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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 lithium-ion batteries (LIBs) using similar solvents.[1-4] Furthermore, radiolysis generated these species in measurable amounts at time scales significantly shorter than that of electrochemical cycling in a battery cell (minutes vs. days) and enabled proposing reaction mechanisms and measuring rate constants.[1-3]

In order to provide safe and reliable lithium-ion batteries, the knowledge of aging phenomena is crucial. Among the different parts of the system prone to aging, the behavior of the electrolyte is a key parameter. The screening of different electrolytes is then of major interest. However, screening studies on electrolytes are time-consuming because they require numerous cycles in batteries; they are thus barely found. We demonstrate here that radiation chemistry is a valuable tool to screen very quickly, within a few hours, various electrolytes. Comparison with literature data providing classification of batteries by their performance efficiency showed that the H_2 production under electrolyte irradiation allowed obtaining the same stability order. It allowed a direct comparison with experiments performed on pouch-cells. Therefore, we evidenced that irradiation experiments on electrolytes alone, lasting a few hours without any manufacturing operations such as the fabrication of electrochemical cells, makes it possible to reproduce trends observed during battery cycling. This work attests to the interest of radiolysis studies for the effective, reliable and fast screening of electrolytes.

References

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