

## Operand AFM Observation of Lithium Electrodeposition

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Secondary batteries using lithium metal anode have been attracted much attention due to its potentially very high energy density, and however, is not in practical use so far. One of the obstacles against the practical usage of the lithium metal secondary batteries is the lithium dendrite formation during charging.[1] To understand the initial behavior of lithium dendrite growth, nano-scale observation of the lithium surface during charging is of importance. In-situ atomic force microscopy (AFM) observation technique can reveal the surface morphology and simultaneously some surface physiochemical properties with nano scale.[2] In this study, the in-situ AFM observation technique was used to investigate the change in the surface morphology and adhesion property in nano scale during the charging of metal anode.

Lithium metal surface in an electrolyte, 0.1 M  $\text{LiPF}_6$  / propylene carbonate was investigated using in-situ peak-force-tapping mode AFM. The surface morphology and adhesion property was simultaneously observed during charging. Highly inhomogeneous deposition and hence lithium metal protrusion growth was clearly observed. The adhesion map shows the difference between the growing protrusions and less-growing protrusions,[3] indicating the different surface conditions. The simultaneous operand observation of morphology and adhesion property using AFM would play a significant role in understanding mechanisms of lithium dendrite growth at initial stage. The surface analysis using transmission electron microscopy (TEM) will be also presented at the meeting site.

### References:

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