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Characteristics of Electric Double Layer Capacitors Produced with Electrolytes Based on Deep Eutectic Solvents

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The storage capacity of electric double layer capacitors or supercapacitors with electrolytes based on deep eutectic solvents (DES) has been investigated in this study. DES composed of L-lactic acid with nicotinamide, L-alanine, ammonium acetate, sodium acetate and choline chloride have all been prepared at a molar ratio of 7:1. Furthermore, urea with choline chloride at a molar ratio of 2:1 has also been used as electrolyte for the electrochemical supercapacitors. The DES supercapacitors were prepared using commercial activated carbon electrodes after removing the volatile organic electrolyte with back-pumping vacuum. The electric characteristics of these supercapacitors with DES electrolytes were determined by cyclic voltammetry at room temperature and above up to 80°C. The cyclic voltammetry scan rates were varied from 2 to 25 mVs⁻¹. The lowest scan rate led to a high specific capacitance of 150±8 Fg⁻¹ for urea with choline chloride at a molar ratio of 2:1 and using a maximum applied potential of 1.7 V. For higher molar ratio (7:1) of L-lactic acid with the others hydrogen bond acceptors (HBA) it was necessary to increase the temperature above room temperature to improve the specific capacitance. The best results have been obtained with two solids (urea and choline chloride) as starting compounds for preparing the DES. Equivalent series resistances (ESR) have also been determined in this work employing galvanostatic cycling tests with current densities between 2 and 20 mA g⁻¹.