Novel Hydrophobic Molten Salts Based on Tetrakis[3,5-bis(trifluoromethyl)phenyl]borate Anion for Electrochemistry of the Molten Salt|Water Interface

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Room-temperature molten salts (RTMSs) that form a polarized RTMS|W interface, so far proposed, are composed of hydrophobic cations, such as tetraalkylammonium ions, and the hydrophobic anions, such as PF_6^- or bis(perfluoroalkylsulfonyl)imide anion ($C_nC_nN^-$). To extend the polarized potential window so that the transfer of more hydrophobic cations or of more hydrophobic anion from W to RTMS. RTMSs composed of more hydrophobic anions are required. In this study, we will show that the potential window can be extended by using the hydrophobic anion, tetrakis[3,5-bis(trifluoromethyl)phenyl]borate ($TFPB^-$).

The cations used are 1-alkyl-3-methylimidazolium (C_nmim^+, n=2, 4, 5, 6, 7, 8, 10, 12), 1-dodecylpyridinium ($C_{12}Py^+$), tri-n-octylmethylammonium ($TOMA^+$), and 2-octadecylisoquinolinium ($C_{18}Iq^+$). The electrochemical voltammetric measurements of the RTMS|W interfaces were made by using capillary electrodes. The electrochemical cell is represented by

Ag /AgCl	0.1 M Li_2SO_4 x M CCl	CA	0.1 M LiCl	Ag/AgCl
	W2	RTMS	W1	

where C^+ and A^- denote the cation and anion comprising RTMS. The potential of the right-hand side terminal with respect to the left will be referred to as *E*.

The melting points of the $TFPB^-$ based molten salts are shown in Table. 1. All C_nmim TFPB used and C_{12}PyTFPB show melting points higher than room temperature. TOMATFPB and C_{18}IqTFPB are found to be liquid at room temperature. The potential window of the RTMS|W interfaces are estimated by using cyclic voltammetry. The width of the potential window of TOMATFPB|W and C_{18}IqTFPB|W interfaces were measured to be 150 mV and 300 mV respectively. Compared with our previous results of the potential window of $C_{18}IqC_2C_2N$|W interface 250 mV, the potential window was 50 mV extended by using TFPB anion.

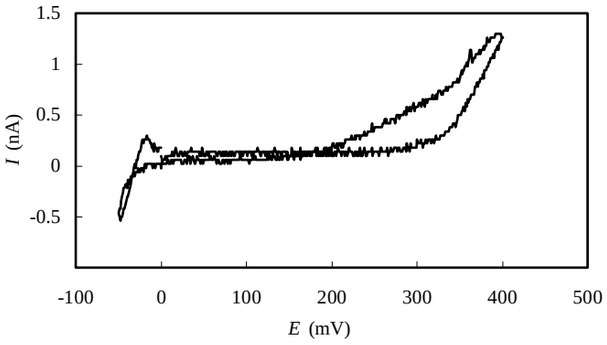

Fig 1. Cyclic voltammogram for the ion transfer across C_{18}IqTFPB|W interface at 56 ℃. Scan rate: 50 mV/sec.

Table 1. Melting points of TFPB-based molten salts

Cation	m.p. /℃
C_2mim^+	134.0
C_4mim^+	104.0
C_5mim^+	82.0
C_6mim^+	82.0
C_7mim^+	69.0
C_8mim^+	75.5
$C_{10}mim^+$	85.5
$C_{12}mim^+$	72.0
$C_{12}Py^+$	64.0
$TOMA^+$	< 30
$C_{18}Iq^+$	< 25