

Ion Migration Property of PVDF-type Polymer Gel Electrolyte for Lithium Ion Battery

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Polymer gel electrolytes have been developed for application to lithium ion battery (LIB). We have been investigating the conduction mechanism of the polymer gel electrolytes in order to design high-conductive electrolytes for LIB [1–3]. In this study, dynamic properties of lithium polymer gel electrolytes comprising PVDF-type polymers were investigated based on the diffusion coefficients and ionic conductivities. We prepared several types of gel electrolytes, with changing the chemical component of PVDF polymer, heating temperature during the gelation process, and the mixing ratio of solution to polymer. Electrochemical impedance technique and pulsed gradient spin-echo NMR technique were applied to the gel electrolytes for the estimation of their ionic conductivity and diffusion coefficients of the individual species in the gel. Table 1 represents D/D_0 , D is the diffusion coefficients of the individual species in the gel and D_0 is the diffusion coefficients of the individual species in the electrolyte solution, with changing the polymer fraction of the gel. $D_{Li}/D_{Li,0}$ was larger than $D_F/D_{F,0}$. This indicates that anion species would be selectively interacted with the PVDF polymer, leading to the increase in the cation transport number in the gel rather than that in the original electrolyte solution.

Table 1 Diffusion coefficients of polymer electrolyte relative to the original electrolyte solution

	PVDF A		PVDF B	
	8%	10%	8%	10%
$D_{Li}/D_{Li,0}$	0.96	0.90	0.94	0.96
$D_F/D_{F,0}$	0.83	0.81	0.88	0.84

Electrolyte: 1M LiTFSI/PC

References:

- [1] H. Kataoka, Y. Saito, Y. Uetani, S. Murata, K. Kii, J. Phys. Chem. B, 106 (2002) 12084–12087.
- [2] Y. Saito, A. M. Stephan, H. Kataoka, Solid State Ionics, 160 (2003) 149–153.
- [3] Y. Saito, M. Okano, K. Kubota, T. Sakai, J. Fujioka, T. Kawakami, J. Phys. Chem. B, 116 (2012) 10089–10097.