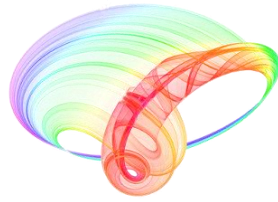


# **Book of abstracts**



## **PHOTONICA2021**

VIII International School and Conference on Photonics

& HEMMAGINERO workshop

23 - 27 August 2021,

Belgrade, Serbia

*Editors*

Mihailo Rabasović, Marina Lekić and Aleksandar Krmpot

Institute of Physics Belgrade, Serbia

Belgrade, 2021

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## Nickel vertical posts: Influence of thickness on magnetic and optical properties

J. Potočnik, M. Popović

*“Vinča” Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia*

e-mail: [jpotochnik@vin.bg.ac.rs](mailto:jpotochnik@vin.bg.ac.rs)

In the present study we have investigated the influence of the nickel (Ni) thin films thicknesses on their structural, magnetic and optical properties. Nickel vertical posts were deposited by Glancing Angle Deposition technique, at the angle of  $85^\circ$ . The films were grown to the thicknesses of 50 nm, 80 nm, 110 nm and 140 nm onto the glass slide substrates, which were rotated at the constant rate during the deposition process.

After the deposition, the samples were characterized by Scanning Electron Microscopy (SEM) and it was found that the thin films are porous and that the diameter of the columns increases from 18 nm to 29 nm with increasing thickness. X-ray photoelectron spectroscopy was used in order to determine the chemical composition of the samples, as well as the identification of the compounds present in the deposited thin films. It was shown that the metallic Ni is the dominant component, while the deconvolution of the oxygen line revealed the presence of NiO and Ni(OH)<sub>2</sub>.

Magnetic measurements of Ni thin films were accomplished by Magneto-Optical Kerr effect Microscope at room temperature. Based on the obtained results it can be seen that the deposited nickel samples possess uniaxial magnetic anisotropy. Also, it was noticed that the coercivity increases with thickness up to 150 Oe, for the 110 nm thick sample and then decreases to the value of 115 Oe. For thinner films, magnetic properties are mainly affected by the diameter of the columns, while for the thicker samples, the mechanism of the column growth determines their characteristics.

Optical and electrical properties of nanostructured nickel thin films were investigated by spectroscopic ellipsometry and four-point probe, respectively. According to the ellipsometric measurements it was found that as the thickness of the deposited samples increases plasma frequency ( $\omega_p$ ) also increases, and the damping factor ( $\Gamma_d$ ) decreases. An increase in the plasma frequency means that the density of conducting electrons is higher for the thicker samples, while the decrease in  $\Gamma_d$  indicates their better structural arrangement and lower concentration of defects. From the ellipsometric measurements, also, was observed the decrease of the refractive index values with increasing the film thickness, which is due to the lower optical density of the samples. Besides, higher values of the column width of the thicker Ni films lead to the reduced scattering of the conduction electrons at their boundaries and consequently increase both conductivity and extinction coefficient. Indeed, four-point probe measurements revealed that the electrical resistivity decreases from  $4.98 \times 10^2 \mu\Omega\text{cm}$  to  $0.44 \times 10^2 \mu\Omega\text{cm}$ , with increase film thickness from 50 nm to 140 nm. Lower values of electrical resistivity are probably due to the larger column diameter and lower defects density, as a result of column connecting during the film growth.