

The influence of Au film thickness and annealing conditions on SERS enhancement

S. Andrikaki^{1,2*}, K. Govatsi^{1,3}, K.S. Andrikopoulos¹,
S.N. Yannopoulos¹, G.A. Voyatzis¹

¹FORTH/ICE-HT, P.O. Box 1414, GR-265 04, Rio-Patras, Greece

²Department of Materials Science, Univ. of Patras, GR-26500, Rio-Patras, Greece

³Department of Chemistry, Univ. of Patras, GR-26500, Rio-Patras, Greece

Surface enhanced Raman scattering (SERS) offers the possibility to perform quantitative measurements and/or identification of molecular species at extremely low concentrations. The technique is based on the enhancement of the weak Raman scattering signal when the probed species are in the vicinity of nanostructured metallic substrates. Colloidal SERS substrates are advantageous with respect to their easy preparation and low cost with concurrent high enhancement [1]. In comparison, solid substrates enable flexibility in sampling [2]. In the current work, Au films of various thicknesses (< 5 nm) were deposited by sputtering onto Si wafers <100>. The solid state thermal dewetting of Au films at 400 °C resulted in the formation of Au nanoparticles with morphologies such as those shown in Fig. 1. The initial film thickness controls the resulting particle size distribution [3]. The optical properties of the substrates were studied by UV-Vis spectroscopy and their enhancement on the Raman signal was evaluated by observing the Raman features of an active agent MTX that was properly spin coated on the substrates. Correlation of SERS signal with the optical properties as well as the mean particle size of Au was attempted and optimum conditions for maximum SERS signal were investigated.

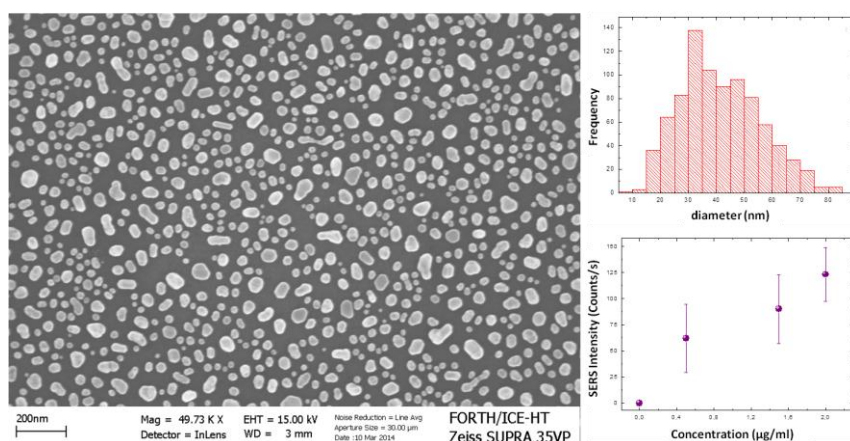


Figure 1: SEM image of a sample with 30 nm average Au nanoparticle size. The particle size distribution and the correlation of SERS intensity with the concentration of MTX.

Acknowledgement: The present work was funded from the European Union's Seventh Framework Programme (FP7/2007-2013) under the grant agreement N^o NMP4-LA-2012-280759 and the acronym 'NanoBarrier'.

References

- [1] J. Anastasopoulos, A. Soto Beobide, G. Voyatzis, *J Raman Spectrosc.* **44**, 401 (2013).
- [2] E. Kammer, et al., *Phys Chem Chem Phys* **16**, 9056 (2014).
- [3] K. Govatsi, A. Chrissanthopoulos, V. Dracopoulos, S. Yannopoulos, *Nanotechnology* **25**, 215601 (2014).

* andrikaki@iceht.forth.gr