

Project Results - Stage II:
01.01.2017 – 29.12.2017

Optimization of nanostructured GeSn coatings and advanced characterizations

Objectives, activities and estimated results of the second stage of the project were fully achieved:

- ✓ Layers of GeSn in SiO₂ matrix were produced by magnetron sputtering varying Sn concentration between 11% and 19%, and that of SiO₂ around 10%.
- ✓ The substrate temperature during deposition was varied in the range from room temperature to 350°C. It was shown that nanocrystallization of GeSn without segregation of Sn can be obtained for an optimum substrate temperature mainly depending on Sn concentration, directly during the magnetron sputtering deposition.
- ✓ It was found that the change of the working plasma atmosphere from Ar to Ar+H₂ results in the increased mobility of the ad-atoms and improvement of the ex-situ rapid thermal annealing (RTA) nanocrystallization process.
- ✓ The deposition conditions have been correlated with the effects of the nanostructuring processes that was studied by different techniques in order to find the optimal RTA conditions.
- ✓ Advanced characterizations of morphology, composition, structure and optical properties have been performed using different analytical techniques: EDS (Energy-dispersive X-ray spectroscopy); XRD (X-Ray Diffraction); HRTEM (High Resolution Transmission Electron Microscopy) cu EDS; XPS (X-ray Photoelectron Spectroscopy); ATP (Atomic Probe Topography); AFM (Atomic Force Microscopy); DHM (Digital Holographic Microscopy) and transmittance-reflectance optical spectroscopy. The results have been correlated to the deposition and RTA parameters.
- ✓ Optical and photoelectrical characterizations on experimental structures have been performed, finding the optimal concentrations of Sn of 11% -12% and RTA treatment at 400°C, to achieve the target threshold of sensitivity in the range of 2 - 3 μm wavelength.
- ✓ Two periodic project meetings were organized at German partners: Institute of Semiconductor Nanoelectronics, Peter Grünberg Institute (PGI 9) Forschungszentrum Jülich - November 9th, 2017; nanoplus Nanosystems and Technologies GmbH, Oberer Kirschberg, Gerbrunn – Germany - May 4th, 2017. The information about these meetings was saved on the project web site, and the presentations and discussions of the partners results were saved at Restricted Area field as a common database accessible for all partners of the project.
- ✓ Project results have been published in ISI indexed papers (one in Optica and two in IEEE CAS Proceedings 2017, another paper was submitted for publications in Scientific Results) and by four presentations at international conferences.
- ✓ Project web page (<http://www.infim.ro/projects/nano-structured-geSn-coatings-photonics-gesnaphoto>) was periodically updated.

December 5th 2017