Electronic Supplementary Material (ESI) for Faraday Discussions.
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Supplementary Information

Formation sequence of solid-electrolyte-interphases and impacts on lithium deposition and dissolution on copper: an in-situ atomic force microscopic study

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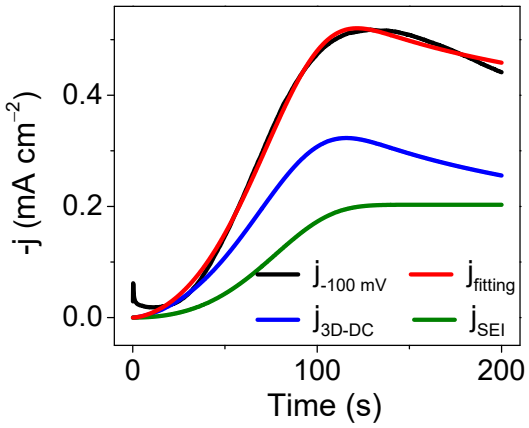

Fig. S1 The experimental current-time transient at –100 mV and the corresponding theoretical current-time transient j_{3D-DC} and j_{SEI} by nonlinear curve fitting.

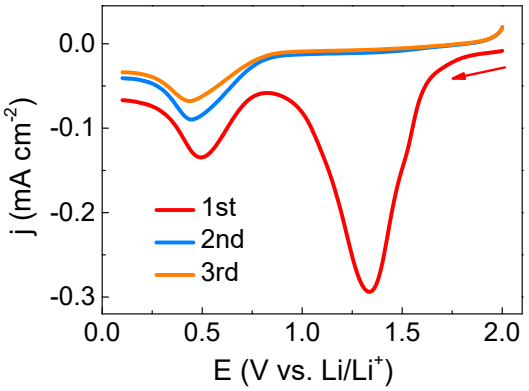

Fig. S2 Linear sweep voltammetry from 2 V down to 0.1 V of Cu electrode in 0.5 M LiTFSI/Py_{14}TFSI-Py_{14}FSI (1:1, v/v) electrolyte containing 1300 ppm H_2O showing the formation of SEI-Cu-lsv. Scan rate: 10 mV s^{-1}. The SEI formation is almost completed in the first negative potential sweeping prior to Li OPD, and the reduction of electrolyte at the 1.33 V becomes almost absent and the background of the UPD peak significantly reduced in the subsequent two sweepings.

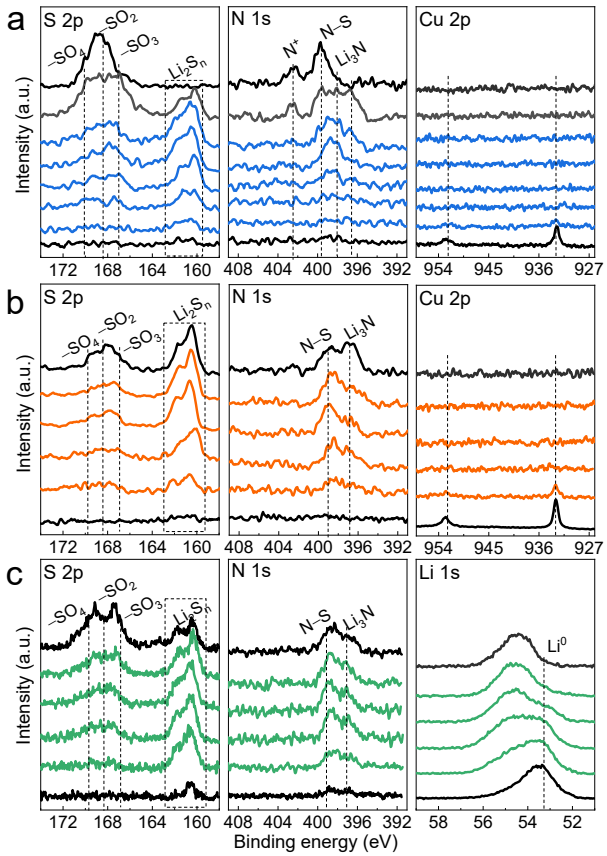

Fig. S3 XPS depth profiles of S 2p, N 1s, Cu 2p and Li 1s elements recorded after different time of argon ion sputtering at (a) SEI-Cu-lsv, (b) SEI-Cu-step and (c) SEI-Li.

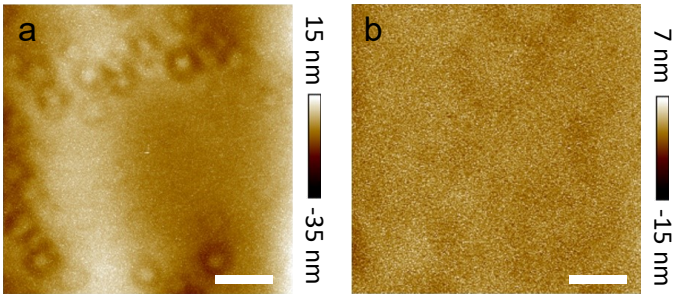

Fig. S4 (a and b) AFM images of pristine Cu(100) electrode at 2 V in 0.5 M LiTFSI/Py_{14}TFSI-Py_{14}FSI. Scale bars are 6 µm in (a) and 2 µm in (b).

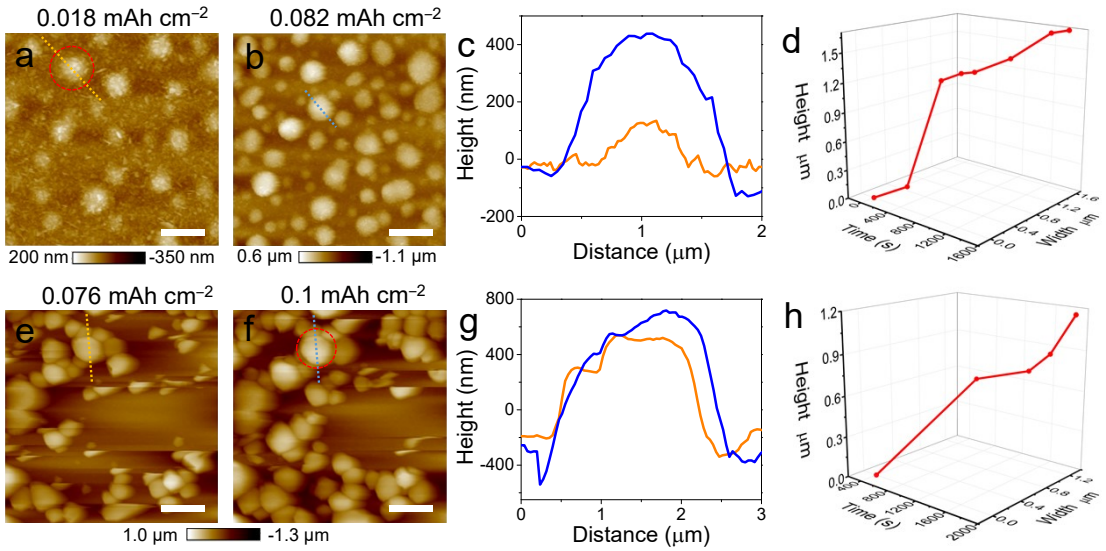

Fig. S5 In-situ AFM images of different Li deposition capacity (a, b) after SEI-Cu-lsv formation and (e, f) potential stepping from 2 V to –100 mV. (c, g) Cross section profiles of particles in (a, b) and (e, f), respectively. (d, h) Development of height and width of a growing Li nucleus marked by circle in (a) and (f), respectively. Scale bars are 1 μm in (a) and 2 μm in (b, e and f).