Effect of Salt Concentration on Sulfolane-Based Electrolytes for Secondary Lithium Batteries

Tong Zhang [a,c], Chunsheng Wang [b], Elie Paillard [a]

[a] *Helmholtz Institute Münster – Forschungszentrum Jülich (IEK-12), Corrensstrasse 46, Münster 48149, Germany*

[b] *Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20740, USA*

[c] *Department of Physical Chemistry, University of Münster, Corrensstrasse 46, Münster 48149, Germany*

For further increasing the energy density of secondary lithium batteries, an approach consists in increasing the operating voltage of cathodes, which require electrolytes with higher anodic stability than typical carbonate mixtures. Sulfolane (SL), a by-product of the oil industry, is a promising alternative solvent, due to its favorable properties in terms of dielectric constant and donor/acceptor numbers as well as its very low vapor pressure. Besides, SL is known for leading to Li-ion electrolytes with high anodic stability, which is supported by experimental results [1] as well as fundamental studies [2].

According to our previous study, SL is a promising candidate to replace ethylene carbonate as co-solvent in non-aqueous electrolytes (*i.e.* mixed with linear carbonate at 1M $LiPF_6$) for room temperature application [3]. Recently, we noticed the remarkable effect of the salt concentration in the case of LiFSI in SL:DMC electrolytes [4]. Compared with 1M electrolyte, the use of 1.2M LiFSI electrolyte allows significant improvement of the cycling performance, with rather stable capacities and high efficiencies.

In addition, increasing the lithium salt concentration of electrolytes has attracted researchers' attention due to the expanded electrochemical stability window and improved cycling performance [5][6]. Thus, we also examined the possibility of forming new highly concentrated electrolytes (≥3 mol kg-1), based on SL with different low lattice energy lithium salts for room temperature and high temperature operation. The intrinsic physico-chemical properties of those electrolytes such as ionic conductivity, thermal behavior, flammability, etc… have been investigated, as well as the electrochemical performance of graphite and Li metal anodes and cathodes in the electrolytes.

References:

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