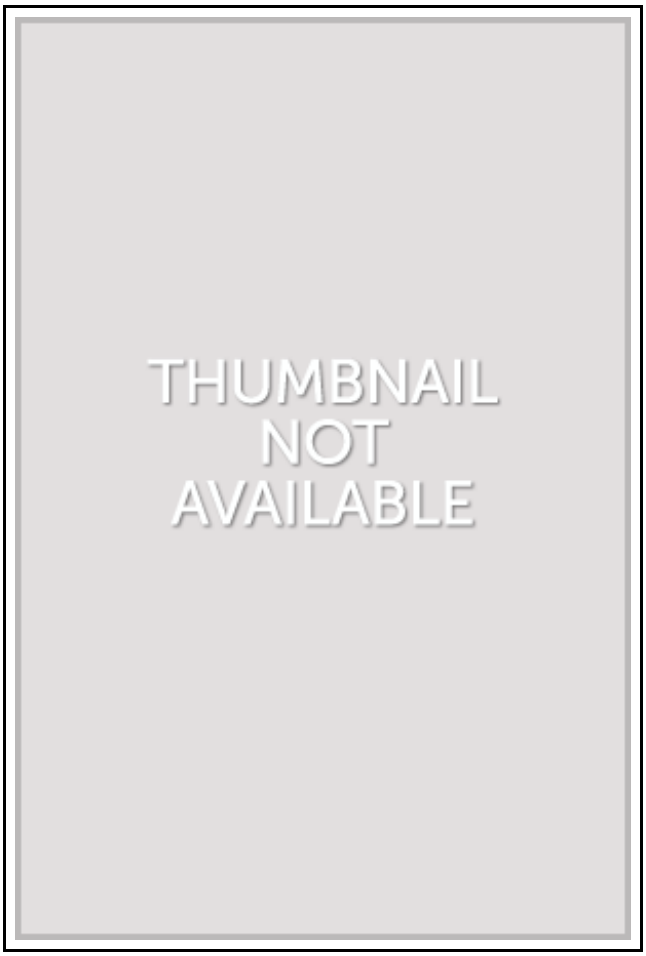
Charge Storage and Aging Phenomena in Electrochemical Double Layer Capacitors



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CHARGE STORAGE AND AGING PHENOMENA IN ELECTROCHEMICAL DOUBLE LAYER CAPACITORS

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Cuvillier Verlag Nov 2009, 2009. Taschenbuch. Book Condition: Neu. 211x149x30 mm. Neuware - The storage of electrical charge in electrochemical double layer capacitors (EDLCs) is ideal for short-term energy storage in stationary and mobile or portable applications in which intermittent power demands and reliability are of prime importance. A significant limitation of the currently employed EDLC technology is the low energy density, whereby a promising approach towards increasing the energy content of present EDLC systems is a widening of the operational voltage window. However, a significant reduction of the device lifetime is observed under elevated voltage conditions. In the present work, the contribution of interfacial charge transfer towards charge storage in and aging of EDLCs based on non-aqueous electrolyte solutions at elevated voltages is considered. The possible charge transfer mechanisms are thus conveniently classified as ionic or electronic. Through an improved understanding of these processes, possible routes for optimizing charge storage and avoiding aging at elevated voltages may be developed. A coconut shell derived activated carbon was selected as electrode material in non-aqueous solutions of 1 M Et4NBF4 in acetonitrile (AN) and in propylene carbonate (PC). Through an electrochemical characterization of these systems via cyclic voltammetry, the potential regions of essentially ideal polarizability could be identified and separated from the regions in which irreversible charge transfer took place. The region of ideal polarizability was characterized by in situ Raman spectroscopy, electrical resistance measurements and electrochemical dilatometry. The results are discussed in the context of those obtained on single-walled carbon nanotubes (SWCNTs) in order to establish a comparison with a high surface area electrode material of well-defined geometric and electronic structure. Fundamental differences in the reversible doping behavior of the two materials were observed, indicating that a conceptual representation of the carbonaceous framework of the activated carbon must take into account...

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