



Nanospectroscopy of thiocyanine dye molecules adsorbed on silver nanoparticle clusters



Uroš Ralević^a, Goran Isić^{a,*}, Dragana Vasić Anicijević^b, Bojana Laban^c, Una Bogdanović^b, Vladimir M. Lazović^d, Vesna Vodnik^b, Radoš Gajić^a

^a Graphene Laboratory of Center for Solid State Physics and New Materials, Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

^b Vinča Institute of Nuclear Sciences, University of Belgrade, P.O. Box 522, Belgrade, Serbia

^c Faculty of Natural Sciences and Mathematics, University of Priština, 38200 Kosovska Mitrovica, Serbia

^d Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

ARTICLE INFO

Article history:

Received 29 June 2017

Received in revised form 13 October 2017

Accepted 21 October 2017

Available online 25 October 2017

Keywords:

Surface enhanced Raman scattering

Atomic force microscopy

Citrate capped silver nanoparticles

Thiocyanine dye

ABSTRACT

The adsorption of thiocyanine dye molecules on citrate-stabilized silver nanoparticle clusters drop-cast onto freshly cleaved mica or highly oriented pyrolytic graphite surfaces is examined using colocalized surface-enhanced Raman spectroscopy and atomic force microscopy. The incidence of dye Raman signatures in photoluminescence hotspots identified around nanoparticle clusters is considered for both citrate- and borate-capped silver nanoparticles and found to be substantially lower in the former case, suggesting that the citrate anions impede the efficient dye adsorption. Rigorous numerical simulations of light scattering on random nanoparticle clusters are used for estimating the electromagnetic enhancement and elucidating the hotspot formation mechanism. The majority of the enhanced Raman signal, estimated to be more than 90%, is found to originate from the nanogaps between adjacent nanoparticles in the cluster, regardless of the cluster size and geometry.

© 2017 Elsevier B.V. All rights reserved.

* Corresponding author.

E-mail address: isicg@ipb.ac.rs (G. Isić).