Conversion-alloying anode materials for lithium-ion batteries

Stefano Passerini

[1]*Helmholtz Institute Ulm (HIU), Karlsruher Institute of Technology, Helmholzstrasse 11, 89081 Ulm, Germany*

[2]*Karlsruher Institute of Technology (KIT), P.O. Box 3640, 76021 Karlsruhe, Germany*

Lithium-ion batteries, the most succesful power source for portable electronic devices, are emerging as the most promising energy storage devices for hybrid and, most likely, full electric vehicles. In our continuous efforts to develop high capacity, conversion-alloying anode materials for lithium-ion batteries, we developed a new active material, Fe-doped SnO_2 ($Sn_{0.9}Fe_{0.1}O_2$, SFO), ideally characterized by low (de-)lithiation potential, high coulombic efficiency and long-term cycling stability. To the best of our knowledge, this is the first report on iron-doped tin oxide as active material for lithium-ion batteries. For battery applications, however, only one manuscript dealing with the utilization of molybdenum-doped SnO_2 as active material for lithium-ion batteries was reported in 1999, i.e., prior to the first report on transition metal oxides as conversion materials by Poizot *et al.* in 2000.

Within this study it is shown as doping SnO_2 with Fe leads to significantly enhanced specific capacity, cycling stability, and coulombic efficiency. SFO-C offers, after ten cycles, a reversible specific capacity of 1519 mAh g^{-1}, i.e., about twice that of pure SnO_2, due to the presence of the dopant (Fe) favoring the reversible formation of lithium oxide and, thus, enabling the beneficial combination of lithium storage by alloying and conversion.