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Using $(t\text{-}Bu)_5[PW_{11}CoO_{39}]$ to fabricate a sponge graphene network for energy storage in seawater and acidic solutions

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Abstract

In this study, the sponge reduced graphene oxide (rGO) is developed by using $[(n\text{-}C_4H_9)_4N]_5[PW_{11}CoO_{39}]$, as a three-dimensional framework and a good precursor to the construction of porous structures. Various techniques are also used to characterize the prepared sponge $[(n\text{-}C_4H_9)_4N]_5[PW_{11}CoO_{39}]$@rGO. It is found to be a nanocomposite of choice for the preparation of electrodes for supercapacitors applications. The power of the nanocomposite toward energy storage is evaluated in both seawater and 0.5 M H_2SO_4 solution using galvanostatic charge and discharge and cyclic voltammetry. The nanocomposite will be found to improve significantly the specific capacitance (834.3 and 311.7 F g^{-1} at 0.91 A g^{-1}) and long service life by 98.0% and 97.5% at 3.0 A g^{-1} in seawater and 0.5 M H_2SO_4 solution, respectively. Furthermore, this nanocomposite is observed to exhibit a high power density 3640.8 (W kg^{-1}) at energy densities of 20.6 and 35.4 (Wh kg^{-1}) in seawater and 0.5 M H_2SO_4 solution, respectively. Due to its sponge structure, multiplex channels are observed to appear that help the quick diffusion of the electrolyte and the reduction of ion diffusion duration. The use of rGO and polyoxometalates offers the advatanges of fast electron transfer and enhanced electrochemical reaction. Overall, the

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