Application Note AN-RA-003

In situ, fast and sensitive: Electrochemical SERS with screen-printed electrodes

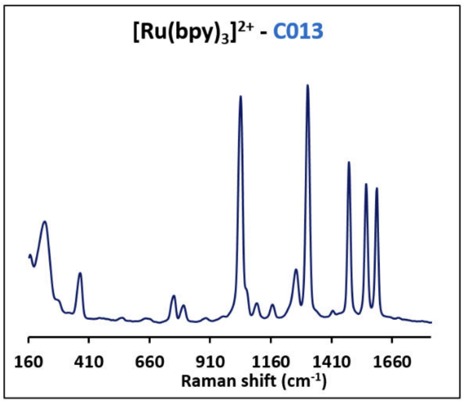
Substrates for surface-enhanced Raman spectroscopy (SERS) are typically fabricated with complex (micro/nano)structures of noble metals, enabling trace level detection of analytes. Due to the high costs and reactivity of these SERS substrates, they often have a limited shelf life. Development of new substrate materials which minimize these issues yet maintain the same performance standards is a constant concern. Screen-printed electrodes can be easily fabricated using different metallic materials with the well-established screen-printing method, leading to mass production of versatile, cost-effective, and disposable devices. In this Application Note, the feasibility of using readily-available screen-printed metal electrodes as suitable substrates for the fast and sensitive detection of different chemical species by in situ electrochemical SERS (EC-SERS) is shown.

INTRODUCTION

Substrates for surface-enhanced Raman spectroscopy (SERS) are typically fabricated with complex (micro/nano)structures of noble metals to obtain high surface-area plasmonic surfaces, which are capable to enhance this effect and, therefore, the detection of chemical species at very low concentrations. These substrates are frequently high-priced and because their high reactivity, they often have a limited shelf life. Development of new SERS substrates that minimize these issues but preserving a good analytical performance is a constant concern.

Screen-printed electrodes can be easily fabricated with different metallic materials and the well-established screen-printing method leading to mass production of versatile, cost-effective and disposable devices. They could be promising SERS substrates.

In this Application Note, the feasibility of using readily- available screen-printed metal electrodes as cost-effective and disposable substrates for the fast and sensitive detection of different chemical species by in situ electrochemical SERS (EC-SERS) is shown.



EQUIPMENT

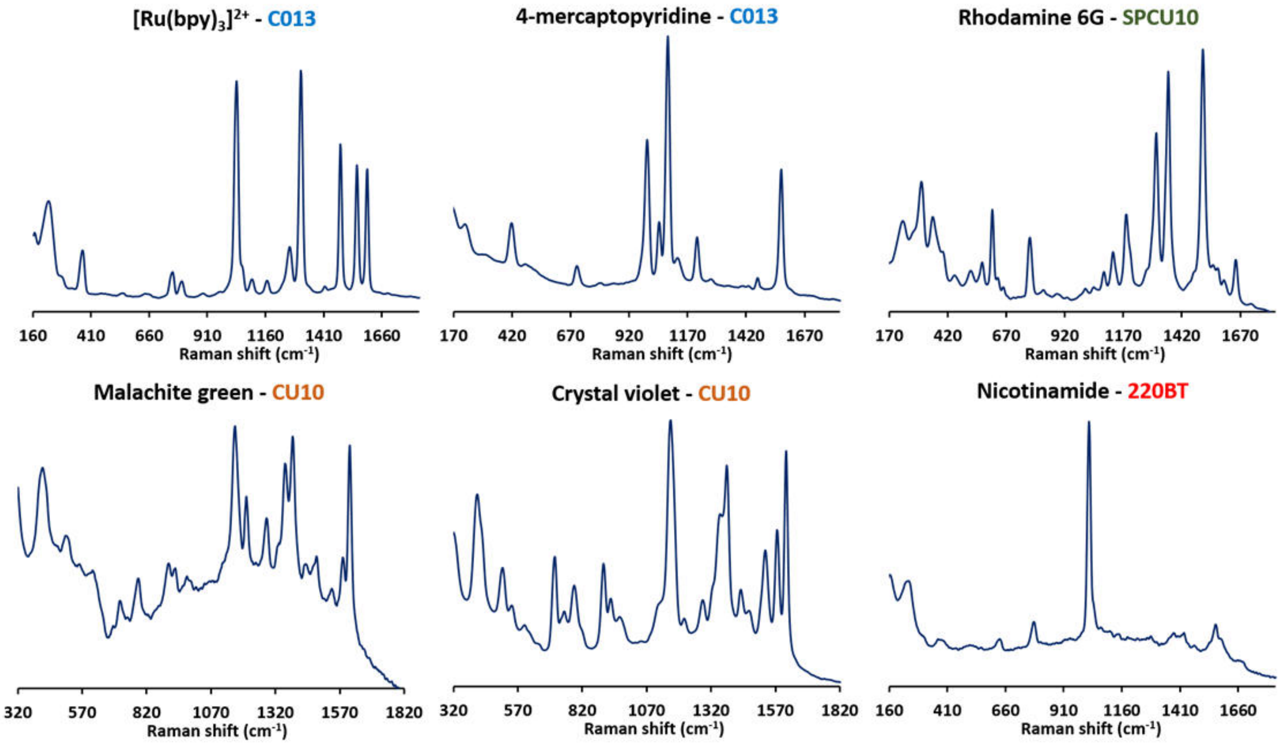
The fabulous, compact and integrated instrument for Raman Spectroelectrochemistry, SPELEC-RAMAN, was used. This instrument integrates in only one box: a spectrometer, a laser source (785 nm) and a bipotentiostat/galvanostat.

Screen-printed metal electrodes (refs. C013 (Silver), 220BT (Gold), CU10 (Copper), SPCU10 (Silver/Copper)) were placed in the Raman cell (RAMANCELL) coupled with the RAMANPROBE, which allows to perform Raman measurements of the electrode surface at the optimal focal distance.

METHODS

Screen-printed electrodes were electrochemically activated by cyclic voltammetry: C013 (from +0.3 V to -0.4 V), 220BT (from +0.6 to +1.2 V to -0.2 V), CU10 (from +0.15 V to -0.6 V) and SPCU10 (from +0.10 V to -0.4 V). A 60 µL solution of 0.1 M KCl containing the specific analyte was used for the in situ and simultaneous activation and detection. Concentrations were: 250 nM for $[Ru(bpy)_3]^{2+}$, 2 µM for 4-mercaptopyridine, 20 µM for Rhodamine 6G, 15 nM for Malachite green, 2.5 µM for Crystal violet and 80 µM for Nicotinamide.

RESULTS



CONTACT

CÔNG TY TNHH METROHM
VIỆT NAM
Tòa nhà Park IX, số 08
Đường Phan Đình Giót,
Phường Tân Sơn Hòa
null Thành phố Hồ Chí Minh

info@metrohm.vn