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The Effect of Oxidation and Charge/Discharge rates on Li Plating in All-Solid-State Batteries ALEXANDER YULAEV, CNST, NIST, Gaithersburg, MD, USA; MSE, UMD, College Park, MD, USA, VLADIMIR OLESHKO, Materials Science and Engineering Division, NIST, Gaithersburg, MD, USA, A. ALEC TALIN, Sandia National Laboratories, Livermore, CA, USA, MARINA S. LEITE, Department of Materials Science and Engineering/IREAP, University of Maryland, College Park, MD, USA, ANDREI KOLMAKOV, Center for Nanoscale Science and Technology, NIST, Gaithersburg, MD, USA — All-solid-state Li-ion batteries (SSLIBs) is currently an extensive area of research due to their promising specific power and energy density properties. Moreover, SSLIBs significantly mitigate the safety risks of the thermal runaway that may occur in liquid electrolyte batteries. We fabricated a model SSLIB, which consists of $LiCoO_2$ cathode layer, LiPON as an electrolyte, and a model ultra-thin carbon anode. Using in operando scanning electron microscopy in conjunction with electrochemical measurements, we found that depending on ambient oxidizing conditions and charging rate, the morphology of plated lithium alternates between quasi-1D and 3D microstructures. In addition, we were able to use an electron beam as a virtual nano-electrode to selectively control the nucleation rate and Li growth structure during the SSLIB charging with high spatial resolution. Finally, we determined the conditions when lithium may be oxidized even during battery cycling under UHV conditions, leading to significant capacity losses. We foresee that our work will provide deeper insights into a safe SSLIB performance under real world operating conditions.

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