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Interfaces in polymer based thin-film lithium-ion batteries

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With rising importance of renewable energy sources the need for reliable energy storage-solutions grows. Most batteries used currently in industry are lithium-ion batteries (LIBs) with liquid electrolytes. Due to the inflammable nature of liquid electrolytes LIBs are prone to dangerous damage preventable by solid state electrolytes based on polymers. However the ionic conductivity still needs to be increased. Polyethylene oxide (PEO) is a well known Li-ion conducting polymer. Its shortcomings in terms of physical stability can be compensated by using block copolymer electrolytes (BCEs). Changing the block length or the solvent environment preparing thin films can be used to manipulate the morphology of the BCE system. Polystyrene-block-polyethylene oxide (PS-b-PEO) has been investigated extensively as electrolyte. The PS block offers mechanical stability while the PEO part is able to solvate lithium ions. Adding the lithium salt lithium bistrifluoromethanesulfonimidate (LiTFSI) provides the necessary lithium-ions as charge carriers for the electrolyte. Thin-film batteries are built using this polymer electrolyte. In-operando SAXS measurements provide insight into changes in the polymer's morphology. The contrast between the two polymer blocks, caused by different electron densities, allows for an analysis of the electrolyte's structural evolution by nondestructive scattering experiments. Previous works have already shown the importance of in-operando measurements.

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