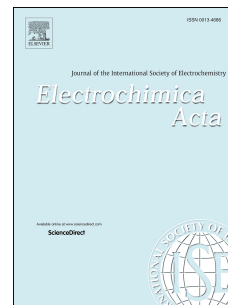


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Electrochemical Impedance Spectroscopy on the Capacitance of Ionic Liquid–Acetonitrile Electrolytes

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Abstract: The effects of acetonitrile on the electric double layer (EDL) capacitance of ionic liquid (IL) 1-butyl-3-methyl-imidazolium hexafluorophosphate with platinum electrode are studied by electrochemical impedance spectroscopy at -1.0 – 2.0 V *versus* silver wire pseudo-reference electrode. For neat IL as well as its mixtures with different acetonitrile contents up to 95 mol%, two capacitance processes are detected, i.e., a fast Debye relaxation and a slow Havriliak-Negami relaxation. The fast Debye relaxation of sub-millisecond time scale for neat IL, and shorter by an order of magnitude at 95 mol% of acetonitrile, is attributed to the EDL charging/discharging processes. The origin of the slow Havriliak-Negami capacitive process is not resolved, but its contribution on the EDL capacitance is not considered. Upon adding acetonitrile into ionic liquid, the EDL capacitance curve switches from bell-shaped for neat IL to camel-shaped with 50 mol% and 95 mol% acetonitrile, and the EDL capacitance increases significantly at higher cathodic and anodic polarizations.

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