Solid Electrolyte Interphase Formation on Anode Electrodes by Radiolysis

We have recently demonstrated that radiolysis is a powerful tool which can accelerate and mimic ageing phenomena in electrolytes of lithium-ion batteries.[1-3] Based on these results, the aim of the present project is to extend the radiolysis approach to carefully study the interfacial processes (electrolyte/electrode) and the formation of the solid electrolyte interphase (SEI) on negative electrode materials. Indeed, besides safety issues, finding an alternative method to synthesize the SEI before implementing the material in the battery is a very crucial point as the formation of the SEI is responsible for the irreversible loss of roughly 15% of the capacity of the battery during the first cycles. We propose to work here with different negative electrode materials: carbon nanoparticles, silicon nanoparticles, core-shell silicon/carbon nanoparticles, and silicon thin films to understand how the nature of the material and its size/morphology impact the formation of the SEI. The first phase of the investigation will use classical electrolyte mixtures of ethylene carbonate and diethyl carbonate with $LiPF_6$ at 1 mol L^{-1} concentration. In the second phase we will probe the effect of the presence of an additive such as vinylene carbonate or fluoroethylene carbonate.

References

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