Preparation of stable, safe electrolytes and innovative separators for improving electrode performance

Giampaolo LACARBONARA – *University of Bologna*

The application of lithium metal anodes in rechargeable cells is hindered by issues such as uncontrolled lithium deposition, which can lead to lithium dendrite growth, dead lithium, short circuits, and cell failure. Electrolytes and separators play a crucial role in counteracting and mitigating lithium dendrite formation. The use of additives in the commonly used electrolytes can be adopted to modify the solid electrolyte interphase (SEI) composition, improving the lithium ion mass transport and, thus, inhibiting dendritic growth. Separators play a significant part in isolating the anode and cathode and preventing short circuits. Meantime, it could absorb enough electrolytes and provide transport of lithium ions to the electrodes [2]. Another approach to suppressing lithium dendrite growth is the design and elaboration of new solid electrolytes [3]. Among all, polymer electrolytes are safer than liquid ones as they do not cause leakage problems and because of their non-toxicity, low vapour pressure, and non-flammability [3]. We investigate organic carbonate-based electrolytes with ammonium salt additives, analyzed using operando Raman spectroscopy to understand their impact on the solid electrolyte interface (SEI) and regulation of lithium deposition/stripping studied by SEM and XPS [4]. Sustainable polymer separators were prepared by exploiting the phase inversion technique, which is nowadays a very widespread processing technique in the membrane industry. These separators were characterized to prove compatibility with lithium metal and activated carbon electrodes.

References

[1] W. Xu, et al., Energy Environ. Sci. 7 (2014) 513-537.

[2] X. Xie et al., J. of Power Sources 555 (2023) 232431.

[3] N. Albanelli et al., J. of Power Sources Adv., 26 (2024) 100140.

[4] G. Lacarbonara et al., J. Colloid Interface Sci. 669 (2024), 699-711.

Acknowledgments: This work has been financed by the Research Fund for the Italian Electrical System under the Three Year Research Plan 2022-2024 (DM MITE n. 337, 15.09.2022), in compliance with the Decree of April 16th, 2018".