

INFLUENCE OF WATER ADDITIVE ON BI (111) | IONIC LIQUID INTERFACE: AN IMPEDANCE STUDY

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Studying the electrical double layer (edl) structure in ionic liquids is important to provide fundamental understanding of interfacial processes. Particularly, the presence of water in hydrophilic ionic liquids can have a strong effect on their properties [1]. In this study, the influence of water on the hydrophilic ionic liquid 1-ethyl-3-methylimidazolium trifluoromethylsulfonate (EMImOTf) | Bi(111) interface has been studied by cyclic voltammetry and electrochemical impedance spectroscopy. Cyclic voltammetry results exhibit wide electrochemical stability potential range, making them as candidates for aqueous electrolytes of electrochemical devices. The series capacitance versus potential curves shows that the capacitance values increase at less negative potential region with the addition of water. It suggests that water has a stronger interaction with the ionic liquid anion than cation. While compared with different mass fractions of water, the capacitance values decrease when water mass fraction increases from 0.05 wt% to 0.1 wt%. The EDL formation depends on both the applied electrode potential and the amount of water. By switching potential direction, the two series capacitance versus potential curves doesn't show obvious hysteresis effect, due to Bi(111) surface being less metallic than other bismuth single crystal planes. Meanwhile, equilibration time for 5 min at every interval potential could reduce the hysteresis effect caused by the volume difference of ions except by specific adsorption. Electrochemical impedance spectroscopy with electrical equivalent circuit modelling has been applied to analyze the interfacial processes [2]. These results suggest an opposite understanding to the intrinsic statement of water as the impurity in ionic liquids.

Acknowledgements

This work was supported by the Estonian Ministry of Education and Research (projects no. IUT 20-13, PUT1033 and PUT1107) and Estonian Centres of Excellence project TK141. Jinfeng Zhao would like to thank for the China Scholarship Council.

Reference

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