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Lithium-ion batteries (LIBs) are very efficient energy storage devices. Recently we demonstrated that the highly reactive species generated by radiolysis (the chemical reactivity induced by the interaction between matter and ionizing radiation) of an electrolyte are the same as those generated during the cycling of LIBs using similar solvents. Furthermore, radiolysis generated these species in measurable amounts at time scales significantly shorter than electrochemical cycling in a battery cell (minutes vs. days). We have also extended the radiolysis approach to study the chemical processes at the anode-electrolyte interface and investigate ex-situ generation of solid electrolyte interphase (SEI). Indeed, the energy cost for the SEI production is very high. For instance, days and weeks are required at the energy plant in order to form a proper SEI on the surface of the anode electrodes. We have demonstrated the fast (within minutes to day) growth, under radiolysis treatment, of a solid phase on anode materials from a mixture of electrolytes and carbon nanoparticles mimicking an anode material, and the improved performances of the resulting material. XPS measurements evidence that the irradiated materials exhibit degradation products similar to the ones obtained in electrochemistry by cycling. Moreover, the electrochemical characterization shows that the SEI formation is shortened and that the first cycle efficiency is increased in irradiated materials as compared to pristine ones. This first study opens the door to the use of irradiation tools for the artificial generation of SEI.

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