The crystallinity of graphite materials used in anodes of lithium-ion cells determines the electrochemical performance of the electrodes. Basically, it can be distinguished between the hexagonal (α-, 2H) and the rhombohedral (β-, 3R) form. Natural graphites are reported to contain up to 30 % of the thermodynamically less stable β-modification. During processing the material’s crystallinity can be changed. Mechanical treatment especially milling enlarges the amount of the rhombohedral phase, while thermal annealing procedures convert the material to the more stable α-form. Mechanical prepared graphites show a superior electrochemical behaviour. Compared to all-hexagonal graphites they are less vulnerable to co-intercalation of solvents [1,2], and also have a better passivation behaviour during the formation of the SEI (solid electrolyte interface) in the first charging step as we could show recently [3]. Figs. 1-2 show for example experiments performed in the solvent mixture of 1M LiClO₄, EC:DMC (1:1, w:w).

Mechanical preparation of graphites results in the formation of SEI with improved properties. The charge-discharge curves of SO-A and SO-B graphite are shown in Fig. 1 and Fig. 2, respectively. SO-A graphite exhibits a lower capacity compared to SO-B graphite, which can be attributed to the lower content of β-phase. SO-B graphite shows a higher capacity and better cycling performance compared to SO-A graphite.

References

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