Lithium bis(oxalato)borate (LiBOB) as an electrolyte for supercapacitors

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The study of different electrode materials and electrolytes for the application in high energy density/high power density supercapacitors is important in order to replace harmful acetonitrile based electrolytes and to introduce new cheaper capacitor materials with advanced electrochemical characteristics.

Two- and three-electrode test cells were completed inside a glove-box (O₂ < 0.1 ppm and H₂O < 0.1 ppm) using different LiBOB electrolytes based on ethylene carbonate (EC):dimethyl carbonate (DMC) (1:1), propylene carbonate (PC), or EC:PC (2:3) mixed solvents. The electrode material used was mainly microporous carbide-derived carbon C(TiC) (synthesized from TiC by chlorination method) with specific surface area of \( S_{BET} = 1689 \text{ m}^2\text{g}^{-1} \) and pore size distribution maximum at 1.08 nm.

According to Nyquist plots, obtained for a two-electrode system based on 0.8 M LiBOB in EC:DMC, nearly ideal capacitive behaviour was observed up to \( U = 2.5 \text{ V} \) (Fig.1). The energy and power densities calculated for this system at \( U = 2.5 \text{ V} \) were 19 Wh kg\(^{-1}\) and 52 kW kg\(^{-1}\), respectively. Only a 2% loss in discharge capacitance was observed for this system after 1000 cycles of charging/discharging between 0 and 2.2 V.

Three-electrode systems were completed for more detailed analysis of the processes taking place at the C(TiC) | electrolyte interface. The solid electrolyte interface (SEI) formation characteristics, adsorption and mass transfer behaviour at positively and negatively charged electrode surface, etc. were studied.

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