ONLINE ISSN : 1348-2246
PRINT ISSN : 0910-6340

Analytical Sciences
Vol. 26 (2010) , No. 1 p.19

[PDF (836K)] [References]

Redox Cycling Effect on the Surface-enhanced Raman Scattering Signal of Crystal Violet Molecules at Nanostructured Interdigitated Array Electrodes

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(Received November 26, 2009)
(Accepted December 10, 2009)

Nanostructured interdigitated array (IDA) electrodes with different inter-electrode spacing were demonstrated to improve the detection sensitivity of short-lived electroactive species and to follow interfacial dynamics by their surface-enhanced Raman scattering (SERS) functionality. Nanostructured IDA electrodes fabricated using electron beam lithography were used for an electrochemical SERS study of irreversible electroactive species, crystal violet (CV), in an aqueous KCl solution in single and generation-collection (GC) mode experiments. The GC mode enabled us to amplify the SERS intensity. An inter-electrode spacing dependent study found the maximum number of redox cycling, collection efficiency and amplification of the SERS intensity. Its SERS function disclosed the potential-dependent dynamics of CV molecules at the electrode surface, which was not observed in the redox current. Miniaturized nanostructured IDA electrodes are of great importance for developing lab on chip devices, and are useful for analyzing dynamical features within small space/volume domains, which require small amounts and/or concentration of analytes.

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doi:10.2116/analsci.26.19
JOI JST.JSTAGE/analsci/26.19