Development of hybrid $Ni(OH)_2$/rGO nanocomposite based high performance supercapacitor for mechanical energy harvesting application

P. E. Lokhande[1,2*], U. S. Chavan[1]

[1]Department of Mechanical Engineering, Vishwakarma Institute of Technology, Pune, India
[2]Department of Mechanical Engineering, Sinhgad Institute of Technology, Lonavala, India

[*]Corresponding author: prasadlokhande2007@gmail.com

Abstract

Recently, supercapacitor attracted attention of research world due to its fast charge-discharge capabilities, improved stability and longer life-span. Developing easy synthesis and environmental friendly approach to synthesis of active mass for electrode of supercapacitor is a great challenge. In this article we reported one step chemical bath deposition method for synthesis of $Ni(OH)_2$/rGO nanocomposite for high performance supercapacitor electrode. In this method nanocomposite is directly deposited on substrate Ni foam to fabricate binder-free electrode. Crystallographic and morphological study was conducted through XRD and SEM techniques. Result obtained after this characterization demonstrated that pure alpha phase formed and nanosheets connected together forming porous structure on rGO sheet. The electrochemical properties of resultant $Ni(OH)_2$/rGO nanocomposite were then investigated by cyclic voltammetry and galvanostatic charge-discharge test. The $Ni(OH)_2$/rGO nanocomposite showed highest specific capacitance of 1867 Fg^{-1} at current density of 1 Ag^{-1} and about 89% of initial capacitance was retained after 2000 cycles. The results suggests that the obtained $Ni(OH)_2$/rGO nanocomposite is the promising electrode material for supercapacitor applications. Further asymmetric supercapacitor fabricated by using prepared electrode as positive electrode and rGO deposited on Ni foam as negative electrode exhibited energy density of 40 Wh kg^{-1} at power density of 1500 Wkg^{-1}. Such high performance cell is used for harvesting mechanical energy.