SERS spectroscopy: concepts, new materials and application

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The Surface-Enhanced Raman Scattering (SERS) is a special spectroscopic technique which provides an enormous enhancement of the Raman signal from molecules adsorbed on noble-metal surfaces with nanoscale roughnesses. The most beneficial features of SERS are high sensitivity and specificity that makes it possible to use this technique for obtaining detailed information about the structure and composition of a material at the lowest possible concentrations down to single molecule level [1]. Such advantages make SERS spectroscopy perspective for analytical chemistry, food safety, pharmaceutical, medical, forensic science, and many other applications.

The most critical aspect of SERS, before it becomes a routine analytical technique, is the development of new plasmonic nanostructures, called SERS-active substrates. Such materials should have to possess a high sensitivity, reproducibility, stability, simplicity of preparation and compact size [2]. The use of rough surfaces, especially porous materials, as a base support seems one of the ways of fabrication of new SERS-active substrates matching abovementioned requirements. The use of porous materials may offer a high sensitivity because of their larger surface area to host more analyte molecules. Besides, variation of the base support morphological parameters may result in the formation of tailored structures of noble-metal deposits, which offers a high SERS effectivity. Moreover, the metallized porous materials with ordered pore arrangements could result in formation of SERS-active substrates close in parameters to surface-confined material, cheap and easy to produce.

In the present work we report the results on formation of plasmonic nanostructures for SERS based on silvered porous nanostructures and demonstrate the approaches for their analytical and biomedical applications.

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