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Analysis of the effect of potential cycles on the reflective infrared signals of nitro groups in nanofilms: Application of the fractional moments statistics

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Abstract

The effect of the potential cycles on the reflective IR signals of nitro-groups in nanofilms was studied for the statistical characterization of nitrobenzene (NB) and nitroazobenzene (NAB)-modified glassy carbon (GC) surfaces. Both NB and NAB nanofilms were obtained by the electrochemical reduction of the diazonium tetrafluoroborate salts in acetonitrile using cyclic voltammetry (CV). The modified surfaces were denoted as GC-(NB)n and GC-(NAB)n, respectively, where n indicates the number of CV cycles performed during modification. Reflective IR signals of the normalized NB and NAB nanofilms and GC were used for the quantitative evaluation of the effect of the potential cycles on the reflective IR signals of nitro-groups in nanofilms. The detection and quantitative reading of the influence of number of CV cycles were realized in the frame of a new error controllable approach that was applied for analysis of all available set of data. This approach includes in itself the following basic steps: (a) the procedure of the division (normalization) on the GC spectra, (b) the comparison of the smoothed spectra for their statistical proximity in the frame of the statistics of the fractional moments, (c) extraction of possible calibration parameters for possible calibration of the normalized spectra with respect to the number of CV cycles. These three basic steps are becoming effective for detection of the influence of some external factors. In our case it is important to detect the influence of the factor n characterizing CV cycles.

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Keywords

Calibration curves, Diazonium salt reduction modification, Glassy carbon electrode, Nanostructures, Nanosurfaces and interfaces, Nitroazobenzene, Nitrobenzene, Rairs, Statistics of the fractional moments, Thin films