

Elucidating the Electrochemical Stability of Polymer Electrolytes

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Enhanced electrochemical stability of solid electrolytes is often considered as one advantage of these materials compared to the liquid electrolytes. Nevertheless, for the widely studied poly(ethylene oxide) (PEO) and LiTFSI system many different values have been reported ranging from 3.8 to 5.7 V vs Li⁺/Li. The main reason behind this broad range is the arbitrariness of the employed techniques, such as cyclic voltammetry (CV) and linear sweep voltammetry (LSV). While this could be considered an easy task with liquid electrolytes because mass transport limitation is seldom an issue, it is more complicated with solid polymer electrolytes. Therefore, alternative methods are required.

We have developed different electrochemical techniques that can be used to investigate the electrochemical stability of polymer electrolytes. These techniques aim to overcome some of the limitations of the sweep voltammetry techniques. Staircase voltammetry (SV) coupled with electrochemical impedance spectroscopy is used to avoid the mass transport limitation and monitor changes in resistance and interfacial degradation. Synthetic charge–discharge profile voltammetry (SCPV) applies the real voltage profile of the active material of interest. Finally, cut-off increase cell cycling method (CICC) has been developed to investigate the electrochemical stability of the whole system, including the interaction with the electrodes. The feasibility of these different methods has been investigated with two model solid polymer electrolytes: poly(ethylene oxide) and poly(trimethylene carbonate).[1]

- [1] G. Hernández, I.L. Johansson, A. Mathew, C. Sångeland, D. Brandell, J. Mindemark, Going Beyond Sweep Voltammetry: Alternative Approaches in Search of the Elusive Electrochemical Stability of Polymer Electrolytes, *Journal of The Electrochemical Society*. 168 (2021) 100523. <https://doi.org/10.1149/1945-7111/ac2d8b>.