Rechargeable batteries with Graphite as a Cathode: Key Challenges and Opportunities

Kostiantyn V. Kravchyk[a, b] *and Maksym V. Kovalenko*[a, b]

[a] Institute of Inorganic Chemistry, Department of Chemistry and Applied Biosciences, ETH Zürich, CH-8093 Zürich, Switzerland

[b] Empa – Swiss Federal Laboratories for Materials Science and Technology, CH-8060, Dübendorf, Switzerland

E-mails: kravchyk@inorg.chem.ethz.ch and mvkovalenko@ethz.ch

Graphite dual-ion batteries represent a potential battery concept for large-scale stationary storage of electricity, especially when constructed free of lithium and other chemical elements with limited natural reserves.[1-3] Owing to their non-rocking-chair operation mechanism, however, the practical deployment of graphite dual-ion batteries is inherently limited by the need for large quantities of electrolyte solutions as reservoirs of all ions that are needed for complete charge and discharge of the electrodes. In this seminar, we will provide a balanced analysis of the overall cell-level energy density of graphite dual-ion batteries as a function of electrolyte concentration and cathodic capacity of graphite. In addition, we will discuss other issues associated with this technology, one being the low oxidative stability of most metallic current collectors at high potentials of 4.5-5 V *vs*. Li^+/Li.[4,5] Finally, we will present a novel lithium-free graphite dual-ion battery utilizing a highly concentrated electrolyte solution of 5 M potassium bis(fluorosulfonyl)imide in alkyl carbonates.[1] The resultant battery offers an energy density of 207 Wh kg^{-1}, along with a high energy efficiency of 89% and an average discharge voltage of 4.7 V.

References

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