Contribution ID: **38** Type: **Talk**

X-ray and neutron studies on H-bonded polymers that help stabilize lithium metal anodes

Tuesday 7 December 2021 09:05 (25 minutes)

Lithium metal batteries are next generation energy storage devices that rely on the stable electrodeposition of lithium metal during the charging process. In this work, we investigate the effect of polymer dynamics on lithium metal deposition. For this, we design electrolyte (solvent) blocking perfluoro polyether polymer networks with evenly spaced H-bonding sites of various strengths, resulting in significant differences in the molecular ordering, as analyzed by x-ray scattering measurements (SAXS and WAXS). The differences in the H-bonding strength directly influence the mechanical properties of these materials, thus providing a controlled set of samples with a range of polymer dynamics for electrodeposition studies. A systematic evaluation of the lithium metal electrodeposition quality with these polymers as anodic coating showed that polymers with flowability or faster polymer dynamics exhibited higher coulombic efficiency. Preliminary results on the polymer with the strongest H-bonding using the quasielastic neutron scattering (QENS) technique will be shown. The work was supported by the US-German joint collaboration on "Interfaces and Interphases In Rechargeable Li-metal based Batteries"supported by the US Department of Energy (DOE) and German Federal Ministry of Education and Research (BMBF).

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Session Classification: Material Science

Track Classification: Material Science