

Transport and Association of Ions in Lithium Battery Electrolytes Based on Glycol Ether Mixed with Halogen-Free Orthoborate Ionic Liquid

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Abstract

© 2017 The Author(s). Ion transport behaviour of halogen-free hybrid electrolytes for lithium-ion batteries based on phosphonium bis(salicylato)borate [P 4,4,4,8][BScB] ionic liquid mixed with diethylene glycol dibutyl ether (DEGDBE) is investigated. The Li[BScB] salt is dissolved at different concentrations in the range from 0.15 mol kg⁻¹ to 1.0 mol kg⁻¹ in a mixture of [P 4,4,4,8][BScB] and DEGDBE in 1:5 molar ratio. The ion transport properties of the resulting electrolytes are investigated using viscosity, electrical impedance spectroscopy and pulsed-Field Gradient (PFG) NMR. The apparent transfer numbers of ions are calculated from the diffusion coefficients measured by using PFG NMR. PFG NMR data suggested ion association upon addition of Li salt to the [P 4,4,4,8][BScB] in DEGDBE solution. This is further confirmed by liquid state ⁷Li and ¹¹B NMR, and FTIR spectroscopic techniques, which suggest strong interactions between the lithium cation and oxygen atoms of the [BScB]⁻ anion in the hybrid electrolytes.

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