Surface-Barrier Heterostructures on the Base of Nanoporous InP and GaAs Films with Au Nanoparticles

Barlas T.R., Dmitruk N.L., Kotova N.V., Mamykin S.V

Institute of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine

Composite nanomaterials based on porous semiconductors attracted great interest in optoelectronics and photovoltaics due to unique optical and electronic properties which are different from the bulk materials [1]. This work is mainly devoted to the study of photoelectric properties of the Au/porous-GaAs and Au/porous-InP structures in combination with electric ones helping to understand the photocurrent behavior. Porous InP and GaAs have been prepared from the n-type (111) and (100) single crystals respectively by anodization in electrolyte containing HCl. Gold nanoparticles were deposited in electrochemical cell from Au salt. Au barrier contacts with 30 nm thickness have been deposited by thermal evaporation in vacuum. Surface morphology and pore structure have been analyzed by SEM. Photoelectric and electric properties of the structures have been studied with help of short-circuit photocurrent spectra in the 0.4-0.9 μm spectral range and forward/backward I(V) and C(V) characteristics. Au/porous-GaAs heterostructures show greater photosensitivity comparing to flat ones. Deposition of the Au nanoparticles into the pores leads to: i) photosensitivity increase of heterostructures due to increase of light absorption (fig. 1); ii) decrease of the saturation current and ideality factor. The physical nature of these effects can be explained by improvement of the barrier characteristics and the decrease of the optical losses [2].

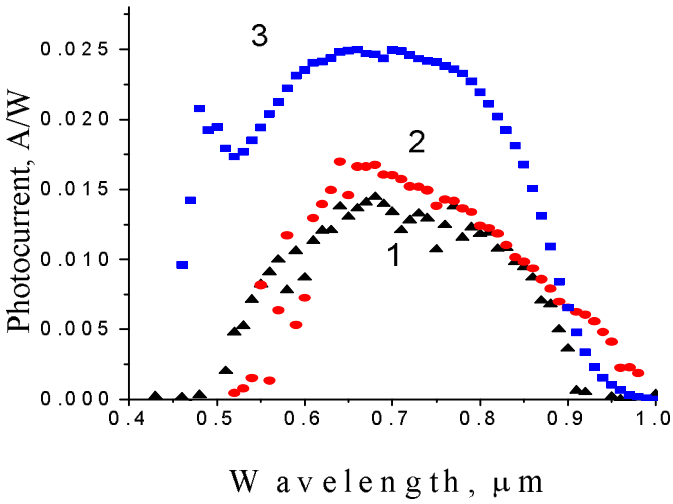

Fig.1. Spectral dependences of the photocurrent for Au/porous-InP structures without Au nanoparticles (1), with small (2) and large (3) amount of Au nanoparticles in the pores.

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2. Dmitruk N.L., Malinich S.Z. Surface Plasmon Resonances and Their Manifestation in the Optical Properties of Nanostructures of Noble Metals // Ukr. J. Phys.-2014.-V. 9, № 1 - p. 3-37.