CAPACITANCE-BASED STUDY OF ADSORPTION FROM IONIC LIQUIDS: HALIDE AND ALKALI ION INSERTION INTO CARBON ELECTRODES

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The development of novel materials and electrolytes for advanced supercapacitors (SCs) is an important step in the realization of a sustainable energy society. To pursue higher specific energy or electrical double layer capacitance, room temperature ionic liquids (RTILs) have the great potential as electrolytes in SCs due to advanced physicochemical properties. Novel carbon materials, such as carbide-derived carbon (CDC) with tunable pore size distribution have a great applicability to use as electrode materials [1]. Influence of iodide anion adsorption from ionic liquid EMImBF$_4$ has been studied at microporous-mesoporous carbon electrodes in SCs where there is a significant increase of capacitance due to the iodide specific adsorption [2].

In this study, the CDC electrodes soaked with up to 5 wt% mixture of halide or alkali ion salts in 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl) imide (EMImTFSI) have been studied in SCs. A noticeable increase of capacitance for carbon electrodes doped with halide ions has been observed, measured by three different electrochemical analysis techniques. Compared with neat EMImTFSI soaked system, carbon electrodes soaked with alkali ion salt mixtures do not show a noticeable improvement. Interestingly, both 5 wt% alkali and halide ion salt mixture soaked system exhibit a stable high capacitance up to 124 F/g at 3.0 V. It is shown that this enhancement of capacitance is due to reversible faradic processes and the specific adsorption of halide ions within the microporous electrode material and does not limit the bulk electrolyte properties.

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References

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