New Insights into Electrolyte and Interphase Studies for Reversible Anion Storage into Graphite

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On the route towards “greener” and more sustainable batteries, it is mandatory to develop and design materials, components and processes that result in battery technologies having a comparable electrochemical performance compared to state-of-the-art lithium ion batteries (LIBs), but need less energy and release less CO_2 during their production and which may have advantages in terms of cost and material availability. With respect to the future development of battery technologies, one has to keep in mind that there will not only be one type of battery, but – as today – most likely different storage technologies available at the market in parallel. This is related to the broad diversification of different applications (*e.g.* portable electronics, electro mobility, home storage, *etc*.) and their versatile requirements for energy storage.

The development of alternative battery technologies most likely focuses on future key parameters such as low cost, sustainability and material availability and include - besides others - the so-called “dual-graphite batteries” (DGBs).[1-3] The interphases formed at the electrode/electrolyte interfaces (*e.g.* the graphite/electrolyte interface) in these systems are of high importance to ensure reversible cation/anion storage and a sufficient charge/discharge cycling stability. However, there is still a lack in fundamental knowledge how to tailor these interphases with respect to improved performance. Here, we present novel strategies and concepts for the development of sustainable battery technologies. In particular, we present the recent developments of the DGB technology with focus on advanced electrolyte formulations and interphase studies.

1. T. Placke, A. Heckmann, R. Schmuch, P. Meister, K. Beltrop and M. Winter, *Joule*, 2018, **2**, 2528-2550.
2. A. Heckmann, J. Thienenkamp, K. Beltrop, M. Winter, G. Brunklaus and T. Placke, *Electrochimica Acta*, 2018, **260**, 514-525.
3. K. Beltrop, S. Beuker, A. Heckmann, M. Winter and T. Placke, *Energy & Environmental Science*, 2017, **10**, 2090-2094.