Two-step novel synthesis of Mn-Ni-Co-Oxide(MNCO)@g-C_3N_4 ribbon-like hetero-nanoarrays for supercapacitor application

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Abstract: Since last few years, the hassle of clean, efficient, and renewable energy sources is remarkable and thereby driving intense scientific concern in the production, storage and management of this precious energy. Among variety of electrical energy storage devices, supercapacitors (SCs), also known as electrochemical capacitors, have industrial attention because of their high power density and very long cyclic stability as compared to their counterparts such as batteries, fuel cells and conventional capacitors etc.

To improve the electrochemical properties of the electrode materials, Mn-Ni-Co-Oxide (MNCO)@g-C_3N_4 Ribbon-like Hetero-nanoarrays were synthesized by a simple two-step approach including hydrothermal method and subsequent calcination process. This ternary metal oxide composite was directly utilized for the psuedocapacitive investigation because it is believed that these three metal elements can provide synergistic effects during the redox reaction process compared to the single component metal oxides. The chemical composition and morphology of the material was characterized by XRD, EDS and FESEM and HRTEM techniques. The electrochemical capacitance of MNCO@g-C_3N_4 was examined by cyclic voltammetry, galvanostatic charge–discharge and electrochemical impedance measurements. Results shows that the MNCO@g-C_3N_4 electrode material exhibits electrochemical activity for supercapacitor applications. A maximum specific capacitance value of 5624 F g^{-1} could be obtained under an applied current density of 1 Ag^{-1} in 6 mol L^{-1} KOH electrolyte. It is envisaged that the novel MNCO@g-C_3N_4 ternary oxide composite material can be an alternate electrode material for high-performance supercapacitor application.

References:

1. Singh, A. K.; Sarkar, D.; Karmakar, K. ACS Appl. Mater. Interfaces 2016, 8, 32, 20786-20792.
2. Jang, G. S.; Ameen, S.; Akhtar, M.S.; Kim, E. Chemistry Select 2017, 2, 8941- 8949.
3. Xu, J.; Zhang, H.; Wang, R.; Tong, Y.; Lu, Q. Nanoscale 2018, 10,13702-13712.
4. Zhang, Q; Xu, W; Sun, J; Pan, Z; Jhao, J. Nano Lett. 2017, 17, 12, 7552-7560.
   Ma, L.; Sun, G.; Ran, J.; Lv, S.; Shen, X. ACS. Appl. Mater. Interfaces 2018, 10, 26, 22278-22290.

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.