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Invited speaker's information form of IUMRS-ICA2017

Presentation on Symposium of "smart materials (D7)"

Presentationtitle:"Zwitterionic-copolymer-modified SERS Substrate Surface for Cationic Fluorescent Tag detection in Human Blood Solution"

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Brief biography of Speaker:Ten-Chin Wen is currently a Chair Professor at Department of Chemical Engineering, NCKU, Tainan, Taiwan. His research interests are in design, synthesis, and study of organic conducting systems including biointerfaces, bioelectronics, biosensors, and stimuli-responsive materials.

Education
Doctor of engineering, Lamar University, USA (1986)
Master of chemical engineering, National Taiwan University, Taiwan (1979)
Bachelor of chemical engineering, National Cheng Kung University, Taiwan (1977)

Rewards
MOST Excellent Research Award in 1994
MOST Outstanding Research Award in 1996, 1998, 2000
Prof. Zai-De Lai (賴再得) Award in 1995
Merit NSC Research Fellow Award in 2008

Abstract: In clinical diagnosis, surface enhanced Raman spectroscopy (SERS) technique has been used for rapid screening of bio-molecules in complex environment via real-time detection. However in complex environment, the enhanced Raman signal is extremely diminished in the vicinity of plasmonic SERS nanostructure, when anti-specific biomolecules (interested analyte) adsorption takes place at nanoscale of solid (SERS substrate)-liquid interface. Therefore, it thus produces a strong background noise, where low sensitivity, and selectivity is often associated with SERS signal from conventional substrate. It is thus necessary to modify the plasmonic (silver nanocube, Ag NC) architecture surface with zwitterionic copolymer, namely poly (glycidyl methacrylate-co-sulfobetaine methacrylate)-poly(GMA-co-SBMA), as novel anti-fouling SERS substrate to ensure specific adsorption capacities of bioanalyte, fast screening and re-usable (upon hydrolysis). Moreover, Ag NCs in concert with grafted copolymer via 1,2-ethanedithiol, which acted as metal-insulator-metal (MIM) substrate. In addition, the high densities of poly (GMA-co-SBMA) grafted at edge of NCs were likely to formation "nano-drift" (fiber like nano-junction) between adjacent NCs by elongated hydrothermal catalysis, causing strong surface plasmon resonance at these junctions. With anti-fouling surface, the adhesion of large biomolecules in platelet-rich plasma (PRP)

solution can be effectively resisted, as determined from immunoassay and fibrinogen adsorption. SERS signals for malachite green (MG) in PRP solution (10^{-6} M) were effectively distinguished using the copolymer-grafted MIM substrate. MG was deposited on adjacent copolymer-grafted NCs, which amplified the SERS signals. Moreover, the copolymer connected adjacent NCs, inducing the electromagnetic effect at copolymer-grafted surfaces, which improved the SERS mechanism. The hydration process restructured the MG-trapped copolymer-grafted surface, decreasing the number of MG characteristic peak regions and increasing that of copolymer regions. These results reveal that the grafting a copolymer onto an MIM substrate allows MG to be easily trapped and released in complex biomatrices and increases surface reproducibility due to anti-fouling, leading to high SERS enhancement.

Keywords: Surface-enhanced Raman scattering (SERS), Zwitterionic, Nanocubes, Platelet-rich plasma