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Modelling of Lithium Whisker Dissolution — •Martin Werres[1,2], Arnulf Latz[1,2,3], and Birger Horstmann[1,2,3] — [1]Helmholtz Institute Ulm for Electrochemical Energy Storage, Ulm, Germany — [2]German Aerospace Center (DLR), Institute of Engineering Thermodynamics, Stuttgart, Germany — [3]Ulm University, Institute of Electrochemistry, Ulm, Germany

In the search for next generation batteries, lithium metal anode research experiences a refreshed attention due to its high theoretical energy density. Focus lies on enhancing the durability of lithium metal anode batteries and eliminating safety concerns. The battery capacity fades over cycling due to continous SEI buildup, consuming lithium and electrolyte, and the formation of inactive lithium, which is electrically disconnected from the anode. As the surface of the anode is highly irregular and tends to form whisker during charging, experiments show that during discharge, the tip of the whisker is not dissolved and a droplet stays behind inside the SEI shell. We developed a generalized phase-field model of the dissolution in order to gain insights in the droplet formation process.

Utilizing non-equilibrium thermodynamics, our phase-field model describes the dissolution of a single lithium whisker by taking the surface tension of lithium metal into account, and the interaction between lithium and the SEI. We are able to predict the nucleation of a Reyleigh instability behind the tip, leading to the formation of an electronically isolated lithium metal droplet.

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