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Electrochemical performance of transition metal sulfide by employing different synthesis techniques for hybrid batteries

Umer Aziz, Muhammad Zahir Iqbal
GIK Institute of Engineering Sciences and Technology, Pakistan

Hybrid batteries have gained peculiar attention in the energy storage domain. However, they still lack to accommodate high specific energy (Es) and power density (Ps) demands. Therefore, the performance enhancement of supercapacitors by utilizing various electrode materials with superior electrochemical activities is desired. Herein, we have studied various manganese-based nanomaterials for hybrid battery applications. Initially, we synthesized manganese sulfide (MnS) via a sonochemical approach and later synthesized it through the hydrothermal method. The structural, morphological, and elemental studies were performed by X-ray diffraction (XRD), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDX). At first, the electrochemical characteristics of MnS materials were studied in both three and two-electrode setups. The electrode with superior outcomes in three-electrode cells was studied further as a positive electrode with activated carbon (AC) in the ASC device. The S2//AC ASC displayed enhanced energy of 62.5 Wh kg-1 at a power of 1700 W/kg (2 A/g). Besides, the device obtained high power of 5950 W/kg and achieved an energy of 10.13 Wh kg-1. Furthermore, a simulation approach was scrutinized to verify the capacitive and diffusive contributions. The results obtained predict strontium sulfides to be efficient materials for asymmetric supercapacitor applications.

Recent Publications

1. Muhammad Zahir Iqbal, Umer Aziz (2022): Supercapattery: Merging of battery-supercapacitor electrodes for hybrid energy storage devices. Journal of Energy Storage. Elsevier Publishing Company. 46, 103823, 2022

Biography

Umer Aziz graduated from Islamia College University, Peshawar with a field of interest in Physics, and material science. He is currently expertise in Applied Physics at Ghulam Ishaq Khan Institute, Pakistan. Umer's past research has focused on Lead-free piezoelectric ceramics and currently studying different nanomaterials for hybrid supercapacitors applications. He is currently interested in perusing his Ph.D. In the area of batteries and supercapacitors. After completion of the program, Umer aspires to work as a researcher in the industry.

umeraziz60@gmail.com