

# Electrocapillarity of the Interface between Water and Room Temperature Molten Salts Composed of Dialkylimidazolium Imides

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Room-temperature molten salts (RTMSs) that are immiscible with the aqueous phase (W) form the two-phase systems which can be utilized for liquid extraction, two-phase organic synthesis, ion sensors, etc.

The phase-boundary potential between the RTMS and W  $\Delta_R^W \phi$  can be varied by applying externally the voltage across the interface or changing the concentration of potential-determining ions in W.

The change in  $\Delta_R^W \phi$  affects the electrochemical properties of the interface, such as the charge transfer across the interface, the double layer capacitance, and the excess surface charge density.

In the present study, we examined the electrocapillarity of the nonpolarized interface between RTMS composed of 1-octyl-3-methylimidazolium bis(perfluoroethylsulfonyl)imide ( $C_8mimC_2C_2N$ ) and the aqueous solution containing 1-octyl-3-methylimidazolium chloride or lithium bis(perfluoroethylsulfonyl)imide as a function of the composition of the aqueous phase. A video image of a pendant drop of the RTMS in W was used to extract the shape of the drop, which was then compared to the numerical solution of the Bashforth-Adams equation to obtain the interfacial tension. The phase-boundary potential calculated for this non-polarized interface from the solution composition enables us to construct a corresponding electrocapillary curve, which shows a parabolic shape with respect to the variation of the phase-boundary potential over 300 mV (Fig. 1).  $C_8mim^+$  ions specifically adsorb at the interface. A Similar result was obtained in the case of  $C_8mimC_1C_1N$ |water interface.

Switching of the potential determining ion from  $C_8mim^+$  to  $C_2C_2N^-$  in W causes the jump of more than 160 mV in the potential at the outer Helmholtz plane on the aqueous side of the interface (Fig. 2).

The composition of the RTMS as well as the W was changed to examine the specific adsorption of ions. Further detailed analysis of the electrocapillary curves will be presented.

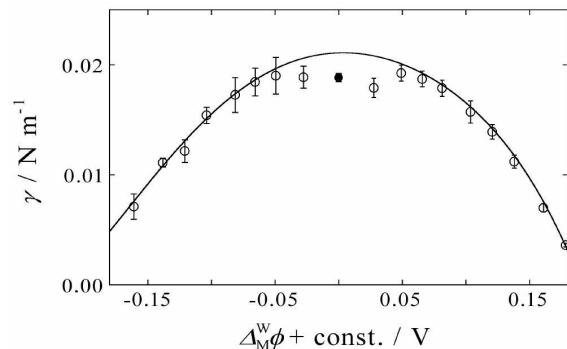


Fig.1. Electrocapillary curve at the  $C_8mimC_2C_2N$ |W interface. The line is to guide the eye. Filled circle in the middle is the data when  $C_8mimC_2C_2N$  and water are mutually saturated.

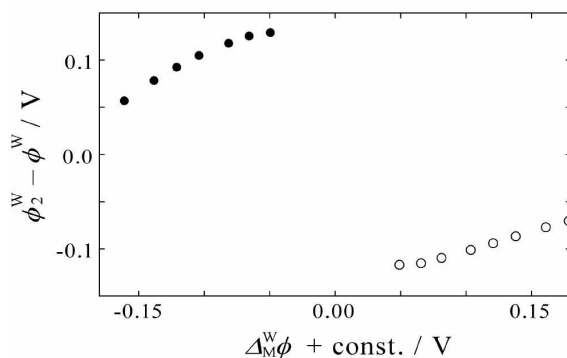


Fig. 2. Potential at the outer Helmholtz plane on the aqueous solution side of the  $C_8mimC_2C_2N$ |W interface.