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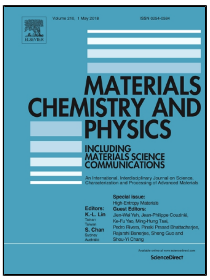

Electrodeposition of Well-Defined Gold Nanowires with Uniform Ends for developing 3D nanoelectrode ensembles with enhanced sensitivity

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PII:	S0254-0584(18)30266-9
DOI:	10.1016/j.matchemphys.2018.04.004
Reference:	MAC 20499
To appear in:	*Materials Chemistry and Physics*
Received Date:	12 November 2016
Revised Date:	24 March 2018
Accepted Date:	01 April 2018

Please cite this article as: Y.Bahari Mollmahale, M. Ghorbani, A. Dolati, D. Hosseini, Electrodeposition of Well-Defined Gold Nanowires with Uniform Ends for developing 3D nanoelectrode ensembles with enhanced sensitivity, *Materials Chemistry and Physics* (2018), doi: 10.1016/j.matchemphys.2018.04.004

Electrodeposition of Well-Defined Gold Nanowires with Uniform Ends for developing 3D nanoelectrode ensembles with enhanced sensitivity

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Abstract

Fabrication of well-defined gold nanowires (GNWs) is of significant importance in many fields such as sensing applications. In this study, the electrodeposition of well-defined GNWs inside polycarbonate (PC) template has been discussed in detail. GNWs were potentiostatically electrodeposited at different filling rates. The growth of GNWs at different stages of pore filling was monitored by electrochemical measurements and field-emission scanning electron microscopy (FE-SEM). It was confirmed that under growth rates between 2.5 to 4 nm/s, GNWs with smooth ends grew uniformly inside the template without any imperfections or corrugations. The length of GNWs was electrochemically controlled to be as same as the template thickness (6 μm) for sensing aims. Ensembles of three dimensional gold nanoelectrodes (3D GNEs) were then developed by partial etching of the PC template, thus making a brush-like structure out of GNWs. The sensitivity of the 3D GNEs was investigated in the presence of $[Fe(CN)_6]^{4-/3-}$ redox couple. The results indicated that the response of the prepared 3D GNEs effectively improved as the number of etching cycles increased. The introduced 3D GNEs show promising results for the future sensing applications.