nanociencias y Nanotecnología, UNAM)

Co-authors: Dr RODRÍGUEZ LÓPEZ, Ramon (CICESE, Km. 107 Carretera Tijuana-Ensenada. Ensenada, Baja California); Dr VILLA FLORES, Emmanuel (CICESE, Km. 107 Carretera Tijuana-Ensenada. Ensenada, Baja California); Dr ABUNDIZ CISNEROS, Noemi (CONAHCyT, Centro de Nanociencias y Nanotecnología, UNAM); Dr SANGINÉS DE CASTRO, Roberto (CONAHCyT, Centro de Nanociencias y Nanotecnología, UNAM); Dr AGUILA MUÑOZ, Juan (CONAHCyT, Centro de Nanociencias y Nanotecnología, UNAM); Dr TERÁN HINOJOSA, Estrella (Centro de Nanociencias y Nanotecnología, UNAM); Ms CRUZ GABARAIN, Lorena (CICESE, Km. 107 Carretera Tijuana-Ensenada. Ensenada, Baja California)

Presenters: Dr MACHORRO MEJÍA, Roberto (Centro de Nanociencias y Nanotecnología, UNAM); Dr ABUNDIZ CISNEROS, Noemi (CONAHCyT, Centro de Nanociencias y Nanotecnología, UNAM)

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