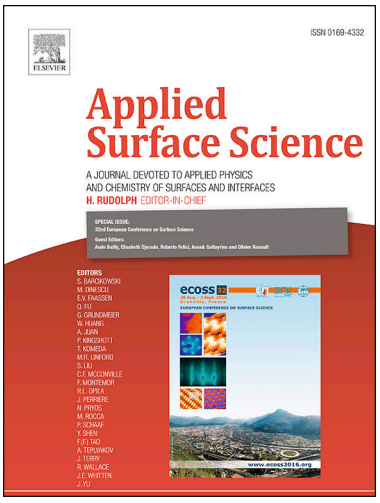
Accepted Manuscript



Full Length Article

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PII: S0169-4332(18)31842-7
DOI: https://doi.org/10.1016/j.apsusc.2018.06.276
Reference: APSUSC 39784

To appear in: *Applied Surface Science*

Received Date: 2 February 2018
Revised Date: 4 June 2018
Accepted Date: 27 June 2018

Please cite this article as: C. Muehlethaler, A. Odate, J.L. Weyher, I. Dzięcielewski, J.R. Lombardi, Enhanced Raman Spectra of Black Dye N719 on GaN Nanowires, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.06.276

Enhanced Raman Spectra of Black Dye N719 on GaN Nanowires

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Abstract

Gallium Nitride (GaN) substrates have recently been proposed as high performance substrates for surface enhanced Raman (SERS) measurements. The GaN substrate acted as a template for nano-structuration of the surface, and a noble metal (e.g. silver or gold) supported the electrical fields and surface plasmon resonances deemed necessary for SERS. However, we demonstrate here that charge transfer conditions can be approached with a selected molecule on pure GaN substrates, and that the surface plasmon resonances of the noble metals are not a prerequisite anymore to obtain SERS conditions. We use a black dye (N719) adsorbed on GaN bundles of nano-wires for which the charge transfer resonances can contribute enhancement factors up to 10^4. The charge transfer (CT) transition from the GaN substrate valence band (-6.75 eV) to the molecular LUMO (-4.26 eV) is in resonance with the energy of the laser excitation at 488 nm (2.54 eV), and with the molecular resonance within the N719 molecule (ω_{Mol} = 2.47 eV).

Keywords: SERS, charge transfer, plasmon, resonance, enhancement factor