Green synthesis of ZnO nanostructured electrode for supercapacitor.

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The electrical double layer capacitor (EDLC), has been extensively investigated for its many applications in electric and electronic devices, due to high power density and long-life cycle. Zinc oxide (ZnO) is a promising candidate for the electrochemical supercapacitor electrode. ZnO is well known to be an active battery electrode material with a high energy density of about 650 Ag^{-1} [1], but it has the disadvantage of dendrites formation during consecutive cycling, which decreases life cycle. In this paper, we report a relatively straightforward, environmental friendly and low-cost method for preparing ZnO electrodes that consists in two steps. Starting with a ZnO seed layer onto a steel substrate employing the successive ionic layer adsorption and reaction (SILAR) method [2]. Subsequently, a chemical deposition bath was used for the nanostructured ZnO growth. A low temperature SILAR method was used in this study, replacing high temperature and vacuum methods, such as chemical vapor deposition or sputtering, to create an interface region between the conductive steel current collector and the nanostructured ZnO electrode. Scanning electronic microscopy has been employed in the characterization of the two-step produced nanostructured ZnO electrodes. The electrochemical performance of the nanocomposite electrodes has been investigated using cyclic voltammetry (10 to 50) mVs^{-1} and charge-discharge curves (1 to 20) $mAcm^{-2}$ in aqueous KOH electrolyte at several concentrations. Cyclic voltammetry exhibited a broad redox peak indicative of typical reversible redox reaction of ZnO with the K^{+}, responsible for the faradaic reactions in the supercapacitor. The enhanced electrochemical performance has been attributed to the synergistic effects of pseudo-capacitance behavior of the ZnO phase grown on the ZnO seeds and to the nanostructured features of the electrode.

[1] Ü.Alver et al., Synthetic Metals 211, p30 (2016)
[2] R.S. Kumar et al., J. of Alloys and Comp. 506, p351 (2010)