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Analysis of the low-frequency noise spectrum in graphene-based biochemical sensors and its application in analyte recognition and quantification

Adriana Peleš[1], Zoran Djurić[1,2] and Ivana Jokić[3]
[1]Institute of Technical Sciences of SASA, Belgrade, Serbia, [2]Serbian Academy of Sciences and Arts, Belgrade, Serbia, [3]ICTM-MTM, University of Belgrade, Belgrade, Serbia

In this study, we use the theoretical model of low-frequency noise in an adsorption-based sensor to analyze the possibility for the recognition and quantification of the analyte based on the measured fluctuations spectrum. We have developed an analytical expression for the spectral density of the fluctuations of the number of analyte particles adsorbed onto the sensing surface which takes into account the processes of mass transfer through the sensor reaction chamber, adsorption and desorption, and surface diffusion of adsorbed particles [1,2]. The numerical calculations performed using the derived theory are in agreement with the experimental data from the literature obtained for graphene-based gas sensors [3,4]. While analyzing the dependence of specific features in the fluctuation spectra of various parameters, we investigate which type of information about the analyte and its interaction with the graphene surface can be obtained from the experimentally obtained noise spectrum.

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