Electrochemical fabrication and characterization of Cu/Cu_2O multi-layered micro and nanorods in Li-ion batteries

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Supporting information

Table S1. The lattice parameters determined for the Cu, Au and Cu_2O phases obtained by XRD analyses of the samples.

	a/Å (Au, Cu-type)	a/Å (Cu, Cu-type)	a/Å (Cu_2O, Cu_2O-type)
80 nm	4.0810(3)	3.617(4)	4.25*
200 nm	4.0812(4)	3.6160(7)	4.270(2)
200 nm HT	4.0810(1)	3.6162(5)	4.256(6)
1 µm	4.0813(8)	3.616(1)	4.246(6)
Reported	4.0782 [1]	3.6149 [2]	4.268 [3]

No uncertainty is given for the cell parameter for the Cu_2O phase in the 80 nm sample, marked with * since only the most intense peak of this phase could be identified for this sample.

Table S2. Multi-layered rod electrode data and theoretical capacities for the cuprous oxide layers

Sample	Pore density (pores/cm^2)	Rod height (µm)	Active area (cm^2)	Combined Cu_2O layer height (µm)	Theoretical capacity (µAh/cm^2)
80 nm	$6*10^8$	3.5	6.3	2.75	18.6
200 nm	$3*10^8$	5	10.4	3.0	63.6
200 nm HT	$3*10^8$	5	10.4	3.0	63.6
1 µm	$2*10^7$	9	6.7	5.3	187

Figure captions

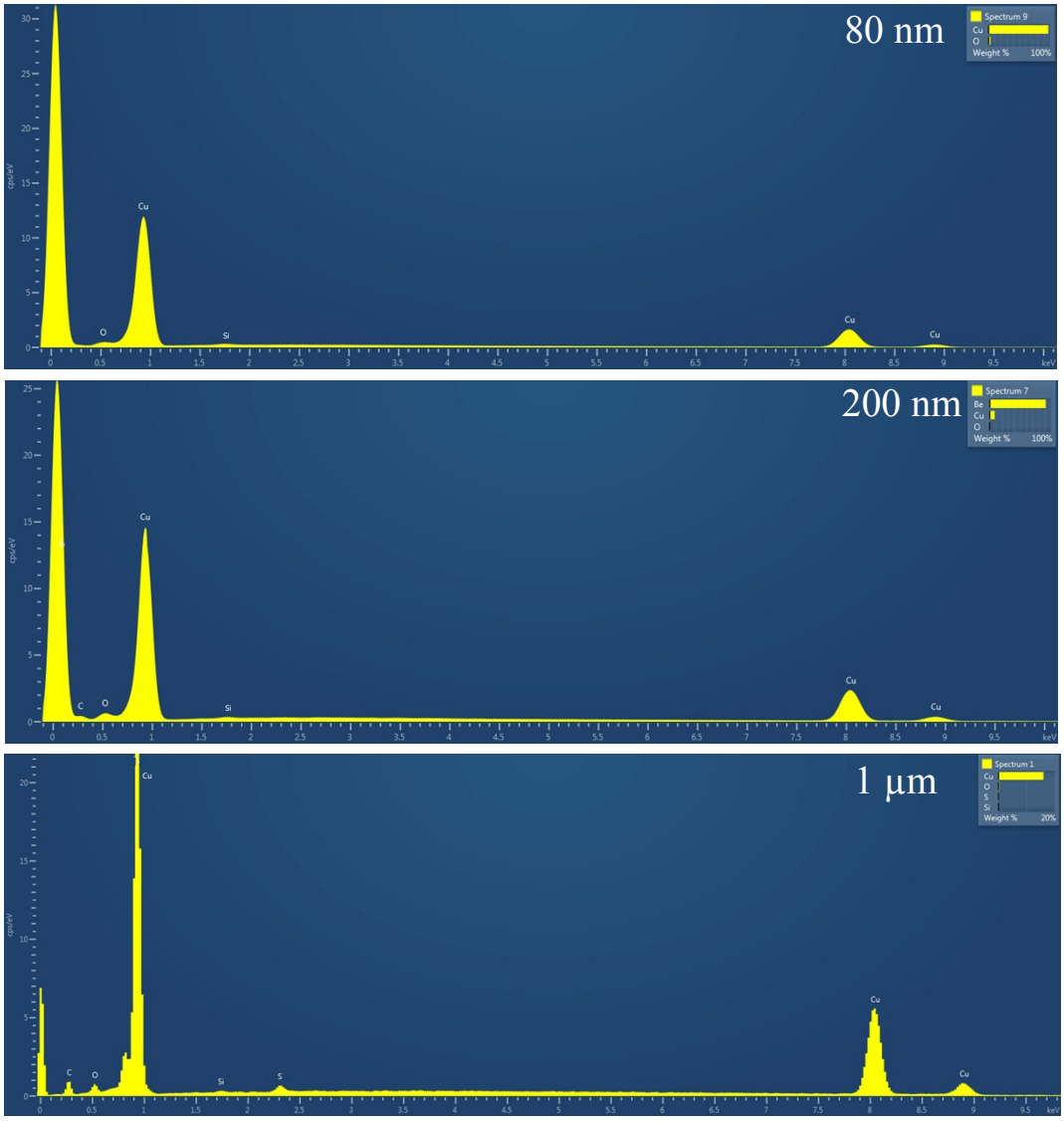

Figure S1. EDS spectra for the different samples synthesized with polycarbonate membranes having pore sizes of 80 nm, 200 nm and 1 µm, respectively.

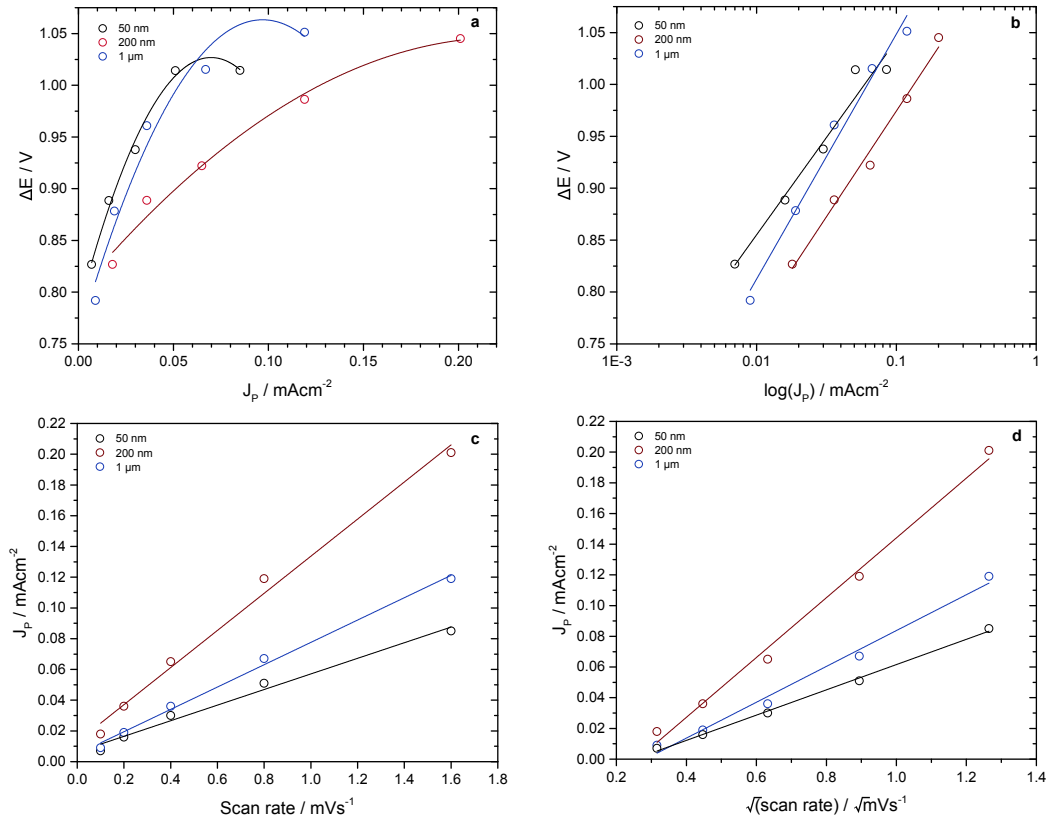

Figure S2. The potential difference between the first reduction peak (e.g. at 1.65 V *vs.* Li^+/Li) and the corresponding oxidation peak (e.g. at 2.35 V *vs.* Li^+/Li) plotted *vs.* the peak current density (a) and the logarithm of the peak current density (b) for all the samples for scan rates between 0.1 and 1.6 mV/s. The peak current density was also plotted *vs.* the scan rate (c) and the square root of the scan rate (d), respectively.

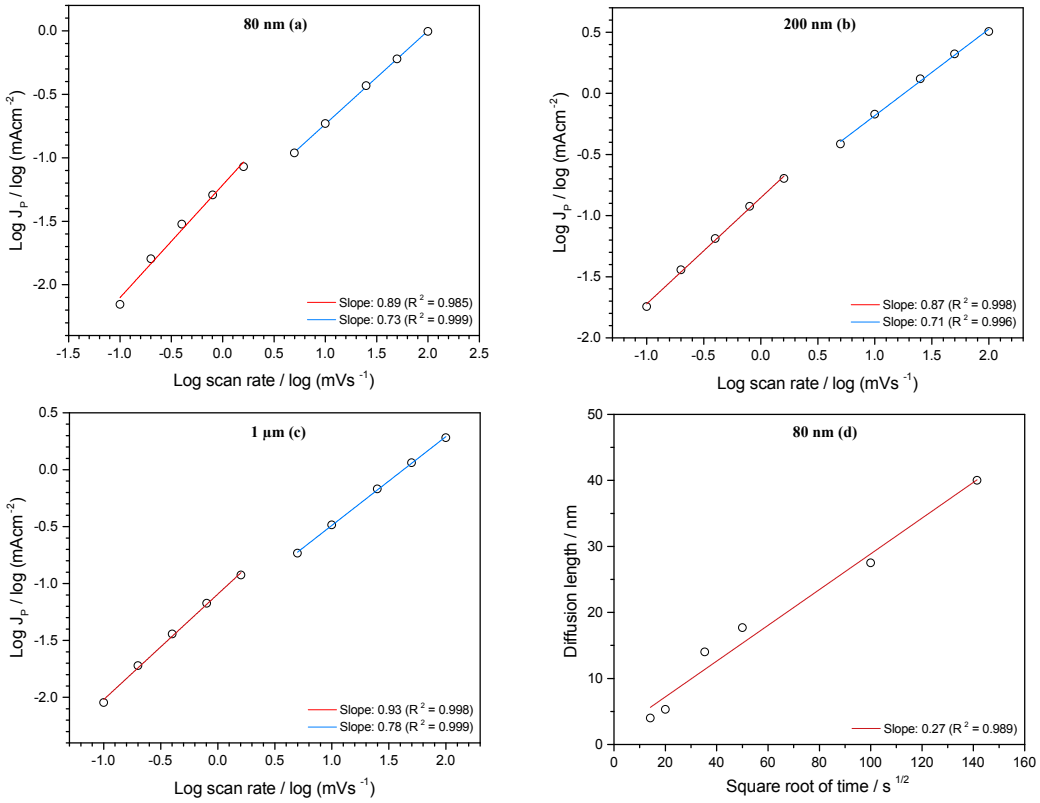

Figure S3. The logarithm of the peak current density *vs.* the logarithm of the scan rate for the 80 nm (a), 200 nm (b) and 1 µm (c) rods. The thickness of electroactive Cu_2O layer plotted *vs.* the square of the time for the 80 nm rods (d). The latter plot was used to determine the diffusion coefficient for Li^+ in Cu_2O as described in the text.

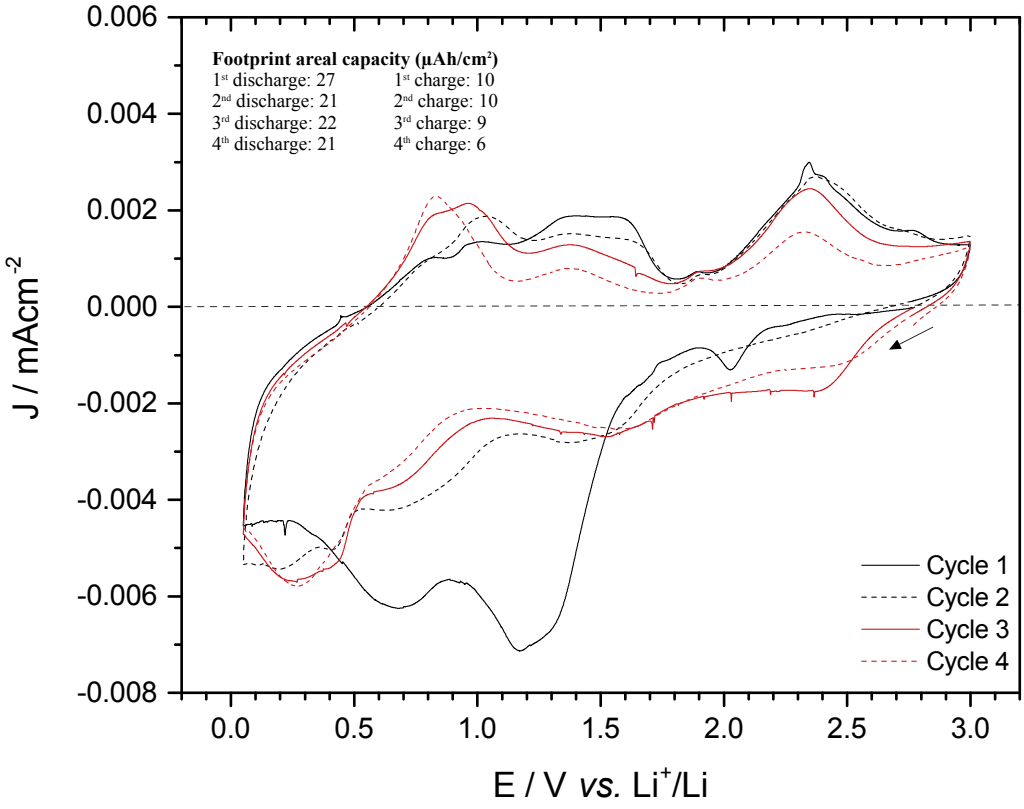

Figure S4. Cyclic voltammetry of an uncoated Cu substrate recorded at a scan rate of 0.1 mV/s.

References

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3. A. Kirfel and K. Eichhorn, *Acta Crystallogr.*, 1990, **46**, 271-284.