

Nanoplasmonics and surface enhanced spectroscopy

Different silver nanostructures as efficient substrate for Surface Enhanced Raman Spectroscopy

O.M. Hreshchuk¹, M.Ya. Valakh¹, Yu.M. Naseka¹, M.A. Skoruk³,

G.Ya. Grodzyuk², V.V. Shvalagin²

¹ *V.E. Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine; 41, prospect Nauky, 03028 Kyiv, Ukraine.*

E-mail: Hreshchuk@gmail.com

² *L.V. Pisarzhevskii Institute of the Physical Chemistry of the NAS of Ukraine, 31, prospect Nauky, Kyiv, Ukraine.*

³ *Nanomedtech LLC, 68, Gor'kogo str., 03680 Kyiv, Ukraine.*

Surface enhanced Raman spectroscopy (SERS) is an efficient analytical method which intensively developing and finds application for diagnostics of substances in chemistry, biology, pharmacology, ecology, and so on. SERS gives the possibility to detect Raman signal from super-low concentrations of analyte.

In this work was investigated the efficiency of using of different silver nanostructures (NS) as SERS-substrates. Silver NS obtained by colloidal synthesis [1] from the solution of silver nitrate and polivinilpirolidon in ethylene glycol.

Using scanning electron microscope it was shown that we obtain three different types of SERS-substrates. First type of SERS-substrate consist of silver NR, the second one - silver NR and different polyhedral nanostructures and the third one - only polyhedral NS like nanocubes, nanotriangles and other.

To investigate the enhancement efficiency of the Raman signal from SERS-substrates, they were covered with identical volumes of the solution of Rhodamine 6G (Rh6G) molecules (10^{-5} M) and referent specimen of Rh6G on glass (10^{-4} M).

The best enhancement of the Raman signal was obtained from 3-d type of SERS-substrate. It can be explained by two reasons: 1) NS polyhedral have

enhanced electromagnetic field on their corners; 2) NS where places closely to each other and this is a prerequisite for the existence of “hot spots”.

As follows, we investigate the morphology, optical properties and efficiency of enhancement of Raman signal for 3 types of SERS-substrates made from silver NS. And it was shown that SERS-substrate which consist of nanocubes, nanotriangles and other polyhedral give higher enhancement of Raman signal.

1. *Jinhwan L., Phillip L., Hyungman L. etc.* Very long Ag nanowire synthesis and its application in a highly transparent, conductive and flexible metal electrode touch panel // Nanoscale.—2012.—4.—P. 6408-6414.