X-ray CT scanning and in-situ densification test of sulfide electrolytes: LPS vs LPSCl

Margherita Martini*†[1], Jérôme Adrien[2], Claire Villevieille[3], Arnaud Demortière[4], and Eric Maire[5]

[1]MateIS – Institut National des Sciences Appliquées (INSA) - Lyon, CNRS – France
[2]MateIS – Institut National des Sciences Appliquées (INSA) - Lyon, CNRS – France
[3]lepmi – LEPMI, Grenoble, France – France
[4]LRCS – Université de Picardie Jules Verne, Université de Picardie Jules Verne – France
[5]MateIS – Institut National des Sciences Appliquées (INSA) - Lyon, CNRS – France

Abstract

All-solid-state batteries, where a solid electrolyte replaces the liquid flammable electrolyte, are expected to be the next-generation energy storage devices because of their enhanced safety. The material choice is crucial influencing the final cell electrochemistry, and a good battery performance highly depends on the electrolyte; however, its nature modification can change the dynamics within the entire cell, making its characterization pivotal to research progress. Although the investigated electrolyte materials are numerous, sulfides are noteworthy because they have good densification properties and high ionic conductivities at room temperature; moreover, they can be cost-effectively synthesized. Specifically, Li6PS5Cl (LPSCl, crystalline) and Li3PS4 (LPS, amorphous) are remarkable. Nevertheless, their study is not trivial being particularly sensitive to humidity and generating toxic H2S gas. Thus, an *in-situ* and non-destructive characterization is required, and x-ray micro-CT scanning turns out to be particularly suitable. This technique allows to perform compression test inside the final battery assembly and to visualize the electrolyte densification at different pressures. Powder of LPS and LPSCl is sited inside of Swagelok cells and is scanned at 2 microns resolution; pressure is steadily increased until complete densification. Similarities and differences of these two sulfide electrolytes are highlighted by this *in situ* compression test, and LPS shows a better densification at room temperature because of its amorphous structure.

*Speaker
†Corresponding author: margherita.martini@insa-lyon.fr