Activated Carbon /Ag_2MoO_4-SnS heterostructured photocapacitor for solar energy harvest and storage

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Abstract

Solar cells and batteries are so far recognized as independent technologies of solar energy harvesting and storage systems which only utilized a fraction of solar energy. It is highly desirable to improve the efficient utilization of solar energy. Harvesting and storing solar energy using heterostructured photocapacitors (HPCs) with activated carbon (AC) is being considered as a promising option. Here, we report a heterostructured photocapacitive device based on AC/Ag_2MoO_4-SnS for energy harvest and storage. Hydrothermally prepared Ag_2MoO_4 nanorods were characterized using techniques such as powder X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) and Diffuse Reflectance Spectroscopy and subsequently deposited on AC coated fluorine-doped tin oxide (FTO) glass substrate by doctor blading method followed by deposition of SnS nanoflakes. The crystalline structure, surface morphology, and optical properties of the AC/Ag_2MoO_4-SnS nanomaterials were also examined. The electrochemical measurements of the synthesized nanomaterials were carried out using Cyclic Voltammetry (CV) by employing the novel device with the structure of AC/Ag_2MoO_4-SnS on FTO as the photoanode (working electrode) and Pt wire as cathode (counter electrode) with the electrolyte solution of sodium phosphate buffer. The energy storage performance of the photocapacitor was investigated under 1 sun illumination, and the specific capacitance of 20 mF/g in the potential range of -1 to 1.3 V *vs.* Ag/AgCl was attained with the novel device fabricated in this study. This study provides a new research strategy for the preparation of economically viable, heterostructured photocapacitors with AC for solar energy harvest and storage.

Keywords: Heterostructured photocapacitor, solar energy, activated carbon, energy storage, working electrode