22nd Iranian Inorganic Chemistry Conference, 23-25 August, 2023
University of Kurdistan

Fabricated a Novel and High Capacitance Symmetric Supercapsitor Electrode by Electrosynthesis NiCo LDH@Vertical Oriented Graphen Sheets on Graphite Sheet

Arezu Beyrami[a], Pouya Abedi[a], Mohammad kazemzadeh[a], Khalil Farhadi[a] , Morteza Bahram[a]

[a]*Department of Analytical Chemistry, Faculty of Chemistry, Urmia University, Urmia, Iran*

[*] *E-mail: beyrami.ab@gmail.com*

Supercapacitors are energy storage devices that have gained significant attention due to their high power density and long cycle life. The performance of supercapacitors is largely dependent on the properties of their electrodes[1]. NiCo LDH/VOGN/Graphite sheet electrode with very high surface area and excellent capacitive behavior was fabricated through the anodizing of the graphite followed by electrodeposition[2]. In this study, fabricated a novel electrode-based graphite sheet was anodized to increase its porosity and conductivity for the fabrication of Vertically Oriented Graphene Nanosheets (VOGN) that were covered by NiCo Layer double hydroxide (NiCo LDH) nanoparticles.[3] NiCo LDH was deposited onto the VOGN using an electrosynthesis method. The prepared electrodes were investigated by Fourier transform infrared (FT-IR), scanning electron microscopy (SEM), and BET (Brunauer–Emmett–Teller). The nanoarray structure can provide a large specific surface area and more channels, which facilitate rapid ion transfer and electron migration between electrolyte and electrode. The effect of anodizing graphite sheets and different ratios of Co and Ni on the electrochemical performance was investigated. It has been found that anodizing graphite sheets on the one hand increase the conductivity of the electrode, on the other hand, it provides more active sites for NiCo LDH attachment[4]. The resulting electrode exhibited excellent electrochemical performance, with high specific capacitance and good cycling stability. This approach provides a promising strategy for developing high-performance supercapacitor electrodes with enhanced porosity and surface area. The NiCo LDH/VOGN/Graphite sheet electrodes showed a very high capacitance of about 943 F g^{-1} at a current density of 1 A g^{-1}, an excellent energy density of 68.4 mWh g^{-1}, the power density of 1496.4 mW g^{-1}, and stable capacity of about 85.6% after 5,000 cycles in the charge/discharge process.

Keywords: Supercapacitor, NiCo LDH, Vertically Oriented Graphene Nanosheets, Graphite sheet Anodizing

References

[1] B.S. Singu, U. Male, S.E. Hong, K.R. Yoon, Synthesis and performance of nickel hydroxide nanodiscs for redox supercapacitors. *Ionics 22*,**2016**,1485.

[2] G. Wang, L. Zhang and J. Zhang, A review of electrode materials for electrochemical supercapacitors, *ChemSoc-Rev*, **2012**, 797.

[3] A.K. Samantara, S. Ratha, Springer Briefs in Materials, Materials Development for Active/Passive Components of a Supercapacitor Background, Present Status and Future Perspective, *Springer Singapore*,**2014**.

[4] X. Lu, F. Zhang, H. Dou, C. Yuan, S. Yang, L. Hao, L. Shen, L. Zhang, X. Zhang, Preparation and electrochemical capacitance of hierarchical graphene/polypyrrole/carbon nanotube ternary composites, *Electrochim. Acta*, 69 ,**2012**, 160.