**Nanoplasmonics and surface enhanced spectroscopy**

**LSPR - nanoparticle array as a sensitive layer in a MIP-based chip for explosives detection**

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Localized surface plasmon resonance (LSPR) properties of gold and silver nanoparticles are well known [1]. The position of LSPR wavelength peak depends on various nanoparticle parameters, such as material, size, shape and distance between particles [2]. The one of most useful properties of LSPR is its sensitivity to environment changes. Any interaction between nanoparticles and molecules in their vicinity leads to the unique LSPR wavelength peak shift. Such behaviour can be used to develop sensitive elements for biosensors or detectors [1].

In present work, LSPR properties of gold nanoparticle (AuNP) array were used to develop a sensitive molecularly imprinted polymer (MIP) nanoplasmonic chip for explosives detection. For this purpose, AuNP array surface was functionalized with a layer of UV-sensitive initiator for polymerization reaction. After that, process of UV-induced photochemical polymerization of acrylamide monomers mixed with analogue of explosive molecule 4-nitrophenol (4-NP) was performed. Finally, polymer-coated chip was washed in aqueous solution of HEPES to remove explosives analogue template and then dried to yield a MIP-AuNP plasmonic chip.

The results of the study indicate that prepared chip reacts on the presence of explosives analogues vapors and kinetic curves expose typical Langmuir shape with saturation. The influence of 4-NP vapor on 4-NP imprinted chip, in comparison with the influence on non-imprinted chip, is shown in Fig. 1. It can be seen that the final LSPR wavelength shift observed with an imprinted chip is twice the shift observed with a non-imprinted chip. Moreover, such chips exhibit sensitivity to a number of explosives analogues with molecular structure similar to the template molecule, as shown in Fig. 2. LSPR peak shift over time (2-60 min) upon MIP-AuNP chip exposure to gaseous analytes 4-NP, 4-nitrotoluene (4-NT), 1-nitronaphthalene (1-NN) and 5-nitroisoquinoline (5-NI) with concentrations 0.1-20 ppm was detectable and reproducible. Such sensor chips, though, need further optimization of selectivity and sensitivity, which will be the object of future research.



Fig. 1. Kinetic dependence of LSPR peak shift for 4-NP-imprinted (1) and non-imprinted (2) LSPR chips in the presence of 4-NP vapour. 4-NP vapour was added at 400 s.



Fig. 2. Histogram of LSPR response upon MIP-AuNP chip exposure to different types of explosives analogue vapor.

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