Pre-lithiated Carbon Nanospheres a High Performance Anode Material

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Nowadays, the fast-charging capability of lithium ion batteries (LIBs) is of great importance. Therefore, it is necessary that the active materials can rapidly accommodate or release a high amount of charge with respect to their practical specific capacity, *i.e.* that they possess a high rate capability.

In this context, carbon nanospheres, obtained by a hydrothermal bottom-up synthesis with glucose as precursor and a subsequent carbonization, are investigated. They show very promising electrochemical properties, namely an extraordinary good rate capability and a good long-term cycling stability. In addition, the influence of different synthesis parameters on the electrochemical performance is investigated. Nevertheless, carbon spheres cannot be applied in LIBs due to their relatively low first cycle Coulombic efficiency caused by the presence of functional groups which can irreversibly react with electrolyte/lithium and the small particle size (150-200 nm), which results in a high specific surface area, and, thus, enhanced electrolyte decomposition.

The first cycle Coulombic efficiency can be remarkably increased with help of pre-lithiation.[1,2] Thereby, the anode is partially lithiated prior to battery operation in order to compensate the active lithium loss. On the one hand, this enables the possibility to use carbon spheres in LIBs, and on the other hand, we want to evaluate the limits of pre-lithiation while focusing on this model anode material having a very low Coulombic efficiency.

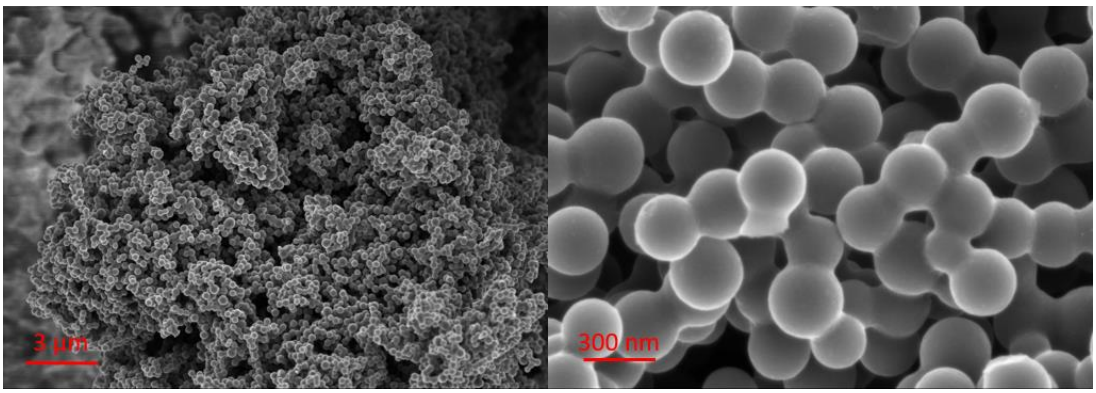

Figure 1: SEM images of carbon nanospheres. Magnification: a) 5000x b) 50000x.

References:

[1] C.R. Jarvis, M.J. Lain, M.V. Yakovleva, Y. Gao, Journal of Power Sources, 162 (2006) 800-802.
[2] H.J. Kim, S. Choi, S.J. Lee, M.W. Seo, J.G. Lee, E. Deniz, Y.J. Lee, E.K. Kim, J.W. Choi, Nano Letters, 16 (2016) 282-288.