NANODEVICES BASED ON $A_{II}B_{VI}$ SEMICONDUCTING OXIDE NANOWIRE

Cristian Lupan

Technical University of Moldova, Department of Microelectronics and Biomedical Engineering, Center for Nanotechnology and Nanosensors, Stefan cel Mare Av., 168, Chisinau, Moldova

Choosing material as sensor is an important part for fabrication of fast and reliable devices, capable of detecting dangerous gases. ZnO is one of the most promising and used material in sensing applications, due to its proprieties, but has drawbacks like poor selectivity, high operating temperature, etc. [1]. These drawbacks can be improved by doping with rare-earth materials, like Eu, which can lead to a higher response and lower operating temperature [2]. Another method of improving sensing proprieties is by using 1D material, instead of 2D [3]. In our work, we present an improved sensing performance of a device based on a single ZnO:Eu_2O_3 nanowire, compared to ZnO:Eu_2O_3 films. ZnO:Eu_2O_3 nanowire arrays were grown using electrochemical deposition method, and single nanowire was integrated using FIB/SEM. Morphology was studied using SEM, observing uniform deposition with nanowires with similar size. Structural proprieties were studied using XRD, observing presence of ZnO and Eu_2O_3 peaks. Device based on a single ZnO:Eu_2O_3 nanowire was tested to a series of gases at different operating temperatures, observing selectivity to 100 ppm hydrogen, an improved response value and lower operating temperature compared to non-doped ZnO and ZnO:Eu_2O_3 films. These results show that by using a single nanowire as sensing material and modifying $A_{II}B_{VI}$ semiconducting oxide proprieties by doping with different metals, we can obtain an improved sensing performance. C. Lupan gratefully acknowledges Kiel University, Chair for Multicomponent Materials, Germany and PSL Université, Chimie-ParisTech IRCP, Paris, France for internship positions in 2023 and TUM, Chisinau, Republic of Moldova.

References

1. Ghanbari Shohany, B.; Motevalizadeh, L.; Ebrahimizadeh Abrishami, M. Investigation of ZnO Thin-Film Sensing Properties for CO2 Detection: Effect of Mn Doping. *J. Theor. Appl. Phys.* **2018**, *12*, 219–225, doi:10.1007/s40094-018-0302-3.
2. Lupan, C.; Khaledialidusti, R.; Mishra, A.K.; Postica, V.; Terasa, M.I.; Magariu, N.; Pauporté, T.; Viana, B.; Drewes, J.; Vahl, A.; et al. Pd-Functionalized ZnO:Eu Columnar Films for Room-Temperature Hydrogen Gas Sensing: A Combined Experimental and Computational Approach. *ACS Appl. Mater. Interfaces* **2020**, *12*, 24951–24964, doi:10.1021/acsami.0c02103.
3. Lupan, C.; Mishra, A.K.; Wolff, N.; Drewes, J.; Krüger, H.; Vahl, A.; Lupan, O.; Pauporté, T.; Viana, B.; Kienle, L.; et al. Nanosensors Based on a Single ZnO:Eu Nanowire for Hydrogen Gas Sensing. *ACS Appl. Mater. Interfaces* **2022**, *14*, 41196–41207, doi:10.1021/acsami.2c10975.

Corresponding author: PhD student Cristian Lupan

Technical University of Moldova, Department of Microelectronics and Biomedical Engineering, Center for Nanotechnology and Nanosensors, Stefan cel Mare Av., 168, Chisinau, Moldova, e-mail: cristian.lupan@mib.utm.md, **ORCID: 0000-0003-2268-6181**