Novel synthesis of $NiCo_2S_4$-GCN (graphitic C_3N_4) composite for high-performance supercapacitor application

Yogesh Kumar Sonia and Sumanta Kumar Meher*

Department of Chemistry, Malaviya National Institute of Technology Jaipur, Rajasthan-302017, India.
E-mail: skmeher.chy@mnit.ac.in

Abstract: Supercapacitors have higher power density than batteries, higher energy density than conventional electrostatic capacitors, fast charge and discharge rate and long service life. Transition metal sulphides have excellent potential for high-performance supercapacitor applications. Graphitic C_3N_4 (GCN) possess interconnected porous matrix that are highly conductive, thus allowing the corresponding hybrid electrodes to realize fast ionic and electronic transportation. The synergistic effect between $NiCo_2S_4$ and GCN can have much effect on the electrochemical properties of the $NiCo_2S_4$-GCN composite.[1–4] In this context, $NiCo_2S_4$-GCN composite was prepared by an improved hydrothermal synthesis method using a very novel precipitating agent. The detailed physiochemical properties of the composite were studied by PXRD, TGA, FESEM, HRTEM, RAMAN and XPS analyses. The electrochemical study of $NiCo_2S_4$-GCN was performed by cyclic voltammetry, galvanostatic charge-discharge and electrochemical impedance spectroscopy methods. The electrochemical analyses of the composite shows excellent pseudocapacitance, Coulombic efficiency and low charge-transfer resistance due to the facile transfer of electrolyte ions and better utilization of the electro-active porous surface. This study clearly reveals that the as-prepared $NiCo_2S_4$-GCN composite can be an excellent electrode material for smart energy storage application.

References:

[1] Chen, X.; Chen, D.; Guo, X.; Wang, R. ACS Appl. Mater. Interfaces 2017, 9, 22, 18774–18781
[2] Qu, G.; Jia. S.; Wang, H.; Cao, F.; Li, L.; Qing, C.; Sun, D.; Wang, B.; Tang, Y.; Wang, J. *ACS Appl. Mater. Interfaces*, 2016, 8 (32), 20822–20830.
[3] Fan, Y,-M.; Fan, L.-Z.,Yongchang, L.; Xiaobin Liu, T.; Yuning Liu, L. Electrochim. Acta 2017, 249, 1–8
[4] Dai, S.; Bai, X.; Wang, X.; Yan, X. Chemistry Select 2017, 2, 246–251.

5th International Conference on Nanotechnology for Better Living (NBL-2019), Jointly organized by National Institute of Technology (NIT) Srinagar and Indian Institute of Technology (IIT) Kharagpur; April 7 – 11, 2019 at SKUAST, Shalimar Srinagar, Jammu and Kashmir, India; Editor: Dr. M. A. Shah and Prof. P. Banerji, ISBN:978-81-939516-0-6; Published by Applied Science Innovations Pvt. Ltd., Pune, Maharashtra, India.