

Influence of Cationic Species of TFSA-Based Ionic Liquids on Charge-Discharge Characteristics of Graphite Negative Electrode

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Room-temperature ionic liquids (RTILs) have attracted much attentions as an electrolyte for lithium-ion secondary batteries due to their non-flammability and negligible volatility. The graphite electrode indicated good charge-discharge characteristics in the bis(fluorosulfonyl)amide (FSA)-based RTILs.¹⁾ while not excellent in the trifluoromethylsulfonyl (TFSA)-based RTILs without organic solvent additives. Our group found that the charge-discharge characteristics of the natural graphite (NG) electrode in the Li-TFSA/*N,N*-diethyl-*N*-methyl-*N*-(2-methoxyethyl)ammonium (DEME)-TFSA were almost similar to those in a conventional organic solvent electrolyte.²⁾ In this study, we investigated the influence of the cationic species on the charge-discharge characteristics of the NG negative electrode in the TFSA-based RTIL electrolytes. The discharge capacity and the charge-discharge efficiency of the NG electrode strongly depended on the composition of the electrolytes. The *N*-methyl-*N*-propylpyrrolidinium (P₁₃)-TFSA-based electrolyte imparted somewhat favorable performance compared to the DEME- and *N*-methyl-*N*-propylpiperidinium (PP₁₃)-TFSA-based electrolytes, by 3-5 % in the capacity and the efficiency. The discharge capacity of the NG electrode in the P₁₃-TFSA-based electrolyte at relatively high rate, i.e. 1.0 C, was also higher than those in the others, indicating superior rate capability of the former electrolyte.

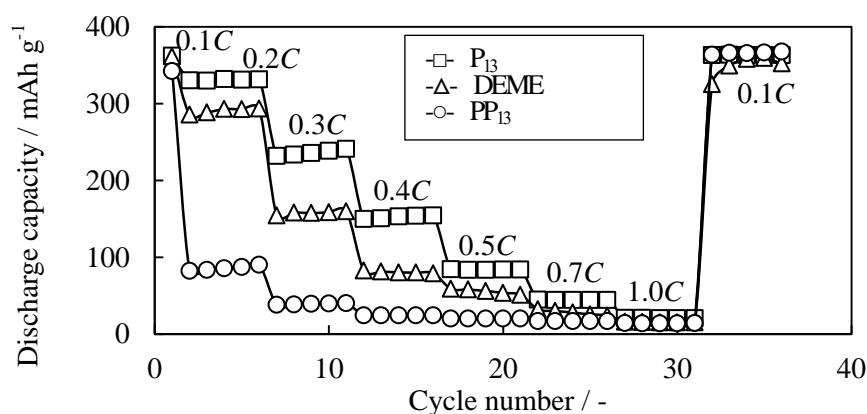


Fig. 1. Rate capability of NG electrodes in various TFSA-based RTIL electrolytes at 25 °C; voltage range: 0.005-2.0 V; C-rate: 0.1-1.0 C (1C = 350 mA g⁻¹).

References:

[1]M. Ishikawa, *et al.*, *J. Power Sources*, **162**(2006) 658; [2]J. Towada, *et al.*, *J. Power Sources*, **275**(2015) 50.