SYNTHESIS OF PIEZOELECTRIC SEPARATOR FOR SELF-HEALING LI-METAL BATTERIES

Mari Ylikunnari[2], Leonardo Pires[1], Elina Jansson[2], Johanna Hiitola-Keinänen[2]

[1]*CSEM Sustainable Energy Center, CSEM SA, Switzerland,*

[2] *VTT Technical Research Centre of Finland Ltd, Finland*

Li-metal batteries are considered the next generation of the Li-ion technology, but they will only be enabled if Li loss is avoided at the anode/electrolyte interface. One strategy to be explored is the use of piezoelectric materials to mitigate dendritic growth. In this study, we use a polar polymer to prepare piezoelectric porous separators by non-solvent induced phase separation (NIPS) [1]. This method takes advantage of the polymer's difference in solubility in two different solvents to trigger a phase separation from liquid to solid. This process is visually summarized in Fig. 1(a). The phase separation mechanism yields a microscopic architecture of interconnected pores, see Fig. 1(b). The polar polymer, here polyvinylidene fluoride-trifluoroethylene (PVDF-TrFE), is selected because upon phase inversion from the liquid phase, it spontaneously crystallizes in the polar phase of PVDF, called β-phase, instead of the non-polar α-phase in which usually PVDF crystallizes. We investigate PVDF-TrFE in Li-metal batteries as a potential self-healing material to mitigate lithium dendrite growth [2]. In the framework of the HIDDEN project, the process is scaled up to a roll to roll pilot line. The produced membranes are then compared in full battery configurations as displayed in Fig. 1(c), demonstrating the potential of piezoelectric polymers in mitigating the build-up of dead lithium. This work was performed in the framework of the Battery 2030+ initiative and the affiliated project HIDDEN.

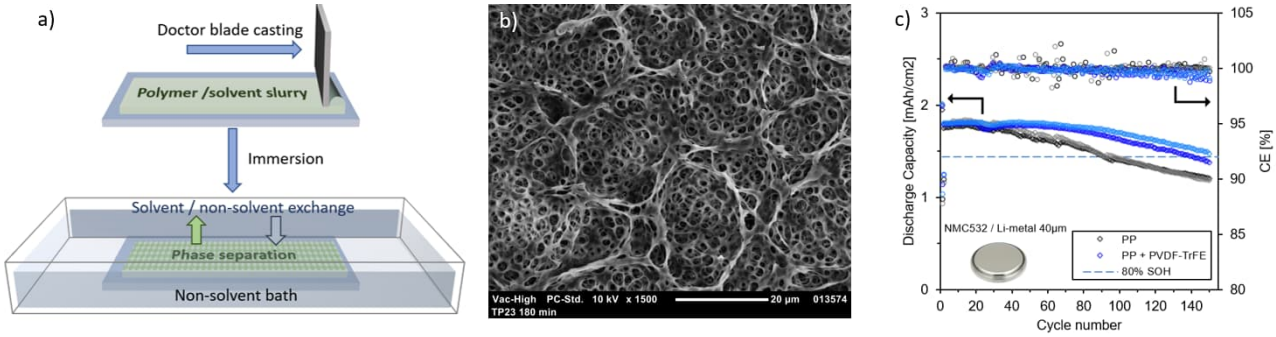

Figure 1. a) Diagram of the NIPS process, b) Cross-section SEM image of the NIPS-produced PVDF-TrFE separator showing the resulting porous structure, c) Li-metal/ NMC coin cell cycling with and without PVDF-TrFE separator.

REFERENCES

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