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# Towards the industrialization of solid-state batteries: Impact of dry room exposure on sulfide-based solid electrolyte materials

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All-solid-state battery technology stirs great interest in the battery community and beyond. Sulfide-based solid electrolytes are attracting particular attention, mostly because of their unrivaled ionic conductivity. [1] However, because of their high sensitivity to moisture – they release toxic H<sub>2</sub>S when in contact with water – most studies in the literature have, understandably, studied these materials in Argon-filled gloveboxes. If sulfide-based solid-state batteries came to be produced at industrial scale, the use of dry rooms as a production environment would be much more advantageous than a completely inert atmosphere. [2]

At the Battery Processing and Prototyping team of the CEA in Grenoble, we are currently studying how this type of technology could be scaled-up and in which environment. For this, we have exposed sulfide-based solid electrolytes to a typical dry room atmosphere and investigated the impact on operator safety and material characteristics and performance.

During the exposure of sulfide materials Li<sub>6</sub>PS<sub>5</sub>Cl, Li<sub>7</sub>P<sub>3</sub>S<sub>11</sub> and Li<sub>5.8</sub>PS<sub>4.8</sub>Cl<sub>1.2</sub> to the dry room atmosphere, the kinetics of H<sub>2</sub>S production were followed thanks to accurate laser detection. An array of physico-chemical characterisation techniques (X-ray diffraction, Raman spectroscopy, electrochemical impedance spectroscopy, scanning electron microscopy and X-ray photoelectron spectrometry) was then used to shed light on the degradation mechanisms. Finally, the electrochemical characteristics of solid-state LiIn-NMC cells containing pristine and exposed sulfide material were compared.

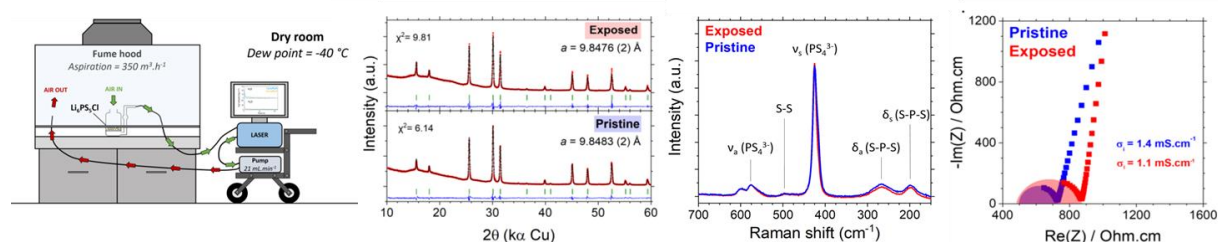


Figure 1. Exposition of sulfide electrolyte to dry room atmosphere and physico-chemical characterization

## References

- [1] C. Yu, F. Zhao, J. Luo, L. Zhang, X. Sun, *Nano Energy*, **83** (2021), 105858.  
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