An Overview of Polymer-based Electrolytes with High Ionic Mobility for advanced Li-solid state battery

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Liquid electrolytes used in commercial Li-ion batteries are generally based on toxic volatile and flammable organic carbonate solvents, thus raising safety concerns in case of thermal runaway. The most striking solution at present is to switch on all solid-state designs exploiting polymer materials, films, ceramics, low-volatile, green additives, etc. The replacement of liquid components with low-flammable solids is expected to improve the safety level of the device intrinsically. Moreover, a solid-state configuration is expected to guarantee improved energy density systems. However, low ionic conductivity, low cation transport properties and issues in cell manufacturing processes must be overcome [1]. Herein, we present the investigation on the use of poly(ethylene oxide) – PEO and polycarbonates (PC), blends in different proportions, and a comparison of their chemical, mechanical and electrochemical properties at fixed LiTFSI concentrations. The study helps identify the best PC and the ideal ratio for ionic conductivity, electrochemical stability window and elastic modulus, thus ensuring their practical application in all-solid-state Li-based batteries. In addition, all formulations were prepared by exploiting a mini extruder, which enabled us to avoid the use of toxic or flammable organic solvents, minimizing polymer degradation phenomena by using an inert atmosphere while blending the polymers. Eventually, UV-induced cross-linking of PEO-PC SPEs is performed to enhance the mechanical and electronic properties of the final system [3].

References

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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".