

Project Results - Stage I:

01.09.2016 – 29.12.2016

Obtaining nanostructured GeSn coatings and preliminary characterisations

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

- ✓ Layers of $(\text{Ge}_{1-x}\text{Sn}_x)_{1-y}(\text{SiO}_2)_y$ have been deposited on different substrates (c-Si, fused quartz and metallic Ti6Al4V) using magnetron co-sputtering from separate targets Ge, Sn and SiO₂;
- ✓ The layer composition was varied in the ranges 7-30% Sn and 0-20% SiO₂, by controlling the power applied to each target;
- ✓ Rapid thermal annealing of samples was performed in the range 250°C - 450°C, in N₂ inert atmosphere;
- ✓ The morphology, composition and amorphous or crystalline structure for different annealing stages were investigated by using SEM, EDS, Raman scattering and XRD measurements;
- ✓ The as-deposited layers are amorphous and start to show nano-crystallization as the temperature increases, being observed a weak segregation of Sn-rich crystals at high temperatures.
- ✓ The optical properties of layers were investigated by transmission-reflection measurements in UV-VIS-IR (0.2 μm – 28 μm) range. The spectral dependence of the absorption coefficient shows an absorption limit E_g in SWIR range of 0.3 – 0.5 eV, depending on the composition and annealing temperature, E_g values being comparable to those of the strain-relaxed GeSn epitaxial layers.
- ✓ Publications:
 - submitted paper „Group IV GeSn LEDs- the influence of SiGeSn barrier material in MQWs”, D. Stange, N. von den Driesch, D. Rainko, I. Povstugar, J.-M. Hartmann, T. Stoica, Z. Ikonc, S. Mantl, D. Grützmacher, and Dan Buca, submitted to the journal *Optica* (impact factor 5.2);
 - in preparation „Optical bandgap in GeSn-SiO₂ films obtained by magnetron sputtering”, T. Stoica, M. Braic, A. Slav, I. Stavarache, A.-M. Lepadatu, C. Palade, S. Lazanu, and M. Ciurea;
- ✓ Project web page was created and updated: <http://www.infim.ro/projects/nano-structured-gesn-coatings-photonics-gesnaphoto>;
- ✓ Kick off meeting was organized by the coordinator (NIMP) in Magurele 14th Nov. 2016, being presented on project web page with agenda saved in the field *News*, and presentations and Minute of the meeting in a *Restricted Area* accessible for all partners.