HYBRID METAL-SEMICONDUCTOR STRUCTURES BASED ON InP AND GaAs NANOTEMPLATES FOR ELECTRONIC AND PHOTONIC APPLICATIONS

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PhD Thesis Summary

Abstract. In this scientific work are presented the results that contribute to solving an important scientific problem related to obtaining of porous templates with controlled morphology and design by replacing acidic and alkaline electrolytes, the use of which presents a danger for the environment, with neutral electrolyte (NaCl) as well as obtaining of the metal-semiconductor hybrid structures using pulsed electrodeposition that offers additional possibilities to control the localized deposition in certain portions of the porous template and allows the controlled fabrication of nanodots, nanowires, nanotubes and perforated metal nanomembranes. Mechanisms of pore propagation in InP and GaAs semiconductor substrates and electrochemical deposition of metals in the produced porous templates are identified and discussed, which allowed to control the direction of pore growth, including those parallel to the substrate surface as well as localized Au deposition.

Keywords: Electrochemical Etching, Current Line Oriented Pores (CLO), Electrodeposition, Pt Nanotubes, Gold Nanomembranes.

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1. Introduction. Motivation of the study

Increased attention to a class of nanostructured materials, namely porous layers, was paid after the discovery of luminescence in porous Si by Canham in 1990 [1], due to the introduction of pores by the electrochemical method by Lehman and Goesele [2]. Electrochemical etching of semiconductor substrates is widely used in the fabrication processes of semiconductor nanostructures [3]. The formation of porous layers by electrochemical methods has been studied quite extensively over three decades, the results being systematized in the monographs of Zhang [4] and Lehman [5].

Semiconductor compounds offer more possibilities for applications in optoelectronics and photonics due to their wider bandgap. Analysis of the literature shows that III-V semiconductor compounds have been extensively studied for the

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