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Immobilization of Au Nanoparticles within Layered Nanoarchitectures for Application as Arsenic Sensor

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Abstract –Synthesis of metallic nanoparticles has attracted attention mainly due to experimental simplicity and possibility of applications in a number of technological areas. Here we describe the synthesis of gold nanoparticles using polyamidoamine dendrimers (PAMAM G4) as stabilizer. The AU-PAMAM NPs were further immobilized within nanostructured layered films in conjunction with a conventional anionic polyelectrolyte on conductive ITO-covered glass plates. The films were employed as modified electrodes for arsenic detection.

Investigation on the surface properties of nanostructured layer-by-layer (LbL) films has become of great interest in areas related to materials science and supramolecular chemistry, due to the potential applications of these systems in catalysis, organic electronics and biosensing [1]. In this study we aimed at developing nanostructured platforms containing immobilized Au nanoparticles to be applied as arsenic sensors. The AuNPs were synthesized according to chemical routes described in the literature, employing dendrimer molecules (PAMAM G4) as templates and formic acid as the reduction agent. Au Nps with an average diameter of ca 5 nm were obtained and their complexation with PAMAM molecules allowed their use as cationic building blocks for LbL film fabrication in conjunction with polyvynil sulfonic (PVS), used as polyanion. Synthesis of AuNPs, as well as LbL film assembly, had been investigated using UV-Vis spectroscopy. The Au-PAMAM/PVS films presented a globular morphology and homogeneity at the nanoscale, as revealed by AFM images, shown in figure 1. The films displayed well defined electroactivity after adsorption on Indium Tin Oxide ITO-covered glass plates. The latter films were employed as modified electrodes, allowing detection of Arsenic at very low detection limits, ca. 0,6 µg L^{-1}.

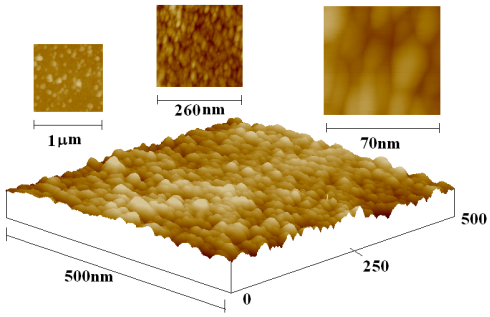

Figure 1: AFM image of a modified electrode containing 6 bilayers of PAMAM-AuNps/PVS.

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References:

[1] 3. Hyun C. Yoon, Mi-Young Hong, and Hak-Sung Kim Analytical Biochemistry 282, 121–128 (2000).