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Hybrid solid polymer electrolyte characterization by SAXS/WAXS analysis

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In an attempt to promote electromobility, the aim of the SAFELiMOVE-project is to meet the requirements of battery electric vehicles, such as fast charging capabilities and prolonged battery cycle life. In this context new solid-state batteries are developed using a hybrid solid polymer electrolyte (HSPE) consisting of Polyethylene oxide (PEO) as primary semi-crystalline polymer, which contains Lithiumbis(trifluoromethylsulfonyl)amid (LiTFSI) as ion-conducting sel. By adding a specific amount of LAMP particles the mechanical strength of these composite materials can be increased while maintaining the high ionic conductivity. As characterization technique, small and wide angle X-ray scattering techniques (SAXS/WAXS) are used to non-destructively analyse the nanostructural relationships inside this solid electrolyte. Primary scientific questions, which can be answered using this method, are addressed in this study. The initial structure of the single components of the HSPE is analysed and compared to the measured SAXS/WAXS signal of the composite material (see Figure 1). This allows for a better assessment of structural modifications, such as ordering, anisotropy of the polymer chains, and crystallographic arrangements. Since these materials are operated under slightly elevated temperature (60°C) to increase their electrochemical performance, analyses were carried out *in situ* at these temperatures to follow structural evolutions. Current investigations are focused on post-mortem analysis (after specific amount of cycles) and *operando* studies. We will highlight in this presentation first results and methodologic procedures.

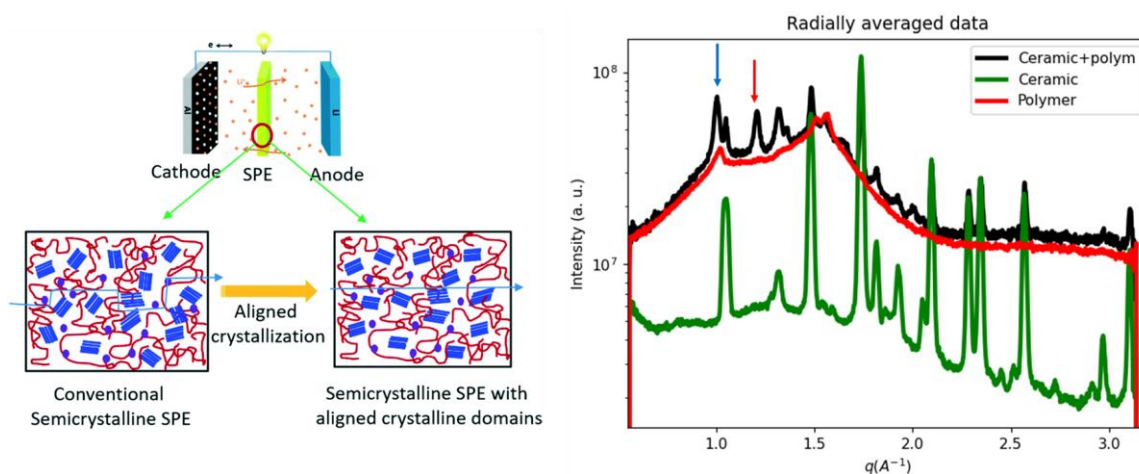


Figure 1. (left) schematic overview of a battery with solid polymer electrolyte and structural information and (right) WAXS signal of the different elements and the composite material.

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SAFE **Li** MOVE