Facile Synthesis of Carbon-Encapsulated Fe₃O₄ core/shell Nanospheres for Application in Pb(II) Electrochemical Determination

Shengbo Sang¹, Hui Zhang^{1,2,*}, Youyi Sun^{3,*}, Aoqun Jian¹, Wendong Zhang¹

¹ Micro Nano System Research Center, Key Lab of Advanced Transducers and Intelligent Control System of the Ministry of Education & College of Information Engineering, Taiyuan University of Technology, Taiyuan 030024, China.

² College of Computer and Control Engineering, North University of China, Taiyuan 030051, China.

³ Shanxi Province Key Laboratory of Functional Nanocomposites, North University of China, Taiyuan 030051, China.

*E-mail: zhanghui_8078@163.com, syyi2010@163.com

doi: 10.20964/2017.02.28

Received: 21 October 2016 / Accepted: 7 December 2016 / Published: 30 December 2016

In this study, carbon-encapsulated Fe₃O₄ core/shell nanospheres (Fe₃O₄@C) were synthesized by a facile method and characterized by transmission electron microscopy, scan electron microscopy, X-ray diffraction, IR spectroscopy and Raman spectroscopy. Furthermore, Fe₃O₄@C nanospheres electrode was characterized by cyclic voltammetry and electrochemical impedance spectra. The Fe₃O₄@C nanospheres electrode exhibited remarkable electrocatalytic activity towards Pb(II) oxidation with higher limit of detection and sensitivity of 0.17 μM and 95.6 μA/μM compared to other active materials on electrochemical detection of Pb(II) reported in previous works. Moreover, the Fe₃O₄@C nanospheres electrode exhibited high cycling stability and long-term durability. These results were attributed to the porous structure of the Fe₃O₄@C nanospheres electrode, which enabled the Fe₃O₄@C nanospheres to become highly accessible to the metal ion and provided more void volume for the reaction with metal ions. This work suggests that there is great potential in employing the Fe₃O₄@C nanospheres as heavy metal ions sensors.

Keywords: mesoporous carbon, Fe₃O₄, core-shell, electrochemical detection, heavy metal.

[FULL TEXT](#)

© 2017 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).