Supplementary Information (SI) for EES Batteries.

Supporting Information

Vertically Orientated One-dimensional Titania Lepidocrocite Quasi Nanoflakes for Stabilized Lithium Deposition in Lithium Metal Anodes

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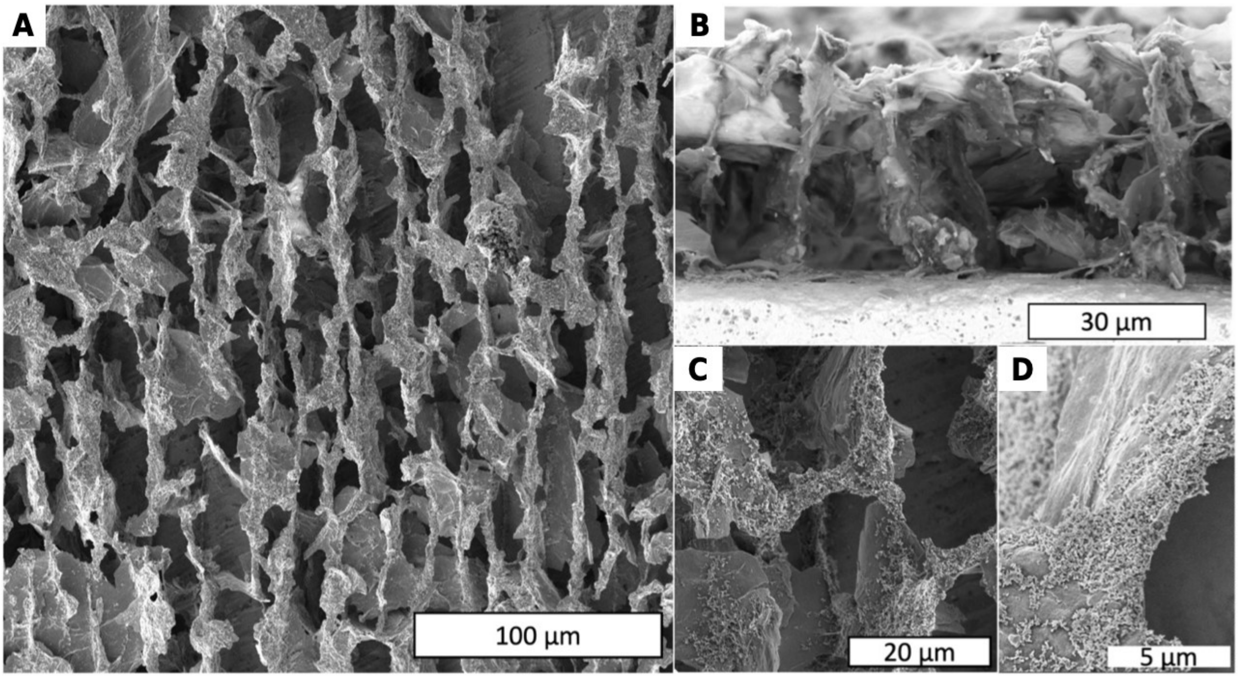

Figure S1. SEM images of vertically aligned 1DL-based flakes A) top down SEM image B) cross section view of the 1DL aligned normal to the surface C) and D) zoomed in view of the 1DL top down SEM view

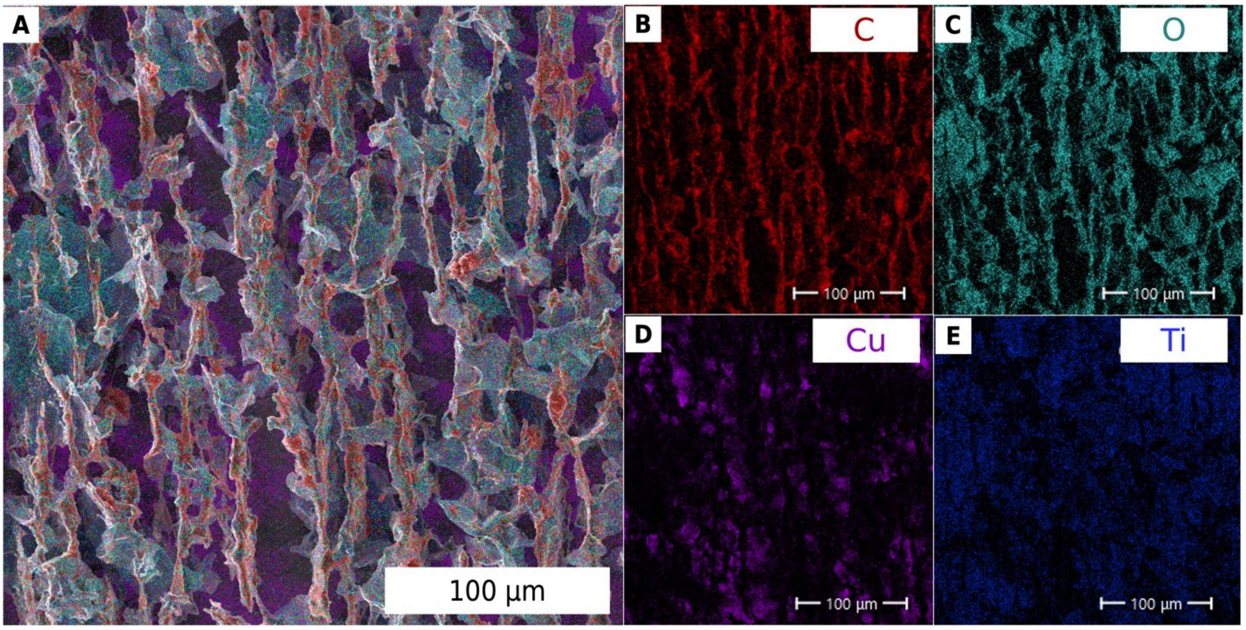

Figure S2. EDS maps overlayed on, A) SEM image. B through E map out the C, O, Cu and Ti, signals, respectively.

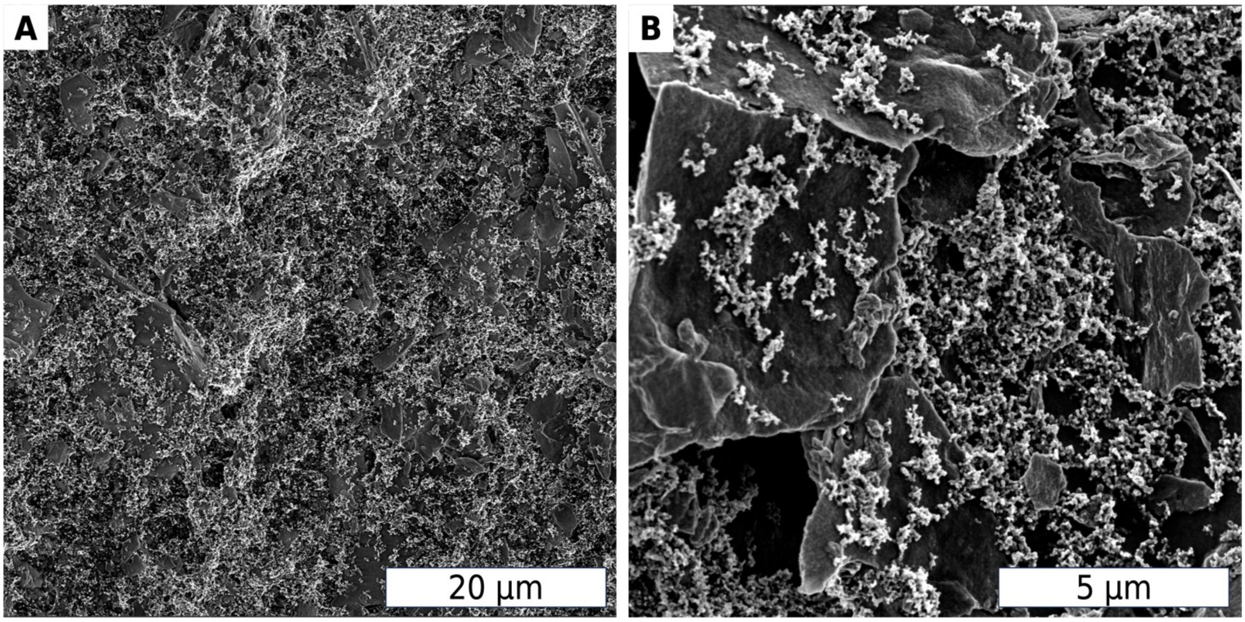

Figure S3. SEM micrographs of non-oriented electrodes.

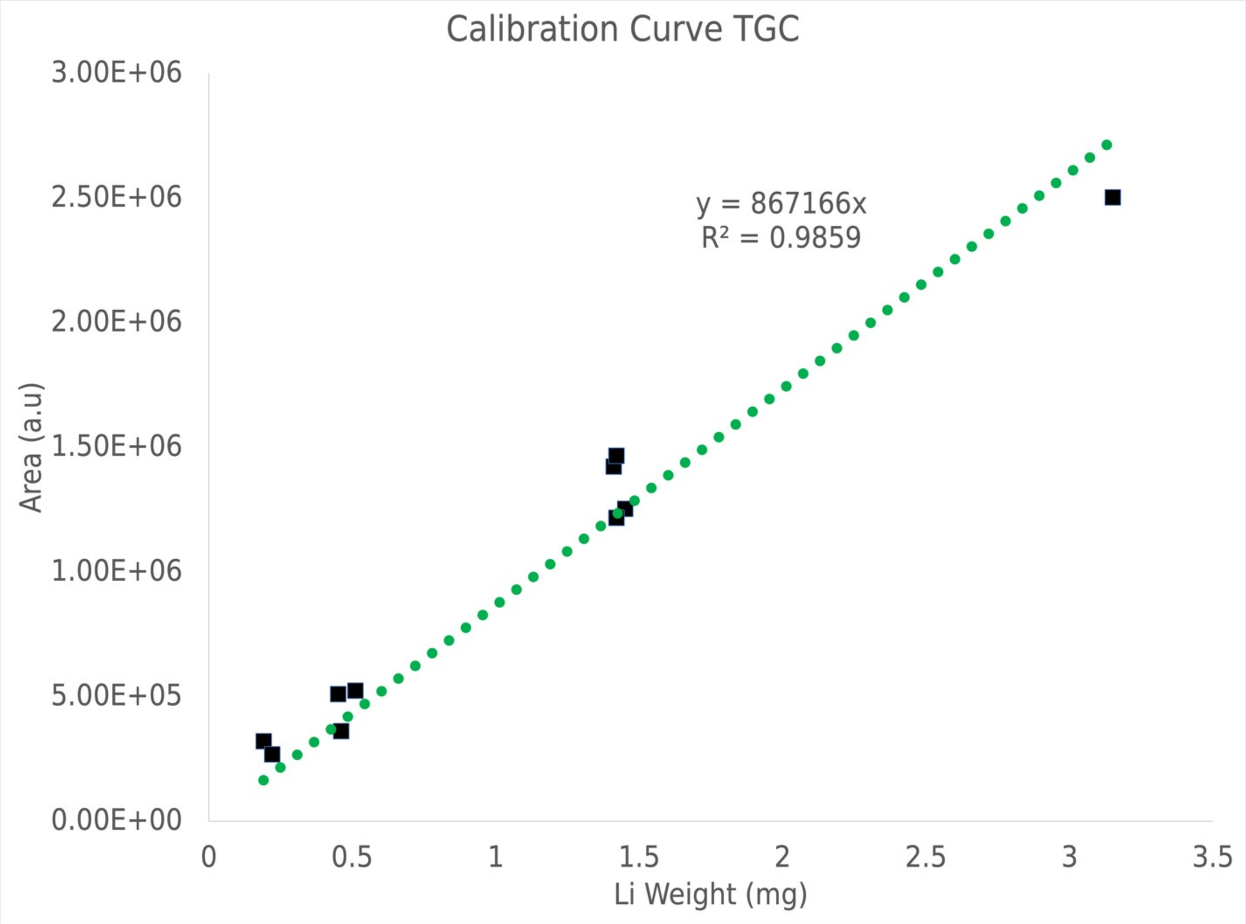

Figure S4. Calibration curve generated to quantify dead Li in electrodes.

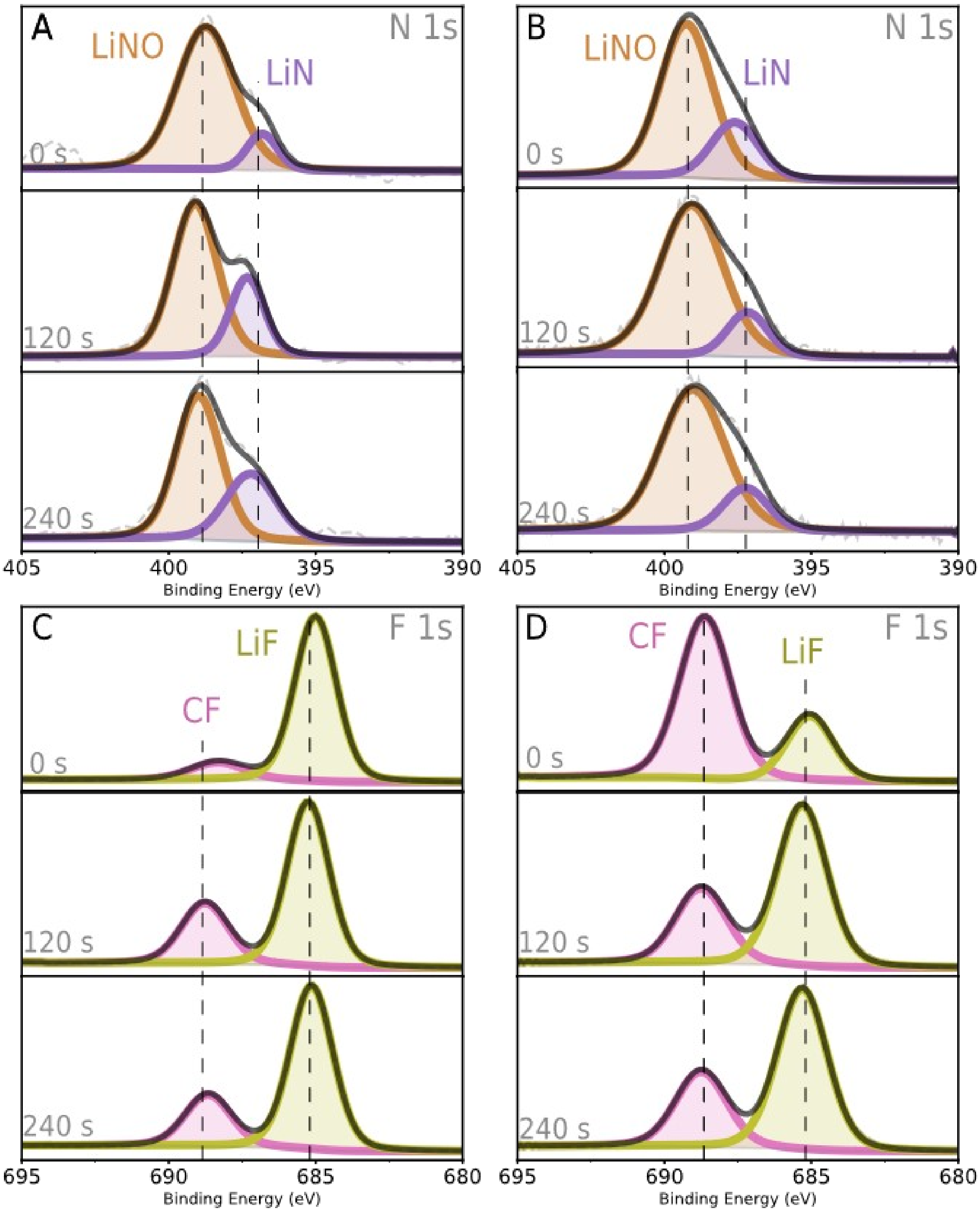

Figure S5. Postmortem XPS of cycled electrodes (A) Cu N 1s, (C) Cu F 1s, (B) V-1DL N 1s, and (D)V-1DL F 1s

Table S1. XPS in supplementary fitting constraints in eV

	Cu			**V-1DL**		
	0 sec	120 sec	240 sec	0 sec	120 sec	240 sec
C-C C 1s	285 ± 0.5	285 ± 0.5	285 ± 0.5	285 ± 0.5	285 ± 0.5	285 ± 0.5
C-O C 1s	289 ± 1	289 ± 1	289 ± 1	289 ± 1	289 ± 1	289 ± 1
C-F C 1s	292 ± 1	292 ± 1	292 ± 1	292 ± 1	292 ± 1	292 ± 1
C=C 1s		282 ± 2	282 ± 2		282 ± 2	282 ± 2
CF 1s	688 ± 1	688 ± 1	688 ± 1	688 ± 1	688 ± 1	688 ± 1
LiF 1s	685.1 ± 1	685.1 ± 1	685.1 ± 1	685.1 ± 1	685.1 ± 1	685.1 ± 1
LiOH Li 1s	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5
LiCO 1s	54.5 ± 0.5	54.5 ± 0.5	54.5 ± 0.5	54.5 ± 0.5	54.5 ± 0.5	54.5 ± 0.5
Li2O Li 1s	53.5 ± 0.5	53.5 ± 0.5	53.5 ± 0.5	53.5 ± 0.5	53.5 ± 0.5	53.5 ± 0.5
LiF 1s	56.5 ± 0.5	56.5 ± 0.5	56.5 ± 0.5	56.5 ± 0.5	56.5 ± 0.5	56.5 ± 0.5
LiN 1s	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5	55.5 ± 0.5
Li 1s		52.5 ± 0.5	52.5 ± 0.5		52.5 ± 0.5	52.5 ± 0.5
LiNO 1s	399.1 ± 0.9	399.1 ± 0.9	399.1 ± 0.9	399.1 ± 0.9	399.1 ± 0.9	399.1 ± 0.9
LiN 1s	397 ± 0.9	397 ± 0.9	397 ± 0.9	397 ± 0.9	397 ± 0.9	397 ± 0.9
LiOH O 1s	532.5 ± 1	532.5 ± 1	532.5 ± 1	532.5 ± 1	532.5 ± 1	532.5 ± 1
LiCO O 1s	530.9 ± 0.4	530.9 ± 0.4	530.9 ± 0.4	530.9 ± 0.4	530.9 ± 0.4	530.9 ± 0.4
Li2O O 1s	526.1 ± 2.8	526.1 ± 2.8	526.1 ± 2.8	526.1 ± 2.8	526.1 ± 2.8	526.1 ± 2.8
TiO O 1s					530.5 ± 0.5	530.5 ± 0.5

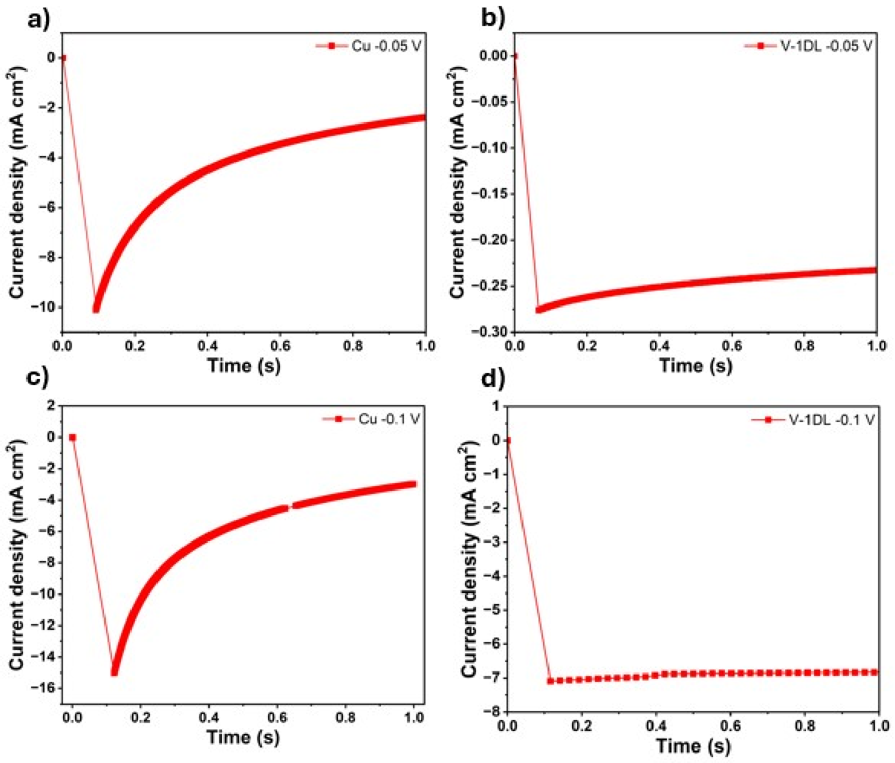

Figure S6. Chronoamperometry test of Li plating at -0.05 V on (a) bare Cu, (b) V-1DL; at -0.1 V on (c) bare Cu, and (d) V-1DL

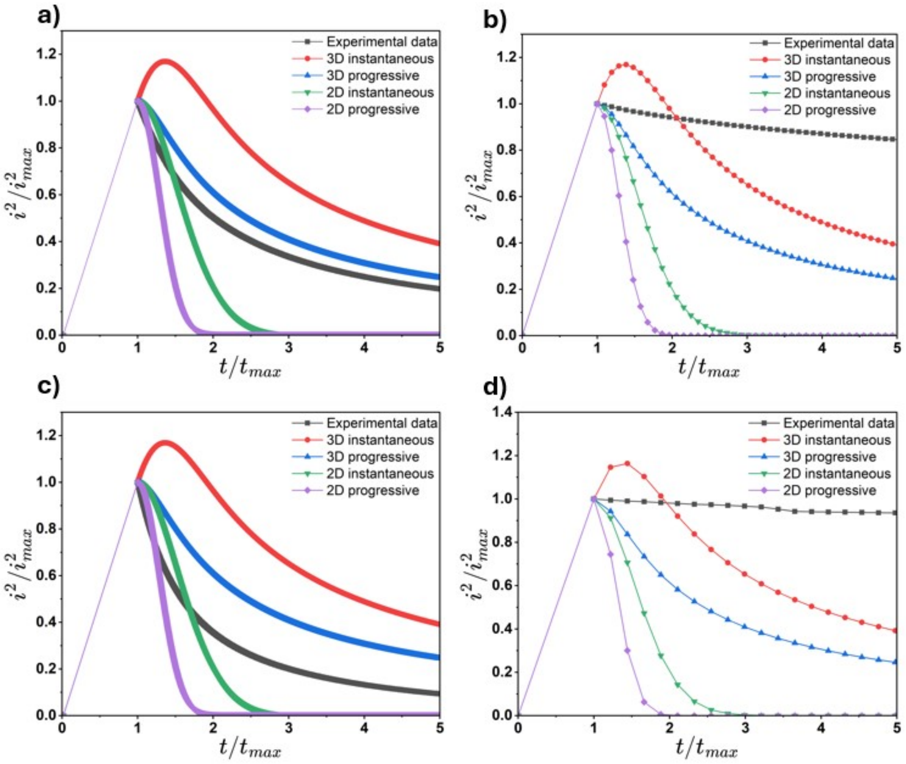

Figure S7. Comparison of different types of nucleation growth and experimental potentiostatic nucleation transient of Li plating at -0.05 V on (a) bare Cu, (b) V-1DL; at -0.1 V on (c) bare Cu, and (d) V-1DL

Table S2. Comparison of nuclei densities of Li deposition on bare Cu and V-1DL

	E = -0.05 V	E = -0.1 V
	Nuclei density * 10^6 (cm^{-2})	
Cu	1734.85333	1606.497571
V-1DL	0.63283	0.014167

Nuclei densities of bare Cu and V-1DL were calculated using equation (1) and (2) for 3D progressive and 3D instantaneous nucleation, respectively [1,2]:

$$N = 0.065\left(\frac{zFC^{\infty}}{t_m i_m}\right)\left(\frac{\rho}{8\pi C^{\infty} M}\right)^{1/2} \tag{1}$$

$$N_s = \left(\frac{0.01109(zF)^4 (C^{\infty})^3}{\pi V_m {i_m}^4 {t_m}^4}\right)^{1/2} \tag{2}$$

[1] B. Scharifker, G. Hills, *Electrochimica Acta* **1983**, *28*, 879.

[2] E. Navarrete, C. Heyser, R. Henríquez, R. Schrebler, R. Córdova, E. Muñoz, *Journal of Electroanalytical Chemistry* **2014**, *727*, 39.