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Magnetron sputtered tungsten di-sulfide: An efficient battery grade electrode for supercapattery devices

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Tungsten disulfide (WS2) due to its layered structure and high capacitance is an attractive electrode material for supercapattery application. In this study, different thickness of WS2 is deposited by the magnetron sputtering technique. The thickness of the sputtered layer is also optimized. The sputtered WS2 is characterized by various techniques such as X-ray diffraction and atomic force microscopy to examine the structural morphology and study the surface morphology. The electrochemical performance of sputtered WS2 is investigated through three-electrode assembly via cyclic voltammetry, galvanostatic charge-discharge, and electrochemical impedance spectroscopy. Sample S2 (WS2 with 250 nm thickness) shows the best performance in comparison with other samples. The S2 exhibits the maximum specific capacity of 346 C/g at 0.5 A/g. The hybrid device is designed by keeping S2 as positive and activated carbon as the negative electrode. The device exhibits a maximal specific capacity of 190.2 C/g and after 3000 galvanostatic charge-discharge, cycles it retains 98.6% of its initial capacity. The maximum specific energy of the device is 45.2 Wh/kg which is high enough and an exceptional maximum specific power of 10,200 W/kg. Furthermore, by applying Dunn's model the diffusive and capacitive contributions of the hybrid device are studied. Moreover, b values are calculated by employing power law, the trend of b values confirms the asymmetric nature of supercapattery device. The excellent results of magnetron sputtered WS2 make it a favorable electrode for its application in supercapattery devices.

Biography

Nayyab Amjad graduated from Hazara University, Mansehra with a field of interest in Physics. She is currently expertise in Applied Physics and studying different nanomaterials for hybrid supercapacitors applications at Ghulam Ishaq Khan Institute, Pakistan. She is also interested in perusing her Ph.D. in the area of batteries and supercapacitors. After completion of the program, Nayyab aspires to work as a researcher in the industry

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