Journal of Power Sources
Volume 359, 15 August 2017, Pages 17–26

Lithium and sodium ion capacitors with high energy and power densities based on carbons from recycled olive pits

Jon Ajuria[a], Edurne Redondo[a], Maria Arnaiz[a], Roman Mysyk[a], Teófilo Rojo[a, b], Eider Goikolea[a]

Show more

https://doi.org/10.1016/j.jpowsour.2017.04.107

Highlights

- Synthesis of Hard Carbon and Activated Carbon from recycled olive-pit bio-waste.
- Fabrication of Lithium Ion Capacitor exceeding 100 Wh Kg^{-1}_{AM} and 10 KW Kg^{-1}_{AM}.
- Lithium Ion Capacitor with 90% capacity retention after 10000 cycles.
- Fabrication of Sodium Ion Capacitor exceeding 100 Wh Kg^{-1}_{AM} and 7 kW kg^{-1}
- Sodium Ion Capacitor with 70% capacity retention after 5000 cycles.

Abstract

In this work, we are presenting both lithium and sodium ion capacitors (LIC and NIC) entirely based on electrodes designed from recycled olive pit bio-waste derived carbon materials. On the one hand, olive pits were pyrolized to obtain a low specific surface area semigraphitic hard carbon to be used as the ion intercalation (battery-type) negative electrode. On the other hand, the same hard carbon was chemically activated with KOH to obtain a high specific surface area activated carbon that was further used as the ion-adsorption (capacitor-type) positive electrode. Both electrodes were custom-made to be assembled in a hybrid cell to either build a LIC or NIC in the corresponding Li- and Na-based electrolytes. For comparison purposes, a symmetric EDLC supercapacitor cell using the same activated carbon in 1.5 M Et_4NBF_4/acetonitrile electrolyte was also built. Both LIC and NIC systems demonstrate remarkable energy and power density enhancement over its EDLC counterpart while showing good cycle life. This breakthrough offers the possibility to easily fabricate versatile hybrid ion capacitors, covering a wide variety of applications where different requirements are demanded.