Electrochemical Investigation of Polypyrrole/ Nd_2O_3 Nanocomposite as High Performance Supercapacitor Material on Mild Steel Substrate

F. Abdollahi, M. Shahidi-Zandi*, M.M. Foroughi, M. Kazemipour

Department of Chemistry, Kerman Branch, Islamic Azad University, Kerman, Iran.

*E-mail: meshahidizandi@gmail.com

doi: 10.20964/2020.12.70

Received: 5 July 2019 / Accepted: 24 October 2019 / Published: 31 October 2020

The PPy films prepared on the mild steel substrate in the absence of the non-conductive iron(II) oxalate layer can be used as the effective electrodes for electrochemical supercapacitors. This study introduces a nanocomposite material for electrochemical redox capacitors, which has advantages, such as long life cycle and stability in an aqueous electrolyte. A polypyrrole/ Nd_2O_3 thin film electrode was synthesized electrochemically as an electrochemical supercapacitor. The supercapacitive performance of the PPy/ Nd_2O_3 coated electrode was investigated in 0.1 M H_2SO_4 solution using cyclic voltammetry (CV), galvanostatic charge–discharge and electrochemical impedance spectroscopy (EIS) techniques. The calculated specific capacitance of the PPy and PPy/ Nd_2O_3 electrodes using the CV method was 119 and 259 F.g^{-1} , respectively. The PPy/ Nd_2O_3 nanocomposite as a capacitor material has shown some advantages such as long life cycle and stability in an aqueous electrolyte. The retention of capacitance after 3000 cycles was about 88% of the initial capacitance at the current density of 1 A.g^{-1} . According to EIS data, the supercapacitor using PPy/ Nd_2O_3 nanocomposite material on mild steel substrate has high specific capacitance of 268 F.g^{-1} compared with 125 F.g^{-1} for PPy coating.

Keywords: Electrosynthesized polypyrrole; Supercapacitor; Nd_2O_3 Nanorods; Electrochemical impedance spectroscopy.

[FULL TEXT](#)

© 2020 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/>).