The 3rd INTERNATIONAL CONFERENCE ON THE PHYSICS OF OPTICAL MATERIALS AND DEVICES

ICOM 2012

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MEMBRANE-BASED PLASMONIC NANOCOMPOSITES FOR CHEMICAL OR BIOLOGICAL SENSING

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One of the important applications of subwavelength plasmonic optics is sensing of chemical and biological analytes [1]. Plasmonic sensors are based on tuning of either propagating surface waves (surface plasmon polaritons, SPP) or nonpropagating (localized) ones. The adsorption of analyte modifies the surface refractive index, ensuring ultrahigh sensitivities that may exceed 10^{-8} refractive index units, i.e. 1 ng/cm^2 (0.003 monolayer) [2]. For all plasmonic sensors it is of interest to enhance their selectivity, since their operation is based solely on refractive index sensing, i.e. different materials with similar refractive indexes cause similar outputs.

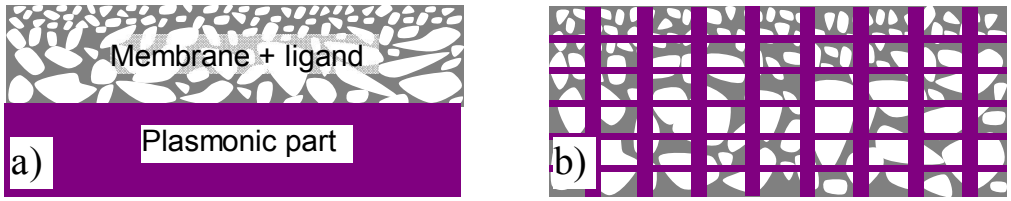

Fig. 1. Plasmonic structures for chemical. a) laminar structure with porous membrane functionalized by ligand over plasmonic part; b) multifunctional structure with plasmonic lattice integrated with porous membrane.

In this work we propose the integration of active plasmonic part with separator (e.g. membrane or nanomembrane with nanopores) and ligand binding the targeted analyte into a single structure. This may be done by membrane nanocompositing [3], e.g. by lamination (Fig. 1a) or volume structuring/pore formation (Fig. 1b). At the same one may use built-in (nano)pores to augment the effective surface for adsorption and thus vastly increase the amount of adsorbate. For our work we chose macroporous crosslinked copolymers (MCP) which are readily formed into membranes and keep a permanent well-developed porous structure. Particularly we used glycidyl methacrylate (GMA)-based MCP. GMA has already been successfully used for heavy and precious metals adsorption and enzyme immobilization [4]. For the formation of membranes comprising GMA we selected a new method combining traditional immersion precipitation with photopolymerization and crosslinking of functional monomers [5]. Our approach may be extended to other types of chemical and bio sensors.

Acknowledgment:
This work has been funded by Serbian Ministry of Education and Science through the projects TR32008 and III 43009.

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