Surface-fluorination for active electrode protection technology - a glance at fluorinated titanium dioxide materials… and more!

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In all domains, materials need protection: protection against corrosion, weathering, or scratches. Our objective is to provide protection to metal oxides in the field of energy storage. Used as electrode, metal oxides are extremely sensitive to their chemical environment.[1, 2] For instance, in Li-ion batteries, metal oxides are slowly degraded by the electrolyte. Such degradation, coupled with other inherent problems of batteries, leads to what is tagged as irreversible capacity: a lost electrochemical capacity that cannot be brought back. We propose a solution to protect metal oxides materials by surface fluorination, an innovative concept applied to metal oxides. In Li-ion batteries, the surface fluorination of metal oxides will provide a surface protection against capacity fading by preventing its cause: the unwanted lithium consumption. The idea behind this is as simple as it seems: re-enforce the surface of TiO_2 electrode surface with fluorine, the same way toothpaste acts everyday on your own teeth!

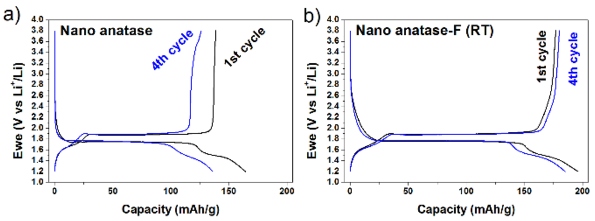

Figure 1. Galvanostatic charge-discharge curves for TiO_2/Li (a) and TiO_2-F/Li (b) half-cells, at C/20 current density; electrolyte is $LiPF_6$ EC:PC:3DMC 1M.

The main objective is to study the influence of the surface fluorination (through molecular or atomic fluorine) on the electrochemical behaviour of TiO_2 electrodes under operating conditions. In Li-ion batteries, one of the main drawbacks for titanium oxides is the large irreversible capacity on the first charge/discharge cycle that is associated with surface reactions between the electrolyte and the electrode. Thus, surface fluorination is the key, as presented on Figure 1.[3]

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