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Co₃O₄ nanostructures on flexible carbon cloth for crystal plane effect of nonenzymatic electrocatalysis for glucose

Jianan Xu,^{a,c} Fenghua Li,^a Dandan Wang,^a Mian Hasnain Nawaz,^{a,d}

Qingbo An,^a Dongxue Han,^{*a,b} and Li Niu,^{*a,b}

^aState Key Laboratory of Electroanalytical Chemistry, c/o Engineering Laboratory for Modern Analytical Techniques, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, P.R. China.

^bCenter for Advanced Analytical Science, c/o School of Chemistry and Chemical Engineering, Guangzhou University, Guangzhou 510006, P.R. China.

^cUniversity of Chinese Academy of Sciences, Beijing 100039, P.R. China.

^dInterdisciplinary Research Centre in Biomedical Materials (IRCBM), COMSATS University Islamabad, Lahore Campus

*E-mail: (D.H.) dxhan@ciac.ac.cn & (L.N.) lniu@ciac.jl.cn; Fax: +86-431-85262800; Tel: +86-431-85262425.

ABSTRACT

This work accounts the influence of facet effect of Co₃O₄ nanocrystals towards nonenzymatic electrocatalysis of glucose induced by different crystal planes modified on carbon cloth (CC) electrode. Tuning the molar ratio of precursor compounds during hydrothermal synthesis of Co₃O₄, followed by thermal decomposition protocols, different crystal structure including nanocubes, nanothorns, nanooctahedrons and nanosheets were obtained with respective {001}, {110}, {111} and {112} facets. The electrochemical results of these different Co₃O₄ crystals demonstrate that the nanooctahedron with crystal plane of {111} displays the best nonenzymatic electro-catalytic glucose activity with widest linear range (0.5 – 1000 μM), highest sensitivity (246.8 μA mM⁻¹) and detection limit of 0.012 μM (S/N=3). Interestingly, the electrocatalytic activity for nonenzymatic electro-catalytic glucose is ranked in the order of {111} > {112} > {110} > {001}.

Key words: crystal plane effect, electrocatalysis, nonenzymatic glucose sensor, carbon cloth electrode, Co₃O₄

1. Introduction

Quantitative determination of glucose is important in various fields of research including food sciences (Holman et al. 2014; Shabnam et al. 2017), fuel cells (Bandodkar et al. 2016; Zhang et al. 2016), environmental and pharmaceutical industries (de Sales et al. 2018; Kirsch et al. 2013). In these lines, several methods have been applied for the quantitative detection of glucose.

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