Ethylene Carbonate-Free Electrolytes for Li-ion battery: Study of SEI layer formed on graphite anodes

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Operating lithium-ion batteries (LIB) at high voltage is essential to enhance their energy density but still an obstacle due to the limited anodic stability of state-of-the-art alkyl carbonates-based electrolytes. Therefore, alternative electrolyte formulations with high anodic stability have been proposed. Adiponitrile (ADN) is one of the alternative solvents which offers among the highest anodic stabilities [1]. In addition, its high flash and boiling points makes ADN a promising candidate to increase the safety of liquid electrolytes in LIBs [2].
Still, the preparation of high energy Li-ion cells requires, in most cases, the use of graphite-based anodes. However, the operation of a graphite anode in ADN-based electrolytes is problematic, due to their insufficient cathodic stability and poor ability to form a solid electrolyte interphase (SEI) unless ethylene carbonate (EC) is used as co-solvent. Nevertheless, since EC is known to be responsible for failure at high voltage, efforts are toward EC free electrolytes.

Recently we reported the cycling of graphite electrodes of *c.a.* 7.5 mg cm^{-2}, in ADN:DMC mixtures with LiDFOB or LiFSI as lithium salts, with or without fluoroethylene carbonate (FEC) as additive [3]. Low solubility of typical inorganic salts such as $LiPF_6$ in ADN:DMC mixtures lead toward the use of lithium difluorooxalatoborate (LiDFOB) and lithium bis(fluorosulfonyl)imide (LiFSI), which are good candidates as they provide enhanced SEI forming ability in various type of electrolytes. Herein, post-mortem study via scanning electron microscope (SEM) and X-rays-photoelectron spectroscopy (XPS) reveals the influence of the salt and additive on the composition of the SEI layer in ADN/DMC electrolytes.

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References:

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