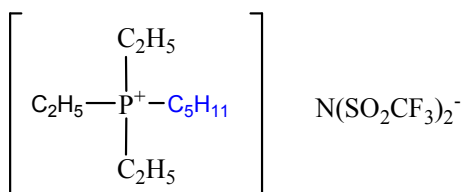


## ROOM TEMPERATURE IONIC LIQUIDS

Date: 5/23/2011

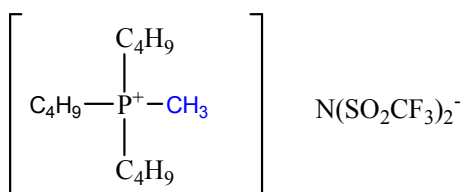
### Quaternary Phosphonium Ionic Liquids

**HISHICOLIN PX-25TFSI  
( P2225-TFSI )**



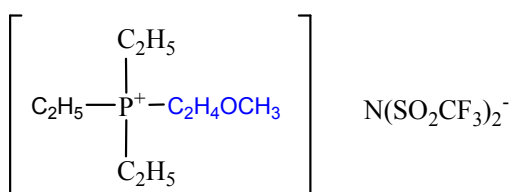
Chemical name : Triethyl pentyl phosphonium  
bis(trifluoromethylsulfonyl)imide  
F.W. : 469.44  
Melting point : 17 °C  
Density : 1.32 g cm<sup>-3</sup> (25 °C)  
Viscosity : 88 mPa s (25 °C)  
Conductivity : 1.7 mS cm<sup>-1</sup> (25 °C)

**HISHICOLIN PX-4MTFSI  
( P4441-TFSI )**



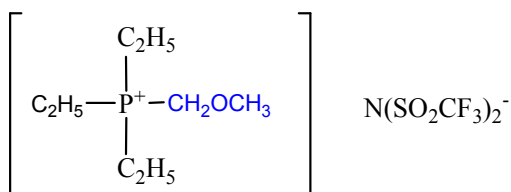
Chemical name : Tri-n-butyl methyl phosphonium  
bis(trifluoromethylsulfonyl)imide  
F.W. : 497.50  
Melting point : 16 °C  
Density : 1.28 g cm<sup>-3</sup> (25 °C)  
Viscosity : 207 mPa s (25 °C)  
Conductivity : 0.42 mS cm<sup>-1</sup> (25 °C)

**HISHICOLIN PX-2METFSI  
( P222(2O1)-TFSI )**



Chemical name : Triethyl(2-methoxyethyl) phosphonium  
bis(trifluoromethylsulfonyl)imide  
F.W. : 457.39  
Melting point : 10 °C  
Density : 1.39 g cm<sup>-3</sup> (25 °C)  
Viscosity : 44 mPa s (25 °C)  
Conductivity : 3.6 mS cm<sup>-1</sup> (25 °C)

**HISHICOLIN PX-2MMTFSI  
( P222(1O1)-TFSI )**



Chemical name : Triethyl(methoxymethyl) phosphonium  
bis(trifluoromethylsulfonyl)imide  
F.W. : 443.36  
Melting point : 14 °C  
Density : 1.42 g cm<sup>-3</sup> (25 °C)  
Viscosity : 35 mPa s (25 °C)  
Conductivity : 4.4 mS cm<sup>-1</sup> (25 °C)

## Technical notes

### 1) Electrochemical and thermal stabilities

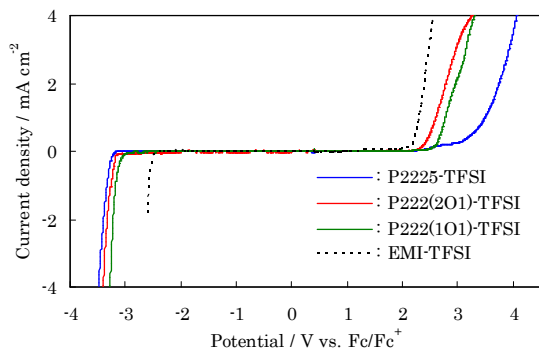


Fig. 1 Linear sweep voltammograms of phosphonium ionic liquids; WE: GC 0.008 cm<sup>2</sup>, CE: Pt, RE: Fc/Fc<sup>+</sup>, Scan rate: 5 mVs<sup>-1</sup>.  
(EMI-TFSI: 1-ethyl-3-methylimidazolium TFSI)

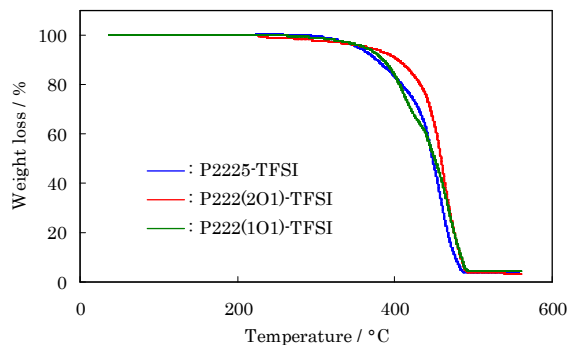


Fig. 2 Thermogravimetric traces of phosphonium ionic liquids under N<sub>2</sub> atmosphere.

Reference: *Electrochemistry Communications*, **9**, 2353 (2007).

### 2) Application to lithium battery electrolytes

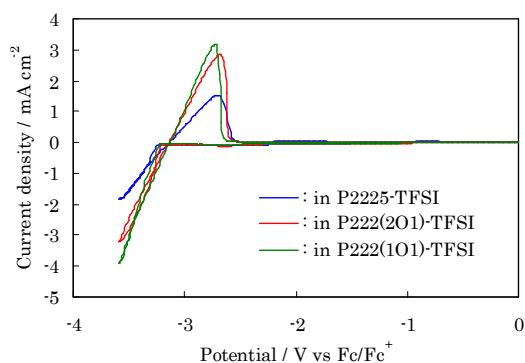


Fig. 3 Cyclic voltammograms of lithium (0.8M) in phosphonium ionic liquids; WE: Ni 0.018 cm<sup>2</sup>, CE: Pt, RE: Fc/Fc<sup>+</sup>, Scan rate: 10 mVs<sup>-1</sup>.

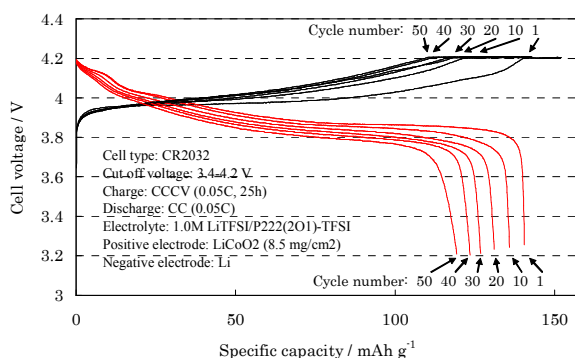


Fig. 4 Charge-discharge curves of a Li/1.0M LiTFSI in P222(2O1)-TFSI/LiCo<sub>2</sub> cell.

Reference: *Electrochemical Solid-State Letters*, **11**, A17 (2008); *Chemistry Letters*, **37**, 314 (2008).

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