Abstract Submitted
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Imaging Lead Dendrite Formation and Ion Diffusion in Aqueous Solution with Scanning Transmission Electron Microscopy[1] EDWARD WHITE, SCOTT SINGER, UCLA Department of Physics and Astronomy & CNSI, VERONICA AUGUSTYN, UCLA Department of Materials Science and Engineering & CNSI, WILLIAM HUBBARD, MATTHEW MECKLENBURG, UCLA Department of Physics and Astronomy & CNSI, BRUCE DUNN, UCLA Department of Materials Science and Engineering & CNSI, B. C. REGAN, UCLA Department of Physics and Astronomy & CNSI — Using a scanning transmission electron microscope, we image the formation of lead dendrites and the local Pb^{2+} concentration in an electrochemical cell containing a saturated solution of lead(II) nitrate. We control the morphology of the lead deposits with the rate of potential change, which can result in dendrites or compact layers. The processes are reversible and can be repeated. During lead stripping and plating the local Pb^{2+} concentration can be measured as an increase or decrease in signal intensity, respectively, as ions come into and out of solution. Quantitative digital image analysis reveals excellent correlation between changes in the Pb^{2+} concentration, the rate of lead deposition, and the current passed by the electrochemical cell. Furthermore imaging the ionic concentration as a function of time and distance from the electrode provides a measurement of the diffusion coefficient of the Pb^{2+} ion. Real-time electron microscopy of dendritic growth dynamics and the associated local ionic concentrations can provide new insight into the functional electrochemistry of batteries and related energy storage technologies.

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