The Effect of Air on Electrochemical Behavior of Activated Carbon at Negative Potentials in Aqueous Li₂SO₄ Electrolyte

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doi: 10.20964/2019.07.07

Received: 13 January 2019 / Accepted: 28 March 2019 / Published: 10 June 2019

The electrochemical behavior of activated carbon (AC) has been studied in the presence of air at negative potentials in 0.5M Li₂SO₄ aqueous electrolyte applying the linear sweep voltammetry (LSV). The AC electrodes of low mass loading are disposed and found with distorted LSV curves at constant scan rate, rather than formation of symmetric rectangular shape. Such unusual phenomenon for AC in the electrolyte exposed to air alternatively can be reflected by the discharge capacity of 145 mAh/g with a pretty high coulombic efficiency (332%) obtained in the galvanostatic charge-discharge (GCD) test. Meanwhile, the variation in current with scan rate at fixed potentials corresponds to the remarkable deviation of exponent in the power-law equation from the value 1. The oxidative effect of O₂ and H₂O is investigated to explain the abnormal electrochemical behavior of AC. In the vessel with N₂ flow, AC turns to exhibit recognizable capacitive behavior without considering residual dissolved oxygen in the electrolyte. The self-discharging of AC from 0V to around -0.2V without any external bias is observed in the electrolyte of low level of dissolved oxygen. The above results show the improved electrochemical stability of AC in the absence of air, providing information of value based on application for aqueous lithium-ion hybrid supercapacitors using AC anode.

Keywords: activated carbon (AC); linear sweep voltammetry (LSV); air; oxidative effect; self-discharging; electrochemical stability

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