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Real time measurement of Al anode degradation in thin film batteries MARINA LEITE, DMITRY RUZMETOV, Center for Nanoscale Science and Technology - NIST, and Maryland NanoCenter, University of Maryland., ZHIPENG LI, LEONID BENDERSKY, Material Measurement Laboratory, NIST, A. ALEC TALIN, Center for Nanoscale Science and Technology, NIST, and Sandia National Laboratories — Li-ion battery (LIB) anodes that alloy with Li, including Si, Ge, Sn, and Al have specific capacities that significantly exceed that of carbon-based intercalation anodes. However, the large volume expansion and contraction that accompany charging and discharging processes lead to large mechanical stresses that ultimately lead to loss of capacity and failure of the anodes. To better understand the failure mechanism, we cycle a thin film LIB with an Al anode in a scanning electron microscope to measure in real time the nucleation and growth of a highly strained (-44%) Al-Li alloy. We use galvanostatic charging and discharging to control the rate of Li diffusion into the Al anode, and by collecting a series of SEM images in small time intervals we are able to directly correlate the nucleation events of Li-Al with specific peaks in the measured voltage. Based on these observations and ex situ transmission electron microscopy we develop a semi-quantitative description for the mechanism of Al anode degradation that could be extended to other alloy anode materials.

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