COMBINATION OF POROUS SILICON SUBSTRATE WITH ALD METAL OXIDE NANOLAYERS: POSSIBLE APPLICATIONS FOR Si/TiO_2 , Si/ZnO, Si/RuO_2 COMPOSITES

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Porous silicon (PSi) is one of the most important semiconductor materials in different scientific areas. It became possible due to its good optical and structural properties such as PL, biocompatibility, etc. One of the most important factors for choosing of porous silicon in science is low-cost of materials and fabrication procedure and accessibility. It is frequently used in combination with nanoscale metallic particles or metal oxides (for improving its optical, structural, biosensing properties [1].
We report about obtaining the new combination of materials: PSi/TiO_2 , PSi/ZnO, PSi/RuO_2 that could be suitable for use in water splitting, supercapacitor fabrication technology, catalytic applications, biosensorics and energy saving technologies.
PSi/TiO_2 nanostructures were fabricated using metal-assisted chemical etching and atomic layer deposition. The of the prepared and annealed. The approximate size, crystalline structure, chemical composition and morphology of TiO_2 nanolayer inside the PSi matrix was estimated using XRD, TEM and Raman spectroscopy. It was shown, that by controlling the number of deposition cycles, the size of TiO_2 nanocrystallites inside the PSi matrix could be controlled.
Ruthenium oxide RuO_2 have received significant attention in recent years for supercapacitor electrodes applications [2] and as promising catalytic material [3]. The results of comprehensive study of porous Si substrate combined with RuO_2 layer formed by MOCVD and ALD, was done. X-Ray diffraction, Raman spectroscopy, XPS, SEM, TEM techniques were used for samples investigation.
Also, ZnO thin films deposited on silicon substrates by ALD has been used as material for optical immunosensor development for the detection of Grapevine virus A-type (GVA) antigens [1]. The GVA-antigen was determined by evaluation of changes and behavior of the photoluminescence band around 425 nm, appeared as a result of immobilization of anti-GVA antibodies on the surface of the ZnO films. The sensitivity of the obtained immunosensor towards the GVA-antigens was determined in the range from 1 pg/ml to 10 ng/ml [1].

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