TUNING STABILITY OF LI-ION ELECTROLYTES BASED ON CONCENTRATED $LiBF_4$ / PC SOLUTION USING EC ADDITIVE

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Electrolyte is one of the most important components in all applications for the accumulation and conversion of electrochemical energy. Search for new electrolyte solutions is one of the key factors enabling further development of metal-ion batteries. Electrolytes with high salt concentration (> 1.0 M) have received a lot of attention during last several years because of number of intriguing properties [1].

The advantages of highly concentrated electrolytes are high reducing and oxidative stability, reduced solvent volatility, increased thermal stability, a high density of charge carriers and fast electrode reaction. The main reason for such properties is the “structure” of the solution. With increasing concentration, lithium ions tend to be more associated to form contact ion pairs and aggregates. Since ethylene carbonate (EC) is capable of creating a protective layer on the surface of graphite, which prevents co-intercalation, and propylene carbonate (PC) demonstrates high chemical and thermal stability, a mixture of these co-solvents is promising for lithium-ion batteries. The aim of the present work is the study of electrochemical properties of the concentrated solutions of $LiBF_4$ in mixture of PC and EC with different ratios and research of their redox stability with high-voltage spinels and graphite electrodes.

Cyclic voltammetry of $LiBF_4$ in PC-EC with idle electrodes showed the high oxidative stability. Cyclic voltammetry of $LiBF_4$ in PC-EC with graphite electrodes revealed increasing of the Coulomb efficiency and cyclability with increasing EC content. The most effective is the composition of 70 vol.% PC – 30 vol.% EC (Fig. 1). The stability of electrolyte solutions at high potentials with a cathode based on $LiNi_{0.5}Mn_{1.5}O_4$ and the transport characteristics by impedance spectroscopy were also investigated.

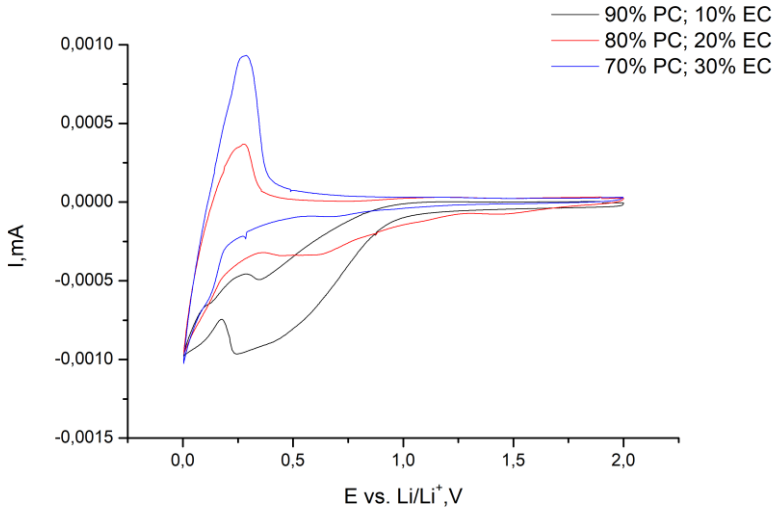

Fig. 1. Cyclic voltammetry of the graphite electrodes (PVdF : graphite = 1:9) in $LiBF_4$-PC-EC solutions within 0-2 V vs. Li/Li^+ voltage range.

References:

1. Jianming Zheng, Joshua A. Lochala, Alexander Kwok, Zhiqun Daniel Deng, and Jie Xiao // *Adv. Sci. 2017*