Characterization of anodic materials for Lithium-ion batteries: the case study of TiO_2-rGO hybrids for high-power applications.

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The market of Lithium-ion batteries (LIBs) is constantly increasing.[1] LIBs found applications into electronics and portable devices initially; however, actually they found even more uses in the automotive field, as they are replacing the NiMH technology especially considering hybrid and micro-hybrid electrical vehicles. [2] The electrochemical and chemical-physics characterization of the electrodic materials for LIBs is so a *new working field for the analytical chemists*.
We report here the case study of the titanium dioxide/reduced graphene oxide (TiO_2-rGO) composites used as anodic material in LIBs for high-power applications. TiO_2-rGO hybrids were synthesized at different loadings of carbonaceous phase and used as anode materials in Lithium-ion cells, keeping in mind the feasibility of industrial scale-up. GO was synthesized from graphite [3], adsorbed onto commercial TiO_2 and reduced to rGO with chemical, photocatalytic and hydrothermal procedures. [4] TiO_2-rGO obtained with the first two procedures showed good cycle stability, high capacity and impressive rate capability. The photocatalytic reduction was also applied on pre-formed electrodes reaching the goal of a further simplification of the anode production. The synthesized materials were in-depth characterized with a *multi-technique approach*, including *electrochemical methods*. The very promising performances, from the point of view of the specific capacity, were correlated with an effective reduction and with the maintenance of the 2D geometry of the final graphenic structure observed for the TiO_2-rGO hybrids obtained by both the chemical and photocatalytic reduction procedure. The excellent electrochemical properties obtained at high C-rate (i.e. until 40C), the feasibility and the easy scalability of the production method show that these materials are promising candidate for their use as anode in LIB for power application.

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