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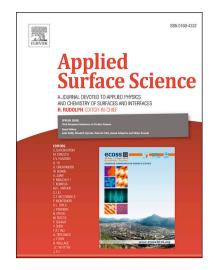
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ACCEPTED MANUSCRIPT

Enhanced Raman Spectra of Black Dye N719 on GaN Nanowires

Cyril Muehlethaler^a, Asami Odate^b, Jan L. Weyher^c, Igor Dzięcielewski^c, John R. Lombardi^d

^a University of Quebec at Trois-Rivieres, Canada, Department of Chemistry, Biochemistry and Physics

^b Brown University, Providence, USA, Department of Chemistry

^c Institute of High Pressure Physics, Poland, Polish Academy of Sciences

^d City College of New York, USA, Department of Chemistry and PhD program in Chemistry, CUNY

Corresponding author:

Cyril Muehlethaler University of Quebec at Trois-Rivières Department of Chemistry, Biochemistry and Physics, CIPP-2134

Tel: +1 819 376 5011 (4559)

Email: Cyril.Muehlethaler@uqtr.ca

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 ($\omega_{\text{Mol}} = 2.47 \text{ eV}$).

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

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