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# High energy density post Li-ion batteries through electrolyte optimization

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When we consider metal anode batteries, the density and redox potential of the metal itself are the keys to theoretical performance, with the largest figures of merit corresponding to lithium. Moving from Li to Li-ion battery technology ensures viability from a safety point of view, to the expense of a large penalty in energy density. In this case, lithium is only present as lithium ions which are the positive charge carriers in the system. When considering possible alternative M-ion technologies, the theoretical performance depends on the electrochemical capacities and operating potentials of the negative and positive electrodes. Such figures are not in any way related to the capacity values of metal anodes except for the fact that the lowest negative electrode potential limit is set by the standard redox potential of the metal itself. Thus, there is no reason why the Na-ion battery technology could not reach figures of merit comparable to those of the ubiquitous Li-ion, provided suitable electrode materials and electrolytes can be developed.

Although it had fallen into oblivion for ca. 20 years, the Na-ion battery concept is not new and trends identified during the early days of intercalation and knowledge borrowed from the Li-ion battery field should foster its progress, on condition that due attention is also paid to intrinsic differences between lithium and sodium.

The talk will review recent research carried out at ICMAB-CSIC dealing mainly with the optimization of electrolyte formulation [1-3] and the study of negative electrode materials, including hard carbon prepared from sugar pyrolysis. [4,5] Finally, the possible development of alternative M-ion technologies will also be discussed.

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