Ultrafast Electrodeposition Of Faceted Li Metal Polyhedra

Electrochemical deposition of metals with precise morphological and chemical control is of fundamental importance to a broad range of electrochemical systems, including energy storage, large scale manufacturing, electronics, and electrocatalysis. For non-reactive metals (e.g. Ni, Pt), electroplating is a commercially established process that gives the desired control of deposition morphology and chemistry. However, deposition of reactive metals (e.g. Li, Na) critical for enabling next-generation batteries is complicated by metal surface corrosion that occurs concurrently with metal deposition, making such electrodeposition processes neither well-understood nor well-controlled. This work highlights the electrodeposition of lithium (Li), a reactive metal anode plagued with uncontrolled dendritic morphologies and surface corrosion, both of which are intimately linked and occur simultaneously. Despite tremendous research efforts to mitigate these issues, common literature descriptions of Li metal deposits (e.g. “chunky”, “pancake”) and their corrosion films (e.g. “strong”, “stable”) are ill-defined and often qualitative, highlighting our incomplete understanding of the deposition process and hindering the practical application of high energy battery chemistries enabled by Li metal. Our work seeks to bridge this critical gap in understanding by solving the fundamental challenge of (1) decoupling simultaneous electrodeposition from surface corrosion of reactive metals and (2) observing their reactive nanoscale interface.

Dr. Yuzhang Li is an Assistant Professor in Department of Chemical and Biomolecular Engineering at UCLA . His research group broadly pursues innovations in energy and environmental technologies. This goal requires designing unique materials that satisfy extraordinary demands. To make significant breakthroughs in these areas, advanced electron microscopy techniques (e.g. cryo-EM) are being developed to establish fundamental guiding principles for the design and synthesis of next-generation materials. He is the first UCLA School of Engineering faculty member to be awarded the DOE Early Career award for FY 2022. His research will be utilizing the cryo-EM facilities at CNSI

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