DIPARTIMENTO DI CHIMICA
SAPIENZA
UNIVERSITÀ DI ROMA

Materials for sodium batteries

Stefano Passerini

Helmholtz Institute Ulm, Karlsruhe Institute of Technology, Albert –Einstein-Allee 11, 89081 Ulm, Germany

The rapid growth of the worldwide demand of lithium for batteries (LIBs) can possibly lead to a shortage of its reserves. Sodium batteries represent a promising alternative since they enable much higher energy densities than other battery systems, with the exception of LIBs, and are not limited by sodium availability.

Herein, we present our most recent developments on sodium battery materials.

Intercalation materials based on transition metal containing, layered manganese oxide are presently under investigation. Initially we focused our activity on $Na_{0.45}Ni_{0.22}Co_{0.11}Mn_{0.66}O_2$ synthesized in air by a co-precipitation method followed by a thermal treatment and a water-rinsing step. In conventional, organic solvent-based electrolytes this material performs the reversible electrochemical redox reaction of Mn^{4+} to Mn^{3+} leading to delivered capacities above 200 mA h g^{-1} for several tens of cycles. On continuing our efforts toward more environmental materials, new Co- and Ni- free materials have been developed , which offers rather interesting performances.

We are also focusing our interest on anodic materials such as TiO2 and Sn-C composites. Tin nanoparticles embedded in micron-sized carbonaceous particles, which successfully prevent the aggregation of tin nanoparticles and buffer the occurring volume strain, show extremely reversible (de-)alloying processes. Such active material presents lithium-ion specific capacities of around 440 and 390 mAh g^{-1} for applied specific currents of 0.1 and 0.2 A g^{-1}, respectively. In addition, this material appears highly promising as anode material for sodium-ion batteries, presenting very stable cycling performance and a specific capacity of more than 180 mAh g^{-1}.

Università degli Studi di Roma "La Sapienza"
CF 80209930587 PI 02133771002
Electrochemistry and Nanotechnology
for Advanced Materials (ENAM)
Prof. Stefania Panero
Piazzale Aldo Moro 5 – 00185 Roma, Italy
T (+39) 06 49913703 – Fax (+39) 06 490631
e-mail: stefania.panero@uniroma1.it