## PS17

# STUDY OF $Ga_2O_3$ THIN FILMS OBTAINED BY AEROSOL SPRAY PIROLYSIS

Morari Vadim [1], Rusu Emil [1], Zalamai Victor [2], Meshalkin Alexei [3]

[1] Technical University of Moldova, D. Ghițu Institute of Electronic Engineering and Nanotechnologies, Chisinau MD-2028, Republic of Moldova, [2] National Center for Materials Study and Testing, Technical University of Moldova, Chisinau MD-2004, Moldova, [3] State University of Moldova, Institute of Applied Physics, Chisinau MD-2028, Moldova

Gallium oxide ($Ga_2O_3$), has attracted much attention in recent years as a transparent semiconducting oxide, relatively high electron mobility (~150 $cm^2/V \cdot s$) and due to its ultra-wide band gap (~4.9 eV) [1], become a potential material for high-performance ultraviolet (UV-C) photodetectors in the wavelength range of 200–280 nm [2]. Besides this, $Ga_2O_3$ exists in five crystallographic phases $\alpha$, $\beta$, $\sigma$, $\gamma$ and $\varepsilon$, where only the $\beta$ phase is the most stable at temperatures higher than 900 °C. The crystalline phases can be change from corundum $\alpha$-$Ga_2O_3$ form at 400 °C to pure monoclinic $\beta$-$Ga_2O_3$ increase of the treatment temperature up to 900 °C. Gallium oxide thin films have been grown by various techniques such as chemical vapor deposition (CVD) [3], vacuum thermal evaporation, atomic layer deposition (ALD), but less from chemical solutions. In this research, we have developed the spray pyrolysis technology which is a pretty cheap, low-cost and simple technology, ideal for optoelectronic applications and allows us to obtain thin films of different thicknesses controlling the temperature and speed of deposition. The obtained film thickness is determined by the rate of precursor solution injection and the duration of deposition process. Thin films of $Ga_2O_3$ films was carried out by aerosol spray pirolysis on Si substrates under an $O_2$ gas flow. Gallium chloride ($GaCl_3$) with molar mass (0.5M) dissolved in ethanol ($C_2H_5OH$) were used as precursors, they being mixed in an ultrasonic bath for 30 minutes at a temperature of 50 - 60 °C. Before the deposition process, the solution was left for 24 hours to make the mixture as clean and clear as possible without some sediment. The thermocouple value was the same as the actual temperature of the substrate 450 °C and the deposition process lasted depending on the desired thickness. The obtained films were characterized by SEM, EDX, optical transparency and electrical conductivity characterization of $Ga_2O_3$ films.

**Acknowledgments.** This work was supported financially by the Ministry of Education and Research of Moldova, through project **nr. #020201** „Nanostructuri și materiale avansate pentru aplicații în spintronică, termoelectricitate și optoelectronică”.

**References:**

1. Z. Galazka. β-$Ga_2O_3$ for wide-bandgap electronics and optoelectronics. Semic. Sci. Tech., vol. 33, no. 11, art. no. 113001, 2018. DOI: org/10.1088/1361-6641/aadf78.
2. Xu, J., Zheng, W., & Huang, F. Gallium oxide solar-blind ultraviolet photodetectors: a review. J. of Mat. Chem. C, 7(29), 8753–8770, 2019. DOI: 10.1039/c9tc02055a.
3. Jubu, P. R., et all. Synthesis and characterization of gallium oxide in strong reducing growth ambient by chemical vapor deposition. Mat. Sci. in Sem. Process., 121, 105361, 2021. DOI: 10.1016/j.mssp.2020.105361.

**Corresponding author: Vadim Morari**

Technical University of Moldova, D. Ghitu Institute of Electronic Engineering and Nanotechnologies, Laboratory of Nanotechnologies, Academiei str. 3/3, MD – 2028, Chisinau, Moldova

**ORCID: 0000-0003-3625-251X**