THE IMPACT OF ELECTROLYTE ADDITIVES ON THE SEI FORMATION IN LITHIUM ION BATTERIES

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Electrolytes used in lithium ion batteries operate beyond their thermodynamic stability. Thus, the application of graphite anodes requires the formation of a stable solid electrolyte interphase (SEI) during the first charge step, in order to prevent further electrolyte decomposition throughout the following cycles. In the case of electrolytes which are not able to form such a film, e.g., propylene carbonate (PC), and which, moreover, tend to solvated intercalation, a film forming compound has to be added. Apart from known additives like ethylene sulfite, vinylene carbonate, and various fluorinated compounds, new compounds containing a double bond, e.g., acrylonitrile, have proven to contribute to the formation of an efficient SEI on graphite anodes in PC based electrolytes [1].

In order to better understand the reduction process of such vinylene compounds, different electrochemical and combined electroanalytical methods are applied. Cyclic voltammetry and charge/discharge experiments are used to verify the capability of the investigated additives and to compare their electrochemical properties. *In situ* FTIR spectroscopy of thin electrolyte layers gives strong evidence that vinylene compounds are reduced by reaction of the double bond. To our opinion, the establishment of the protecting film on the carbon anode may proceed according to a polymerization mechanism shown in Fig. 1. When a glassy carbon working electrode is cathodically polarized at or below the reduction potential of the additive, significant changes of characteristic IR bands can be observed. Furthermore, recent XPS investigations of graphitic carbon fibres that have been charged in additive-containing electrolytes will be presented.

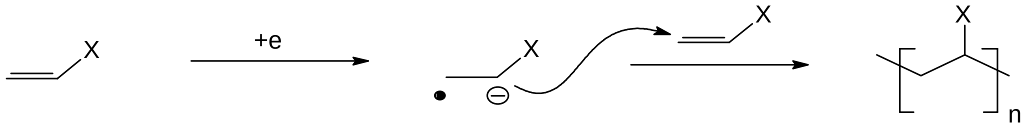

Fig. 1. *Cathodic, i.e., by reduction induced polymerization of vinylene monomers*

References

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