NON-AQUEOUS K-ION BATTERIES

Christoph Vaalma[a,b], Daniel Buchholz[a,b] and Stefano Passerini[a,b]

[a] *Helmholtz Institute Ulm (HIU), Electrochemistry I, Helmholtzstrasse 11, 89081 Ulm, Germany*
[b] *Karlsruhe Institute of Technology (KIT), P.O. Box 3640, 76021 Karlsruhe, Germany*

stefano.passerini@kit.edu

Mobile electronics and increasing interest in electromobility have substantially pushed battery research in recent years. Since the 1970s, lithium- and sodium-based materials forrechargeable batteries have been studied in parallel. The commercialization of the first lithium-ion battery (LIB) in 1991 shifted the focus of the research community solely towards this battery technology. However, the use of LIBs for large-scale applications leads to concerns about the availability and price stability of lithium and other materials (e.g. cobalt), which are commonly used in LIBs. As a result of these concerns, room temperature sodium-ion batteries are facin great interest as the specific materials needed for the sodium based batteries are generally cheaper and less toxic in contrast to lithium based systems [1]. Unfortunately, to date, Na-ion cathodes still show a tendency to deliver lower potentials than comparable Li-ion compounds.

This recently shifted researchers' attention to the investigation of potassium-ion battery (KIB) materials, which could possibly combine the higher potential of Li-ion cathodes and the feasibility of graphite as anode typical of lithium-ion batteries (LIBs) and the lower cost of sodium-ion battery (SIB) materials materials. In fact, the higher ionic radius and mass of K^+ might result in negligible decrease of the gravimetric capacity but could also give access to new advantageous material properties. By that, KIBs could show similar cell performance to LIBs at the lower costs of SIBs.

So far, reported K-ion cells were still using K metal as counter electrode. Since the use of K metal as electrode material is related to severe safety concerns, which are even higher than for the use of Na metal, we will present an organic electrolyte based full cell without the use of K metal and give an outlook on possible perspectives in this new field of battery related chemistry.

[1] M.D. Slater, D. Kim, E. Lee, C.S. Johnson, Advanced Functional Materials. 23 (2013) 947–958. doi:10.1002/adfm.201200691.
[2] S. Komaba, T. Hasegawa, M. Dahbi, K. Kubota, Electrochemistry Communications. 60 (2015) 172–175. doi:10.1016/j.elecom.2015.09.002..