



Contribution ID: 30

Type: **not specified**

Operando observation of local lithium crystallites inside the polymer electrolyte in lithium metal batteries by nanofocus wide-angle X-ray scattering

Tuesday, June 4, 2024 1:40 PM (20 minutes)

Single-ion conducting polymers are a promising candidate as solid-state electrolyte in lithium metal batteries due to a theoretical transference number of one, which is accompanied by the suppression of lithium dendrite growth. This can extend the cycle life and improve the overall safety of lithium metal batteries. However, the practical usage is still under debate, mainly due to low ionic conductivity and hence poor cell performance. Furthermore, dendritic growth of lithium has also been reported in single-ion conducting polymer based cells. Here, we study operando the local formation process of lithium crystallites inside the polymer electrolyte in their early stage with symmetric lithium cells by nanofocus wide-angle X-ray scattering (nWAXS). With this technique, we can spatially resolve the crystalline structure of the cell on a nanoscale by scanning an area of interest of the polymer during the battery operation. With such approach, we can identify rare events, which will help to understand the failure mechanisms in these battery types.

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