

Transport Phenomena of High Concentrated Nonaqueous Electrolyte Solutions: A Comparison between Li- and Na-System

Kentaro KURATANI and Tetsu KIYOBAYASHI

*Research Institute of Electrochemical Energy, Department of Energy and Environment,
National Institute of Advanced Industrial Science and Technology, (AIST)*

In order to understand deeply the transport phenomena of the ions in electrolyte solutions at high concentrations, the solution density, viscosity and ionic conductivity of Li- and Na-TFSI dissolved in GBL and PC were measured at $0.1 \leq C/\text{mol}\cdot\text{dm}^{-3} \leq 2.0$ and $278 \leq T/\text{K} \leq 328$ (TFSI = bis(trifluoromethanesulfonyl)imide, GBL = γ -butyrolactone and PC = propylene carbonate). The partial molar volume of the solute, derived from the density, confirmed that the Na-systems occupy more volume in the electrolyte solutions than the Li-systems. On the other hand, the viscosity and ionic conductivity suggested that the Na-systems are more fluid and conductive than the Li-systems. The relative viscosity vs. the molarity follows a modified empirical Jones-Dole equation. The molar conductivity linearly decreased with respect to the cube-root of the molarity, which was analyzed by the pseudolattice model. The Raman spectroscopy revealed that, while the solvation number is comparable at 1-2 for either the Li- or Na-systems, Li^+ is more tightly bound to the solvent molecules than Na^+ . The higher fluidity and conductivity of the Na-systems than those of the Li-systems result from the less occurrence of the solvent-shared ion pairs in the former than in the latter.