New Polyanionic and Oxide Materials for High-Performance Lithium-Ion Batteries

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Among polyanionic-based electrode materials developed for Li-ion batteries, Tavorite-type compositions offer a rich crystal chemistry, among which $LiVPO_4F$ delivers the highest theoretical energy density. New compositions were recently obtained: $LiVPO_4OH$ and $LiVPO_4F_{1-y}O_y$.[1-3] We will show how vanadyle-type defects tailor the structure, the potential and the reaction mechanism involved, and how they have thus a huge impact on the electrochemical properties.[4]

Li and Mn-rich layered oxides, i.e. $Li_{1+x}M_{1-x}O_2$ (M = Mn, Ni and Co), are also attractive positive electrode materials for Li-ion batteries due to their promising high specific capacities. We will show that the engineering of layered oxide materials, with the formation of core-shell materials, is a track to follow to optimize their performance, even if it does not solve the problem of the continuous voltage decay resulting from their surface chemical instability upon cycling.[5] The global compositions studied are $Li_{1+x}(Mn_{0.47}Ni_{0.26}Co_{0.17})_{1-x}O_2$, with Li and Mn-rich layered oxides in the core, to deliver high capacity, and layered oxides enriched in Ni and in Co moving to the surface of the spherical aggregates, to promote improved chemical and thermal stability for the electrode material.

Acknowledgements:
These researches are funded by Région Nouvelle Aquitaine for layered oxides and by the French National Research Agency ANR (Labex STORE EX and project HIPOLITE) for polyanionic materials. The authors thank also the French network RS2E (http://www.energie-rs2e.com), the European network ALISTORE-ERI (http://www.alistore.eu), FEDER and Région Hauts-de-France.

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