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Electrochemical performance of symmetric supercapacitors based on carbon biomaterials in different electrolytes

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The supercapacitors are known to be promising energy storage devices for applications requiring high power and long cycle life. There are two basic and interlinked approaches to improving their capacity and stability, focusing on the appropriate choice of electrode material on the one hand and the electrolyte on the other.
The present study examines the relationship between the texture and the surface chemistry of two activated carbons, the electrolyte type and the electrochemical properties of symmetric supercapacitors.
The used carbons are commercial materials, produced from "Kuraray Europe" GmbH and obtained by pyrolysis of coconuts by green technology. There are physicochemical characterized by XPS spectroscopy, SEM and BET analyses. The surface functional groups and pore size distribution are determined by Böhm titration method and Barett-Joyner-Halenda analysis, respectively. The supercapacitor performances are tested by charge/discharge galvanostatic experiments in aqueous (KOH, LiOH, NaOH) and organic electrolytes ($LiBF_4$, $NaBF_4$, $LiPF_6$ with different solvents). To go inside into surface and bulk electrode changes during electrode cycling, the *ex-situ* XPS and SEM/EDS experiments are undertaken.
The SC cells demonstrate high discharge and stable capacitance as well as high effectiveness of charge-discharge process in alkaline electrolytes. It is found that activated carbon having lower content of acidic groups and higher specific surface area displays best performances in 6 M KOH. These results confirm that the electrolyte conductivity and the adsorption of the electrolyte ions into electrode materials contribute greatly on charge storage behaviour of the electrodes in these systems.
In organic electrolytes, the investigated ACs show stable behaviour, but a lower capacity than in alkaline electrolytes. The reasons for this result may be related to their morphology and the different (more complex) processes occurring in these mediums. The development of composite electrodes between AC and transition metal oxides/hydroxides, which show complex morphological architectures and provide a synergistic effect between the components, is a perspective of improving their electrochemical properties.

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