SEI FORMATION ON LITHIUM ALLOY ANODES STUDIED BY DEMS

M. R. Wagner[*]*, P. R. Raimann, K.-C. Möller, J. O. Besenhard, M. Winter*

Institute for Chemical Technology of Inorganic Materials
Graz University of Technology, A-8010 Graz, Austria
[*]*robby@sbox.tugraz.at*

When a tin-based electrode is charged from its open circuit voltage (OCV) down to 0 V vs. Li/Li^+, Li ions are inserted into the tin structure. The uptake of lithium ions causes structural changes in the host material, extensive volume expansion and hence, significant mechanical stresses. A lot of research was done concerning the host materials and the composite electrode structure in order to reduce the mechanical stresses that occur during cycling. The advantageous effect of small particle sizes has been shown by our group but the cycle life of lithium alloys, especially during deep cycling still remains as a problem [1]. Therefore other strategies have to be applied in addition. Our strategy to improve the cycle life of lithium alloys concerns the use of new functional electrolytes that may lead to improved SEI properties [2]. Although the SEI formation and composition has been studied extensively with regard to carbonaceous materials only little research has been done to reveal the similarity and differences between the SEI composition and its formation process on carbon and lithium alloy anodes. Gas formation, especially as a follow up reaction of solvent co-intercalation, is prevented on lithium alloy anodes and therefore other reaction pathways of reductive electrolyte decomposition may occur. The impossibility of solvent co-intercalation into lithium storage alloys may cause a difference in the SEI formation process.

This contribution will present DEMS (Differential Electrochemical Mass Spectrometry) studies on the electrolyte decomposition mechanisms and the associated SEI formation processes on lithium storage alloys using EC and PC based electrolytes. The results will be compared with carbonaceous anode materials (c.f. fig. 1).

Support by the Austrian Science Funds through the special research program "Electroactive Materials" is gratefully acknowledged.

[1] M. Winter, and J. O. Besenhard, Electrochim. Acta 45 (1999) 31-50

[2] M. R. Wagner, K.-C. Möller, J. O. Besenhard, M. Winter, 203rd ECS Meeting, Paris, France, 2003

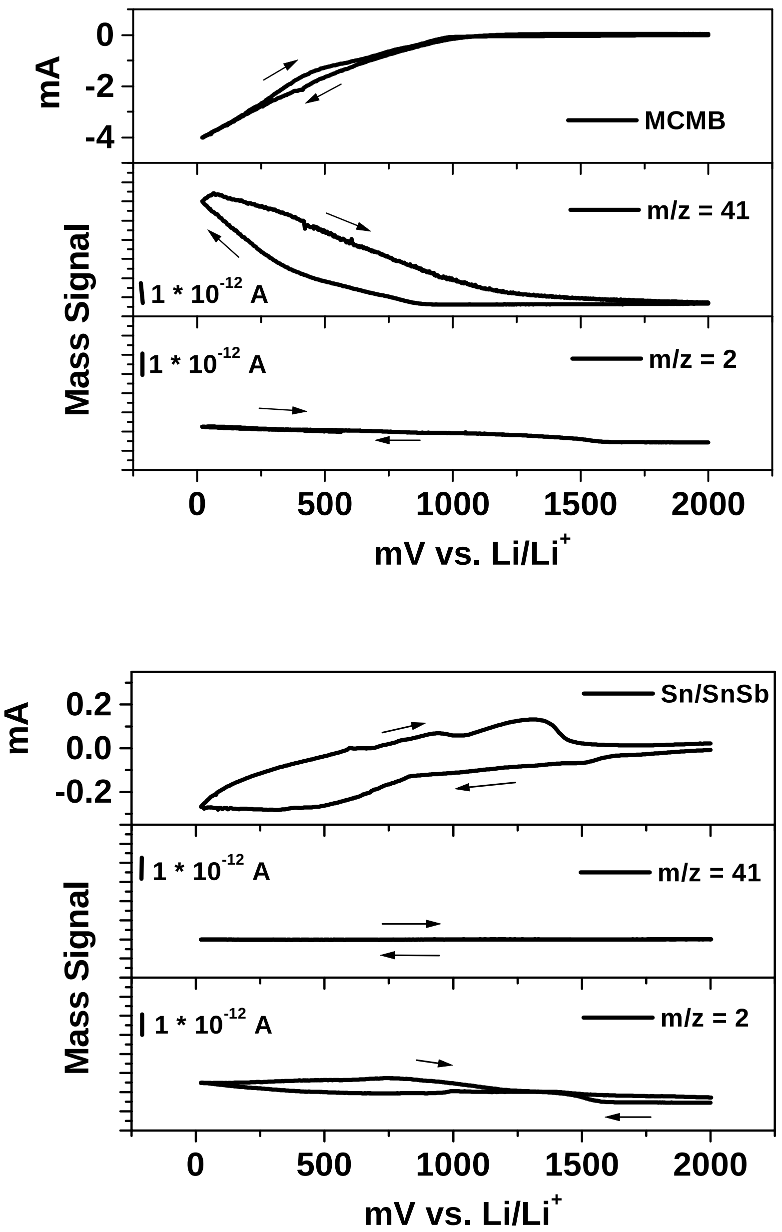

Fig. 1: *MSCV (Mass Spectrometric Cyclic Voltammetry) and DEMS measurement of a MCMB anode in propylene carbonate (PC) / 1M* $LiClO_4$ *electrolyte. Mass signals m/z = 41 and m/z = 2 represent propene and hydrogen (top). MSCV and DEMS measurement of a SnSb anode in PC / 1M* $LiClO_4$ *electrolyte (bottom). Mass Signals m/z = 41 and m/z = 2 represent propene and hydrogen. Note the absence of propene evolution at the SnSb anode.*