DEVELOPMENT OF SUBSTRATES BASED ON AG NANOPARTICLES AND MICROSTRUCTURED SI FOR IDENTIFICATION OF ORGANIC COMPOUNDS BY SERS

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Raman spectroscopy offers us both chemical and structural information of most organic and inorganic materials [1]. SERS is a variant of the Raman technique that is performed when the analyte is in the proximity of a metal, causing amplification of the Raman signal of up to 10 orders of magnitude [2]. SERS substrates containing Au, Cu or Ag particles, allow amplification by plasmon resonance, which is very close to the energy of the laser used for Raman. In this study we opted for the use of nano- particles of Ag and Si as support, using the Metal Assisted Chemical Etching (MACE) technique. MACE consists of dissolution of the semiconductor material preferentially at the sites where particles of Ag, Au or Pt are deposited. In the case of Ag, its chemical deposition in the form of nanoparticles is simple and a good control of the geometry, size, spacing and periodicity over Si substrates can be achieved. Si is used because it is the most abundant semiconductor and there is a variety of techniques for micro- structuring it.

In this study, two types of substrates Ag / Si are produced. The first is polished Si with Ag nanoparticles. The second is obtained from the first, making MACE; thus contains Ag nanoparticles embedded in Si. The average size of all silver nanoparticles is ~0.15 micras. Additionally, naked polished Si wafers are used for comparison.

To analyze the SERS effect of the substrates, malathion was used as test molecule. As shown in Fig. 1, the results show that the intensity of the malathion Raman peaks using substrate 2 is larger than using substrate 1, whose intensity is larger than for naked Si. Taking naked Si as reference, substrate 1 presents an amplification of 20% and substrate 2 of 67%.

Keywords: SERS, MACE microstructuring, Molecule detection

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