Post-mortem analyses

A support service for battery modelling

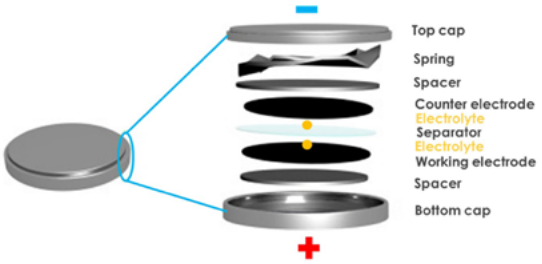
By opening a battery cell and investigating the material status, post-mortem analyses provide valuable and detailed information on the chemical composition and eventual degradation of the elements inside the cell (i.e. electrodes, residual electrolyte and separator). The chemical structure and surface morphology of the elements of dismantled cells can be investigated with several different techniques, such as optical microscopy, scanning electron microscopy, x-ray-based inspection or spectroscopic techniques. To clearly separate the effects occurring at the two electrodes during cycling experiments, we use half cells that contain li-metal as counter-electrode.

Disassembling commercial cells

Commercial or experimental cells are discharged to minimum voltage and are disassembled inside a glovebox filled with argon. In the following we show and describe the procedure for cylindrical cells. A pipe cutter is used to open the cell case on the top and bottom. Then, the lateral case is removed with a gripper. Once the case is completely removed, we detach the insulation tape that keeps the electrodes and separator foils together and we separate all the components.

Coin cell making

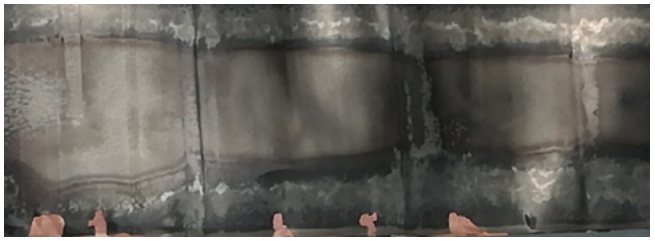
Coin cells allow to characterize the electrodes extracted by commercial cells separately. The cells are assembled as showed in the next figure. The commercial electrodes are normally double-coated, so we need to remove the coating on one side to allow the electric contact with the current collector. Then, we cut the electrode to disk and we coupled it with lithium metal. We use standard electrolyte and glass fiber separator between the two electrodes to complete the coin cell configuration. Once the cell is assembled, we carry out the formation process which is followed by capacity or impedance characterizations.



Digital imaging and optical microscopy

Digital imaging gives a valid support to understand the general status of the electrodes that are extracted by commercial cells. For instance, it is possible to observe formation of passivation layers on the electrode surface. In the picture below you can observe lithium plating on graphite electrode that we extracted from a cylindrical cell.

Optical microscopy gives us an additional support, allowing to observe the structure of the electrodes. In particular, cross section imaging of the electrodes allows to measure the height of the mentioned passivation layers.



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