CONSTRUCTION AND CHARACTERISATION OF DOUBLE LAYER CAPACITORS

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Electrochemical double-layer capacitors [ECDL] (also called supercapacitors) have received much attention over last couple decades due to their possible application as high-power energy-storage device. An ECDL is an electrochemical energy storage device with high power density, which could be used in application such as pulse power devices or electric vehicles. It is well known that the double layer capacitance on a clean graphite surface is fixed at around 20 μF cm^{-2} [1].

ECDL, based on high surface area activated carbons and aqueous, non-aqueous or polymer electrolytes, have been developed with promising results. Batteries have higher energy density, but they suffer from low power density and low cyclability (usually < 1000). Conventional capacitors provide a high power (> 103 kW kg^{-1}) and a long cycle life, but with a small energy density (about 70 mW kg^{-1}). However, their specific energy capacity is limited by the breakdown field (V μm^{-1}) of their dielectric material. The electrochemical double-layer capacitor (ECDL) has been developed for these cases which need a large energy density (Wh kg^{-1}),high power density (W kg^{-1}), and long cycle life (> 100,000). The ECDL capacitor is a new type of capacitor offering new features intermediate those of a battery and a conventional capacitor.

The ECDL capacitor consists of two electrodes that are immersed in an electrolyte with a separator between them. The electrode consists of a current collector in contact with the active material. In ECDL capacitors, the energy storage arises mainly from the separation of electronic and ionic charges at the interface between high-area electrode material and the electrolyte solution. In the ECDL, this charge separation distance, d, is reduced to the Helmholtz double-layer d_D thickness, which is defined as half the diameter of the adsorbed solvated ions at the electrode/solution interface.

Electrodes described in this paper use commercially available activated carbon (AC) material and a composite RuO_2 + AC [2]. Characterization has been performed by an electrochemical system fully developed at Technical faculty in Bor. The system is based on a PC P4, a commercially available ADDA converter and an external interface for analog signal processing [3]. The software platform is LabVIEW 8.2 package and application software is adapted to investigations of the systems containing high capacitancies.

References
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