NEW GENERATION LITHIUM ION BATTERIES

B. Scrosati
Dipartimento di Chimica, Università di Roma "La Sapienza", 00185 Rome, Italy.
E-mail: bruno.scrosati@uniroma1.it

Great research efforts have been lately directed to the development of lithium ion batteries suitable for application as electrical intermittent energy (EES) storage systems as well as power sources for low emission hybrid vehicles (HEVs), or even for no emission, electric vehicles (EVs). However, a successful use in these fields requires the upgrading of the performances of the batteries in terms of energy density, cheapness and, particularly safety. The energy content may be enhanced by passing from the present structure to innovative chemistries involving advanced electrode materials. In this respect, the lithium metal alloys have received large attention due to their very high specific capacity. However, these materials, which are considered as very appealing negatives electrodes to be exploited in replacement of conventional graphite, suffer of large volume expansion and contraction during the charge-discharge cycling, this inducing mechanical disintegration which in turn results in a very poor cycle life. The approach carried out in our laboratory to control this issue has been focused on revolutionary Sn-C nanocomposite structures. These novel electrodes operate at high rates and high capacity with a life extending over several hundreds cycles and thus, they can be successfully used as anodes in advanced lithium-ion battery types.
The safety issue is, among other factors, associated to the common liquid organic electrolytes, which are volatile and flammable. Thus, a promising approach for improving safety is in the use of alternative electrolytes based on more thermally stable solvents. Ideal in this respect are ionic liquids, ILs, namely room temperature molten salts, since they are highly conductive, non volatile and stable up to high temperatures. However, the electrochemistry of IL-based solutions is not totally clear, especially in terms of their compatibility with the electrode materials. A systematic study has been carried out in our laboratory to investigate various classes of ionic liquid solutions and their suitability for lithium battery application.