Smart Metal Oxide Nanocoatings and HIPIMS Technology

Project No.1.1.1.1/18/A/073

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Project Implementers: The Institute of Solid State Physics, University of Latvia (ISSP UL) in collaboration with the vacuum coating SME company Sidrabe Vacuum Ltd.

On the implementation of the project (period 01.07.2019. - 30.10.2019.)

As part of Project No 1.1.1.1/18/A/073 "Smart Metal Oxide Nanocoatings and HIPIMS Technology" the adaptation of the laboratory equipment and the selection of optimal magnetrons were made to obtain heterostructures for metal oxide coatings. In the framework of the project activity "Development of the application technology for reactive R-HiPIMS TMO thin film application" the planned studies were carried out.

Testing results for injectable gases and optical emissions systems were analysed and conclusions were reached. The planned sample coatings were manufactured, described and the data for the par ameters of the coating technological process was prepared. The coverage process parameters were optimized according to the results of the coating measurement analysis.

Research on the synthesis of ReO3 thin films has been continued in the framework of the project activity "Production of the TMO samples and optimization of the reactive R-HIPIMS parameters". Deposition technology of ReO3 thin films has been successfully developed using reactive DC magnetron sputtering. ReO3 samples on quartz, oxidized silicon and Kapton substrates were successfully prepared. The formation of ReO3 from amorphous ReOx was studied at different temperatures (200, 250, 300, 350° C).

Calculating properties of transparent conducting oxides. A new set of calculations has been completed, thus enriching the existing body of knowledge about the material. A summary of the results has been presented in Warsaw on 16.09.2019 during the E-MRS 2019 Fall Meeting as a talk titled "Hybrid density functional calculations of Ir-doped ZnO". A publication with a working title "Ir+Oi complex in ZnO: hybrid PBE0 calculations and experiment" is a work in progress. This publication will enclose all so far obtained results on the iridium-oxygen complex in the zinc oxide matrix.

In the framework of the project activity “Characterization of the obtained TMO and EC samples”, structural and morphology analysis were performed (XRD and SEM measurements), as well as optical (light absorption and transmittance in UV-VIS region) and electrical properties (electrical conductivity and charge carrier mobility) were studied of the as-prepared thin films in relation to the synthesis parameters. EXAFS measurements were also performed on amorphous ReOx and crystalline ReO3 thin films, and it was shown that the EXAFS spectrum of amorphous ReOx films matches ReO2 spectrum.