Physicochemical Properties of Room-Temperature Molten Salts of Symmetrical Tetraalkyl Ammonium Diisooctyl Sulfosuccinates

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Water-immiscible room-temperature molten salts (RTMSs) have drawn much attention as possible alternatives of conventional organic solvents in the field of two-phase organic synthesis and liquid-liquid extraction. To make RTMSs immiscibile with water, hydrophobic anions, especially PF_6^- and bis(persluoro alkylsulfonyl) imide$^-$ have been employed. In the present study, we propose a RTMS composed of diisooctyl sulfosuccinate($DOSS^-$), which is hydrophobic anion without fluoroatoms. We examine the miscibility of this new type of RTMS with water and the electrochemical properties of the RTMS | water interface.

RTMS was prepared as follows. Equimolar quantities of symmetrical quaternary ammonium, R_4NX(R= C4, C5, C6, C7, C8; X= Br, I) and Aerosol-OT(Na^+ $DOSS^-$) were dissolved into chloroform and washed several times with water. After evaporation, we obtained yellow viscous oil. In order to remove the extra hydrophobic halide as a participate, crude RTMS was dissolved into methanol, then added Ag_2O. After further purification with methanol and water, the RTMS was dried under vacuum. We obtained the viscous clear colorless liquid. Density, conductivity, mutual miscibility with water has been measured for obtained RTMSs.

Cyclic voltammograms of the R_4NDOSS | water interface were measured. The electrochemical cell used was,

Ag/AgCl | W2 | RTMS | W1 | AgCl/Ag

For W1 phase, we made use of capillary electrode filled with 100 mM LiCl aqueous solution. W2 phase contains 100 mM NaCl and 1 mM $C6_4NCl$. RTMS | W1 interface was polarized and the area of the interface was 8 $x10^{-11}$ m^2 of the RTMS.

Physicochemical properties are listed in Table 1. Water saturated RTMSs contain 4-9 %w of water. These values are much larger than those for the RTMSs composed of R_4N^+ cations and imide anion. Sulfonate group of DOSS anion may attract water molecules strongly.

Cyclic voltammogram of the $C6_4NDOSS$ | Water interface is shown in Figure 1. The polarized potential range is about 200 mV, while RTMS | water interface of $C6_4N$ bis(perfluoro methylsulfonyl) imide has a potential window of 300 mV. It is 100 mV wider than RTMS with $DOSS^-$ anion. The RTMS with $DOSS^-$ anion thus has smaller hydrophobicity; smaller hydrophobicity of the RTMS originates in smaller hydrophobicity of $DOSS^-$ anion.

Table. 1 Physicochemical properties of RTMS of Symmetrical Tetraalkyl Ammonium Diisooctyl sulfosuccinates. $C4_4N$ means the Tetra butyl ammonium cation.

RTMS	Density / g cm^{-3}	Water Content / %w (mole ratio)	Conductivity (mS cm^{-1})
$C4_4NDOSS$	0.993	8.9 (3.7)	-
$C5_4NDOSS$	0.978	6.0 (2.5)	-
$C6_4NDOSS$	0.968	4.5 (2.3)	21.8
$C7_4NDOSS$	0.961	3.7 (2.0)	14.4

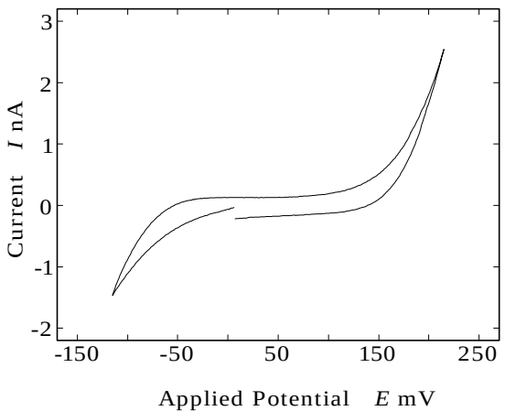

Fig. 1 Cyclic voltammogram of the $C6_4NDOSS$ | water interface. The interface with the radius 5 μm(8 $x10^{-11}$ m^2) was made on the tip of the capillary electrode. Capillary was filled with aqueous phase contains 100 mM LiCl. Reference electrode was Ag/AgCl electrode. Scan rate is 20 mV sec^{-1}.