Zensor NEWS
analytical chemistry
photoelectronics
Article
pubs.acs.org/ac

Photoelectrocatalytic Oxidation of *o*-Phenols on Copper-Plated Screen-Printed Electrodes

Jyh-Myng Zen,* Hsieh-Hsun Chung, Hsueh-Hui Yang, Mei-Hsin Chiu, and Jun-Wei Sue

Department of Chemistry, National Chung Hsing University, Taichung 402, Taiwan

A novel and sensitive detection method based on photoelectrocatalytic oxidation of *o*-diphenols was demonstrated on a copper-plated screen-printed carbon electrode (designated CuSPE) in pH 8 phosphate buffer solution. The *o*-diphenols can be detected amperometrically through electrochemical oxidation at a low applied potential of −0.1 V versus Ag/AgCl, where the CuSPE is much less subject to interfering reactions. The mechanism that induces good selectivity of the CuSPE is explained in terms of the formation of a cyclic five-member complex intermediate (Cu^{II}−*o*-quinolate). A prototype homemade flow through cell design is described for incorporating the photoelectrode and light source. Electrode irradiation results in a large increase in anodic current. The oxidative photocurrents produced by irradiation increase with light intensity presumably because of the formation of semiconductor Cu_2O. The principle used in this study has an opportunity to extend into various research applications.

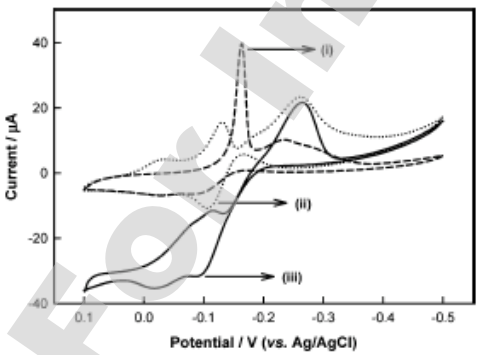
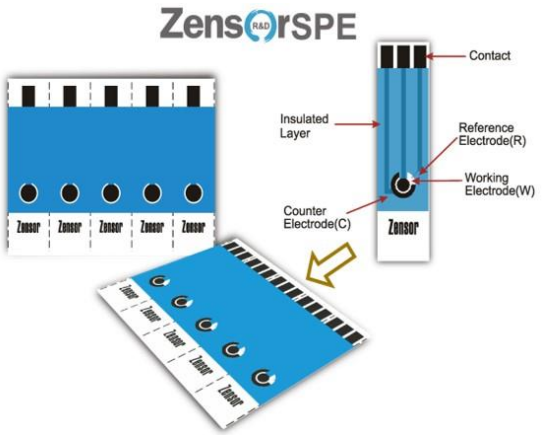


Figure 3. Cyclic voltammograms of the CuSPE in (i) blank pH 8 PBS without electrode irradiation, (ii) blank pH 8 PBS with electrode irradiation, and (iii) pH 8 PBS contained 2 mM CA with electrode irradiation. CV conditions: scan from +0.1 to −0.5 V at a scan rate of 5 mV/s.



Anal. Chem. **2003,** *75,* 7020−7025

For Internal Use Only

analytical chemistry
ARTICLE
pubs.acs.org/ac

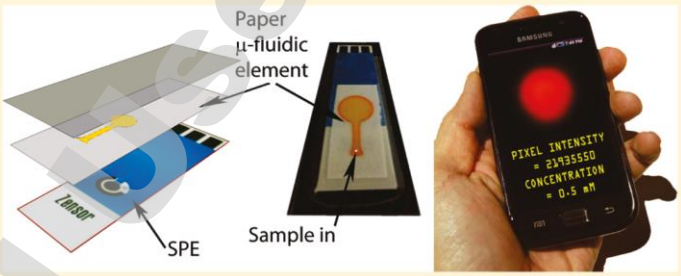
Electrogenerated Chemiluminescence Detection in Paper-Based Microfluidic Sensors

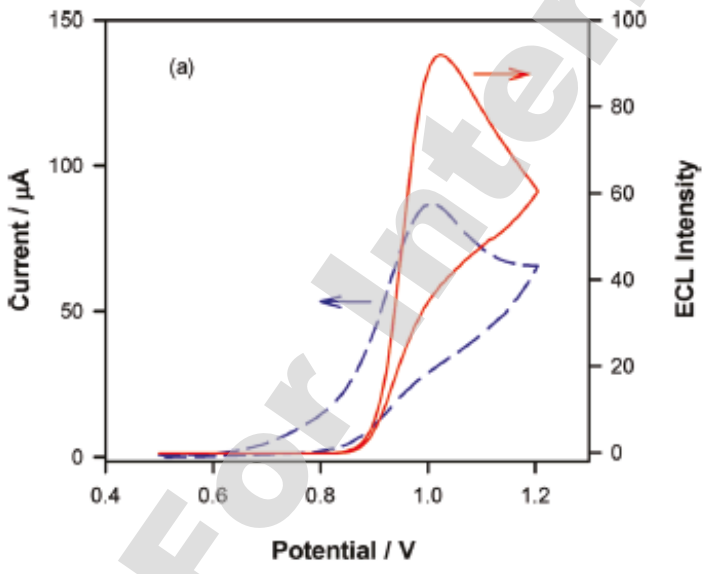
Jacqui L. Delaney,[†] Conor F. Hogan,[*,†] Junfei Tian,[‡] and Wei Shen[‡]

[†]Department of Chemistry, La Trobe University, Victoria 3086, Australia

[‡]Australian Pulp and Paper Institute, Department of Chemical Engineering, Monash University, Clayton, Victoria 3800, Australia

ABSTRACT: This paper describes the first approach at combining paper microfluidics with electrochemiluminescent (ECL) detection. Inkjet printing is used to produce paper microfluidic substrates which are combined with screen-printed electrodes (SPEs) to create simple, cheap, disposable sensors which can be read without a traditional photodetector. The sensing mechanism is based on the orange luminescence due to the ECL reaction of tris(2,2′-bipyridyl)ruthenium(II) ($Ru(bpy)_3^{2+}$) with certain analytes. Using a conventional photodetector, 2-(dibutylamino)-ethanol (DBAE) and nicotinamide adenine dinucleotide (NADH) could be detected to levels of 0.9 μM and 72 μM, respectively. Significantly, a mobile camera phone can also be used to detect the luminescence from the sensors. By analyzing the red pixel intensity in digital images of the ECL emission, a calibration curve was constructed demonstrating that DBAE could be detected to levels of 250 μM using the phone.





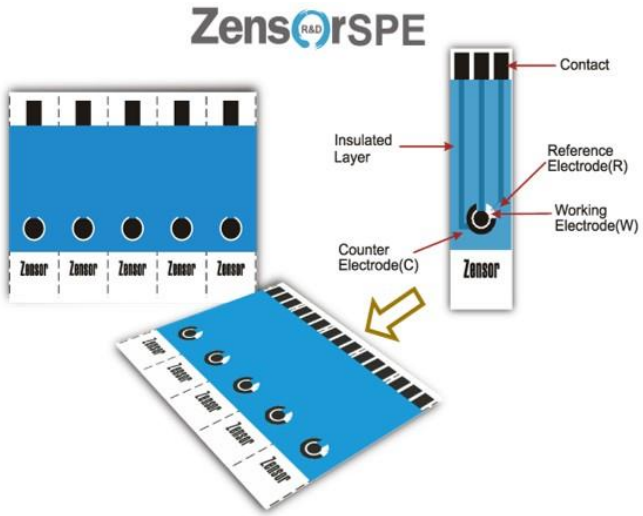


Figure 3. Typical sensor responses for (a) 5 mM DBAE and (b) 5 mM NADH in pH 7.5 0.1 M phosphate buffer. The voltammetric (current)

Anal. Chem. 2011, 83, 1300–1306

For Internal Use Only

ACS APPLIED MATERIALS & INTERFACES
Research Article
www.acsami.org

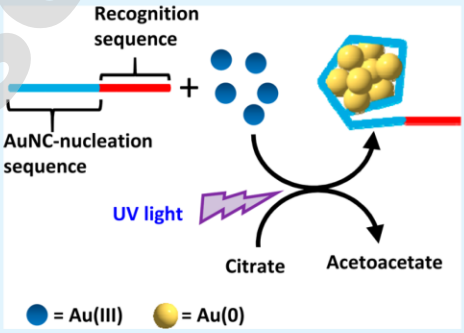
UV-Light-Induced Improvement of Fluorescence Quantum Yield of DNA-Templated Gold Nanoclusters: Application to Ratiometric Fluorescent Sensing of Nucleic Acids

Zong-Yu Li,[†] Yun-Tse Wu,[†] and Wei-Lung Tseng*[,†,‡]

[†]Department of Chemistry, National Sun Yat-sen University, 70 Lien-hai Road, Kaohsiung 804, Taiwan
[‡]School of Pharmacy, College of Pharmacy, Kaohsiung Medical University, Kaohsiung 807, Taiwan

Supporting Information

ABSTRACT: The use of DNA as a template has been demonstrated as an effective method for synthesizing different-sized silver nanoclusters. Although DNA-templated silver nanoclusters show outstanding performance as fluorescent probes for chemical sensing and cellular imaging, the synthesis of DNA-stabilized gold nanoclusters (AuNCs) with high fluorescence intensity remains a challenge. Here a facile, reproducible, scalable, $NaBH_4$-free, UV-light-assisted method was developed to prepare AuNCs using repeats of 30 adenosine nucleotides (A_{30}). The maximal fluorescence of A_{30}-stabilized AuNCs appeared at 475 nm with moderate quantum yield, two fluorescence lifetimes, and a small amount of Au^+ on the surface of the Au core. Results of size-exclusion chromatography revealed that A_{30}-stabilized AuNCs were more compact than A_{30}. A series of control experiments showed that UV light played a dual role in the reduction of gold-ion precursors and the decomposition of citrate ions. A_{30} also acted as a stabilizer to prevent the aggregation of AuNCs. In addition, single-stranded DNA (ssDNA) consisting of an AuNC-nucleation sequence and a hybridization sequence was utilized to develop a AuNC-based ratiometric fluorescent probe in the presence of the double-strand-chelating dye SYBR Green I (SG). Under conditions of single-wavelength excitation, the combination of AuNC/SG-bearing ssDNA and perfectly matched DNA emitted fluorescence at 475 and 525 nm, respectively. The formed AuNC/SG-bearing ssDNA enabled the sensitive, selective, and ratiometric detection of specific nucleic acid targets. Finally, the AuNC-based ratiometric probes were successfully applied to determine specific nucleic acid targets in human serum.



KEYWORDS: *gold nanoclusters, DNA, UV light, fluorescence, ratiometric sensor*

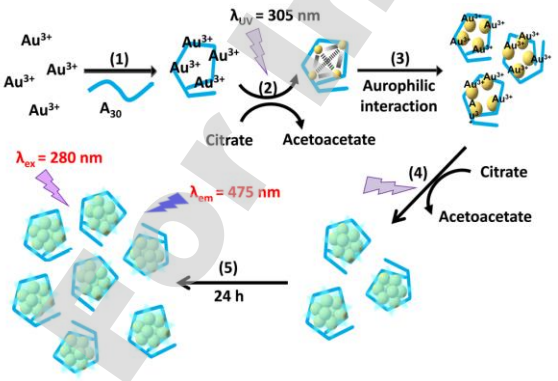
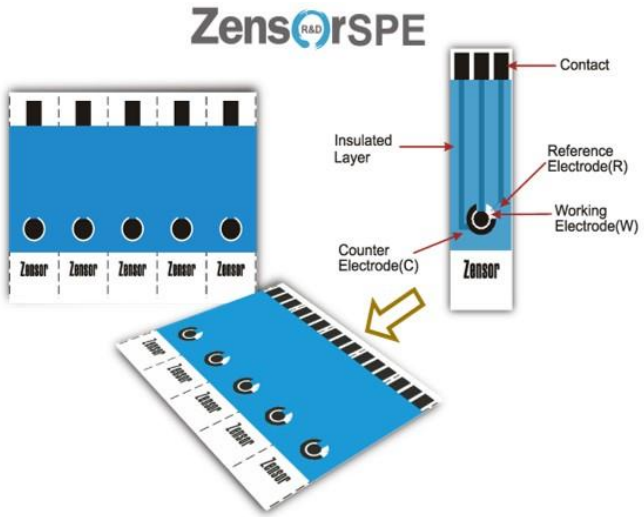


Figure 4. Step-by-step illustration of the procedure for UV-light-mediated synthesis of A_{30}-stabilized AuNCs in the presence of sodium citrate.



DOI: 10.1021/acsami.5b07766
ACS Appl. Mater. Interfaces 2015, 7, 23708−23716

For Internal Use Only

PAPER
View Article Online
View Journal | View Issue

CrossMark click for updates

Cite this: *RSC Adv.*, 2015, **5**, 93293

Surface-enhanced Raman scattering-active desert-rose-like Ag mesoparticles prepared using cyclic voltammetric methods†

You-Hong You, Yang-Wei Lin* and Chung-Yu Chen

Received 5th September 2015
Accepted 26th October 2015

DOI: 10.1039/c5ra18085f

www.rsc.org/advances

Desert-rose-like Ag mesoparticles were deposited on a screen-printed carbon electrode substrate through a cyclic voltammetric process in aqueous $AgNO_3$ containing Au nanoparticles. The prepared mesoparticles were characterized using scanning electron microscopy, energy dispersive X-ray spectroscopy, surface-assisted laser desorption/ionization mass spectrometry, X-ray photoelectron spectroscopy, and high-resolution X-ray diffractometry. In addition, the potential for applying these mesoparticles in surface-enhanced Raman scattering (SERS) was investigated. The prepared mesoparticles exhibited a more intense SERS signal (34.3 times) than did irregularly shaped Ag particles because of their extremely intense local electromagnetic fields. The enhancement factor of 4-mercaptobenzoic acid molecules on these mesoparticles was approximately 10^5. Furthermore, SERS spectra of 4,4′-dimercapto-azobenzene, 5,5′-dithiobis-2-nitrobenzoic acid, and Cy3 dye modified DNA were obtained using these mesoparticles; moreover, hot spots for most of the enhanced SERS signals were easily obtained. The thermal stability and aging behaviour of the prepared Ag mesoparticles were higher than those of irregularly shaped Ag particles.

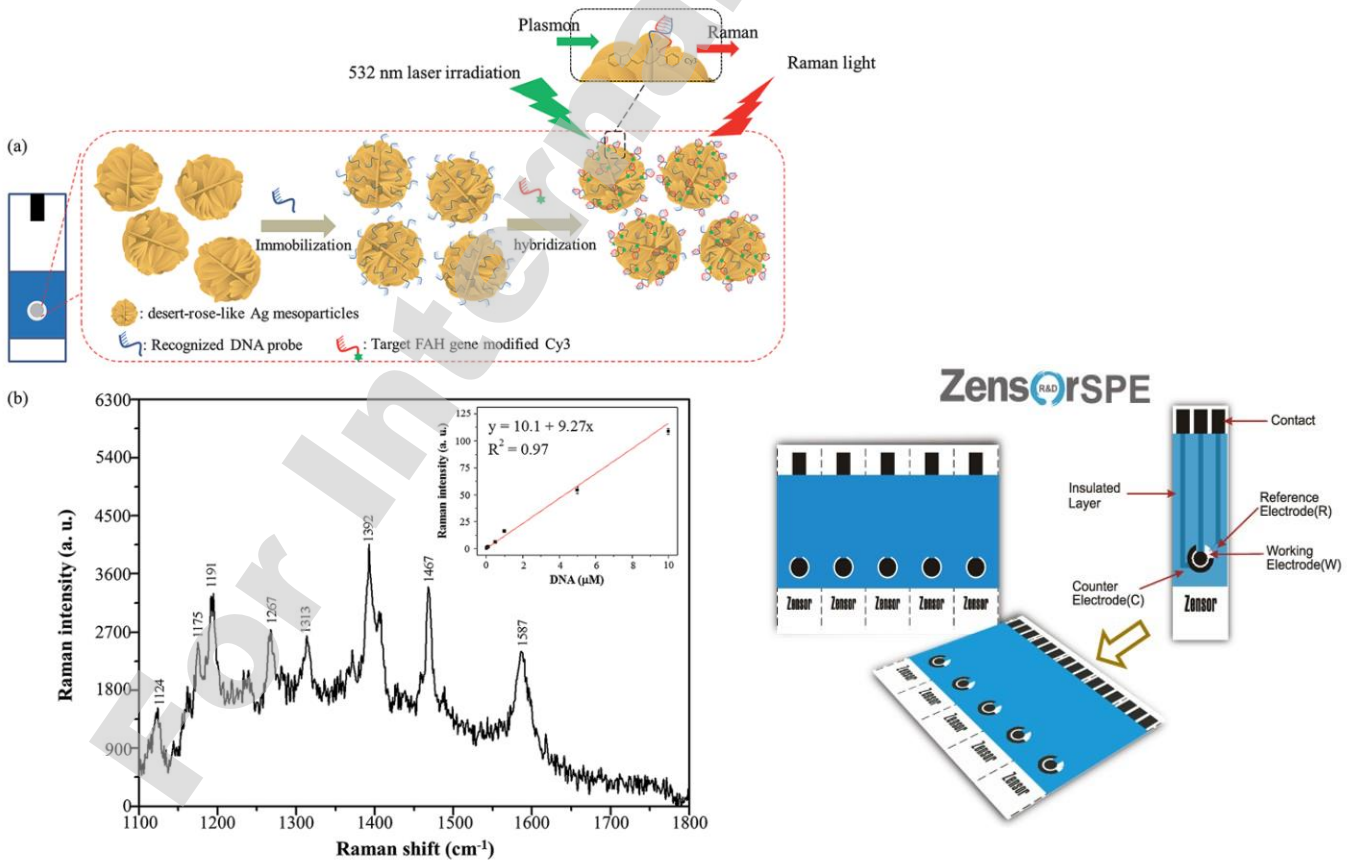


Fig. 4 Demonstration of DNA sensing. (a) Schematic of DNA immobilization and hybridization on the desert-rose-like Ag mesoparticles. (b) Raman spectra of Cy3 obtained using a target single-stranded DNA (FAH gene) attached to the desert-rose-like Ag mesoparticles. Inset: plots of Raman signal intensity *versus* DNA concentration.

For Internal Use Only