

Nanoscale understanding of the relationship between the formation of Li dendrites and diffusion/kinetic-limit reaction

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Li metal battery which has more storage capacity than Li ion battery is promising technology in rechargeable battery systems. However, Li dendrite, which occurs during charging and discharging cycles of Li metal battery, leads to significant issues such as low coulombic efficiency, capacity loss and short-circuits. While previous studies elucidate the mechanism of Li dendrite formation under diffuse/kinetic limits and result in morphological differences, it was elucidated based on only microscale observation, not nanoscale. Here, we observed formation of Li dendrite and mossy in micrometer size through SEM. Furthermore, using synchrotron-based grazing incidence small angle X-ray scattering (GISAXS), we analyzed nucleation rate of Li nanoparticles in real-time. The result clearly shows the diffuse and kinetic limits occur under low and high current densities, respectively, and determine the morphology of Li dendrite. According to results of the experiment, fundamental mechanism of dendrite and mossy formation resolved in this study at nanoscale will provide significant implications in coming up with ideas for the suppression of Li dendrite formation.