Mesoporous Carbon/Co₃O₄ Hybrid as Efficient Electrode for Methanol Electrooxidation in Alkaline Conditions

D.K. Hassan¹, S.A.El-safty^{2,3}, Khalil Abdelrazek Khalil^{1,4,*}, M. Dewidar¹, G. Abu el-maged⁵

¹Mechanical Design and Materials Department, Faculty of Energy Engineering, Aswan University, Aswan 81521, Egypt

²National Institute for Materials Science (NIMS), Research Center for Strategic Materials, 1-2-1 Sengen, Tsukuba-shi, Ibaraki-ken, 305-0047, Japan

³Graduate School of Advanced Science and Engineering, Waseda University, 3-4-1 Okubo, Shinjuku-Ku, Tokyo, 169-8555, Japan

⁴King Saud University, Department of Mechanical Engineering, College of Engineering, P.O. Box 800, Riyadh 11421, Saudi Arabia

⁵Mechanical Design and Production Department, Faculty of Engineering, Minia University, El-Minia, Egypt

*E-mail: kabdelmawgoud@ksu.edu.sa

doi: 10.20964/2016.10.09

Received: 27 June 2016/ Accepted: 4 August 2016 / Published: 6 September 2016

Controlling the combined features of electroactive materials to achieve remarkable improvements in all aspects of electrochemical performances is a great challenge. In this report, C/Co₃O₄ microspherical flowers were directly grown on three dimensional (3-D) porous nickel foam (NF) via a facile microwave-assisted hydrothermal approach followed by a post-annealing process. The self supported structure was employed in the electrocatalytic oxidation of methanol. Impressively, the hybrid C/Co₃O₄ electrode exhibits outstanding electrocatalytic activity and superior stability towards methanol electrooxidation compared to that of pristine Co₃O₄ fabricated by similar procedure. The higher reactivity of the mesoporous hybrid C/Co₃O₄ is largely attributed to the synergetic contribution of both carbon matrices and Co₃O₄ electroactive sites. Furthermore, the enhanced electronic configuration of the hybrid is mainly due to carbon embedment which greatly facilitates the electron transport in the electrode and further promotes the reaction kinetics. Results indicate that the conductive nickel substrate supported the binder free C/Co₃O₄ electrode can be considered as a potential candidate for high-performance energy storage and conversion devices and meet the desired features of high electrocatalytic activity and long-term stability which is indispensable for direct methanol fuel cells.

Keywords: Cobalt oxide, composite materials, direct growth, energy storage and conversion.

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