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Looking at Buried Layers and Interphases Using Neutron and X-ray Scattering

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Energy storage –with its fundamental: electrochemistry - has become a key element of society. The making of cheaper, lighter and safer batteries or the synthesis of novel functional materials relies on understanding dynamic processes. Many of those take place at so-called "buried-interphases", which require advanced characterisation techniques with high penetration depth and sufficient sensitivity in order to be investigated. This is fulfilled for neutrons and high energy x-rays, which can be used to unravel reactions and mechanisms whilst ongoing inside devices and e.g., liquid environments. Small-angle scattering is sensitive to structural changes from a couple to a few hundreds of nanometers with high statistical relevance due to the high flux beam and relatively large sample area (compared to electron microscopy). The morphology of a single-ion polymer electrolyte during cycling at high temperature was revealed by Small Angle Neutron Scattering (SANS), proving the durability of the material when used with a lithium metal anode. In reflection geometry, the average structure of thin films can be determined by Grazing Incidence Small Angle X-ray Scattering (GISAXS). This was done during the electrodeposition of mesoporous silica films in aqueous solution, allowing for the monitoring of the self-assembly process both on the electrode surface as well as the bulk solution.

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