Electrochemical SERS Analysis on SERS-Active Screen-Printed Electrodes

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SERS-active screen-printed electrodes (SPEs) are extensively applied for electrochemical SERS biosensors with the advantages of portable, inexpensive cost, fast measurement and sensitive detection. In our work, an useful fabrication method of sputtering deposition for SERS-active SPEs was proposed. Two kinds of working electrodes of SPE which were carbon electrode and gold electrode were successfully deposited by silver nanoparticles. Besides, the sputtering experiments of different substrates (paper, glass epoxy and polyethylene terephthalate) of the SPE were also conducted. The comparison of SERS enhancement of rhodamine 6G (R6G) on different kinds of SERS-active SPEs was introduced. In addition, the relationship between the surface roughness and SERS enhancement has been investigated. The enhancement factor (EF) of Ag / carbon and Ag / gold electrode were estimated as 2.8×10^5 and 2.2×10^7, respectively. From the SERS experiments, lower background noise of SERS signals could be observed through sputtering deposition method compared with the citrate reduction method. Furthermore, spectro-electrochemical analysis of uric acid was studied. The SERS signals were strongly increased upon the modulation of applied voltage. These results demonstrated the applicability of this mass producible fabrication method for producing SERS-active SPEs, as well as, highlighted the future potential of commercial bio-applications.

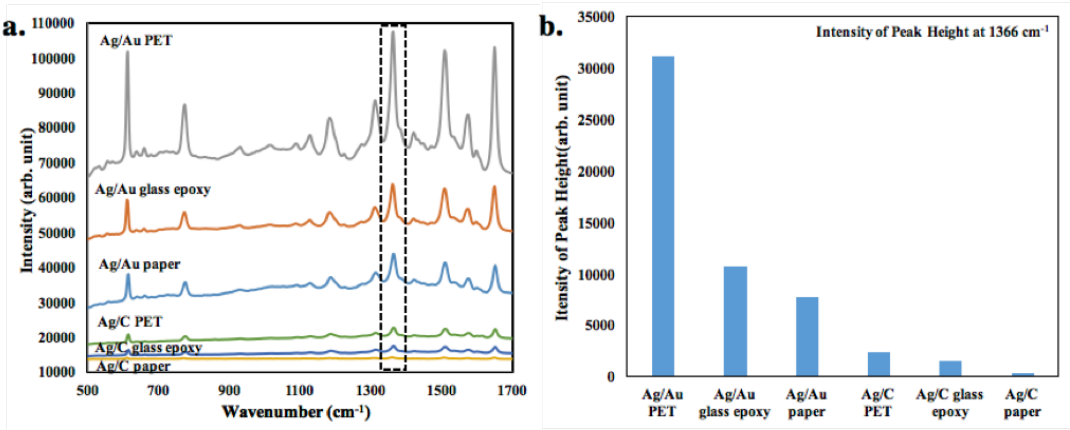

Fig. 1. a) SERS signal of 100 µM rhodamine 6G measured on the six kinds of SERS-active SPEs which were Ag/Au SPE and Ag/C SPE on the PET substrate, Ag/Au SPE and Ag/C SPE on the glass epoxy substrate, Ag/Au SPE and Ag/C SPE on the paper substrate. b) Signal to noise of peak height at 1366 cm-1 of these six kinds of SERS-active SPEs.

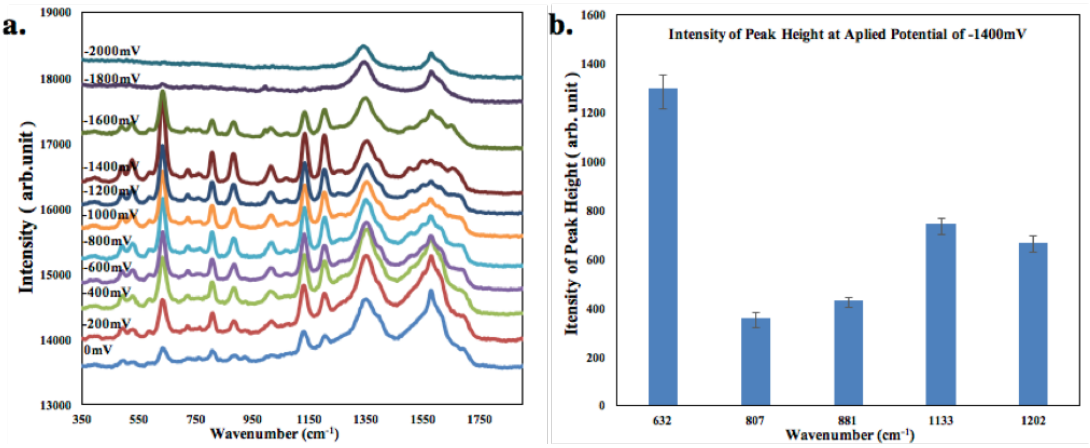

Fig. 2. (a) SERS spectral of 100 µM uric acid in aqueous solution with different potentials at the 12 s silver deposited carbon electrode on the PET substrate. The potentials were stepped in 200 mV increment from 0 mV to -2000 mV vs Ag/AgCl. Acquisition time: 60 s, laser power: 1.4 mW; (b) The peak intensities of SERS spectral of uric acid at the wavenumber of 632 cm-1, 807 cm-1, 881 cm-1, 1133 cm-1 and 1202 cm-1 when applied potential was -1400 mV.