Bulk concentration dependence of electrolyte resistance within mesopores of carbon electrodes in electric double-layer capacitors

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Hexagonally ordered mesoporous carbon materials were synthesized and used as electrode materials in an EDLC. Using this electrode, the change of electrolyte resistance within the mesopores was investigated according to the bulk electrolyte concentration. Using three different electrochemical transient experiments—imaginary capacitance analysis, chronoamperometry, and chronopotentiometry—the time constant associated with electrolyte transport was determined, which was then used to obtain the electrolyte resistance within the mesopores. With decreasing electrolyte concentration, the increase in electrolyte resistance was smaller than the increase in the resistivity of the bulk electrolyte, which is indicative of a different environment for ionic transport within the mesopores. On using the confinement effect within the mesopores, the predicted higher concentration within mesopore probably results in lower electrolyte resistance, especially under low bulk concentrations.