Electronic Supplementary Material (ESI) for Materials Advances.

Temperature-modulated Solution-based Synthesis of Copper Oxide Nanostructures for Glucose Sensing

Supplementary Information

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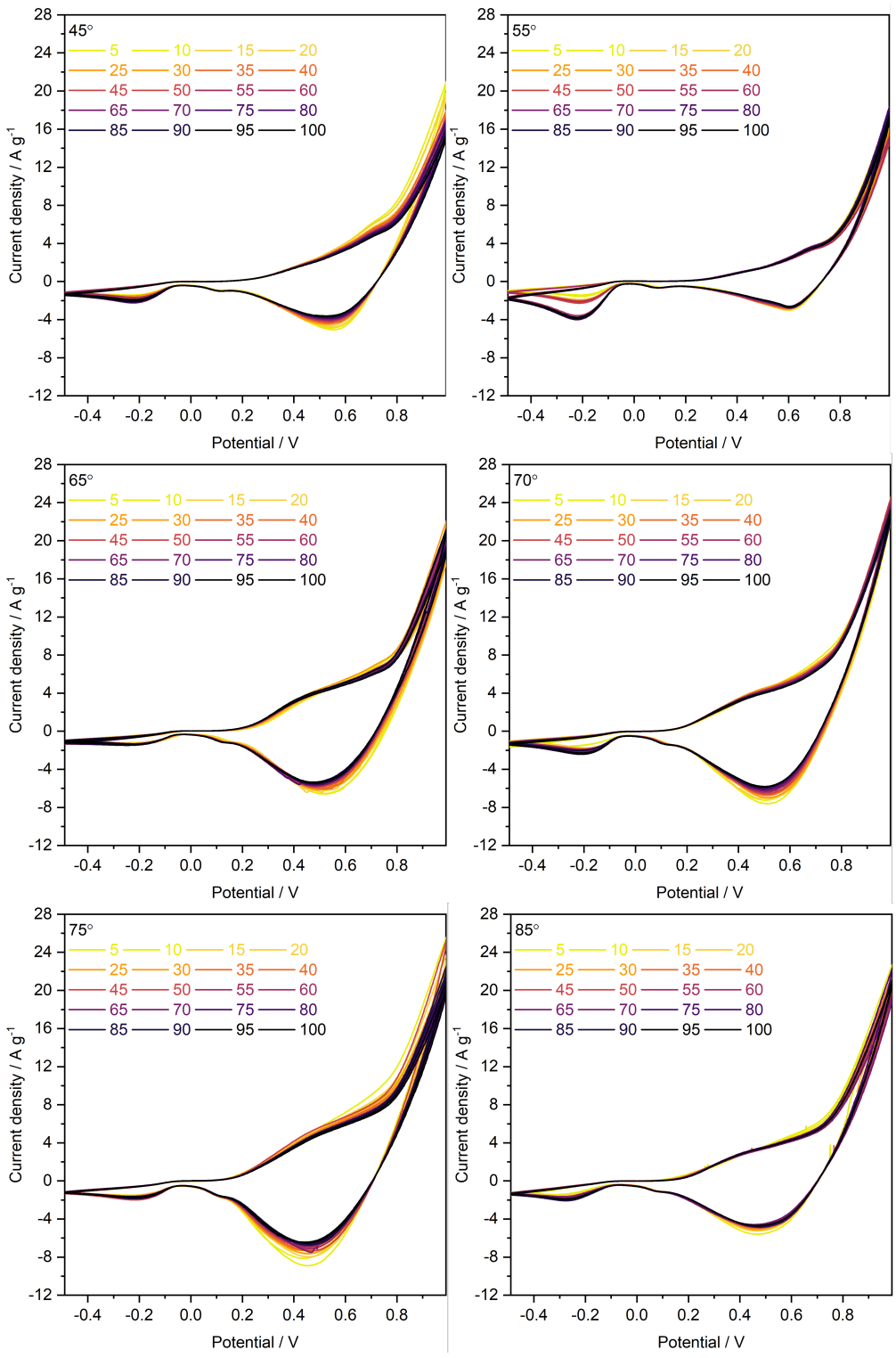

Figure S1: Cyclic voltammograms of CuO nanostructures synthesised at temperatures T from 45 to 85°C collected at 0.05 V/s in 0.1 M NaOH solution with 1 mM glucose over 100 cyles with every fifth cycle plotted.

Table S1: Redox peak position and peak current density of CuO nanostructures synthesised at temperatures T from 45 to 85°C for the 30th and 100th CV cycles. For the sample synthesised at 65°C an average of the 29th and 31st cycle was used as the data for the 30th sample represented an outlier.

T / °C	Peak position / V		Peak current density / Ag^{-1}	
	30th cycle	100th cycle	30th cycle	100th cycle
45	0.71	0.72	5.70	4.86
55	0.70	0.69	3.44	3.48
65	0.73	0.72	6.54	6.12
70	0.45	0.45	3.76	3.58
75	0.48	0.48	4.92	4.70
85	0.45	0.44	3.14	3.08

Table S2: Lattice parameters a, b, c and angle β of as-prepared CuO nanostructures determined from Le Bail refinement as well as for a CuO reference (ICSD Coll. Code: 67850). All values of as-prepared CuO nanostructures are given with an estimated error from the refinement. The standard deviation calculated by TOPAS is also included in the table.

T / °C	a / Å	b / Å	c / Å	β / °
45	4.70(1)	3.43(1)	5.14(1)	99.26(1)
55	4.70(2)	3.43(2)	5.15(3)	99.20(2)
65	4.70(2)	3.43(1)	5.14(2)	99.21(1)
70	4.71(2)	3.44(1)	5.16(2)	99.09(1)
75	4.71(2)	3.44(1)	5.16(2)	99.11(1)
85	4.70(1)	3.43(1)	5.15(2)	99.21(1)
Ref.	4.67975	3.43144	5.13626	99.2625

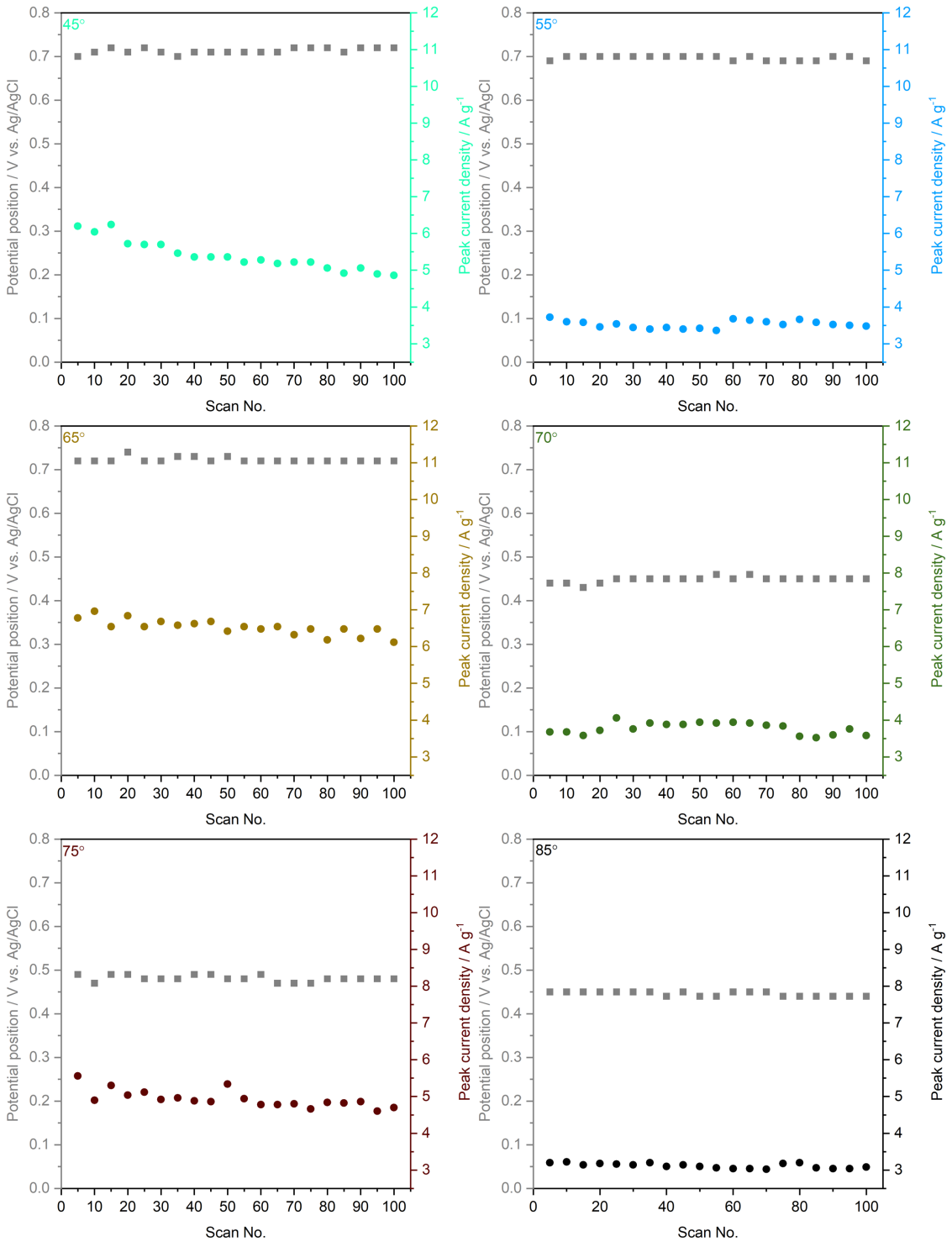

Figure S2: Values for the redox peak position and the peak current density of CuO nanostructures synthesised at temperatures T from 45 to 85°C from every fifth cycle of the 100 cyclic voltammograms collected at 0.05 V/s in 0.1 M NaOH solution with 1 mM glucose. For the sample synthesised at 65°C an average of the 29$^{\text{th}}$ and 31$^{\text{st}}$ cycle was used as the data for the 30$^{\text{th}}$ sample represented an outlier.

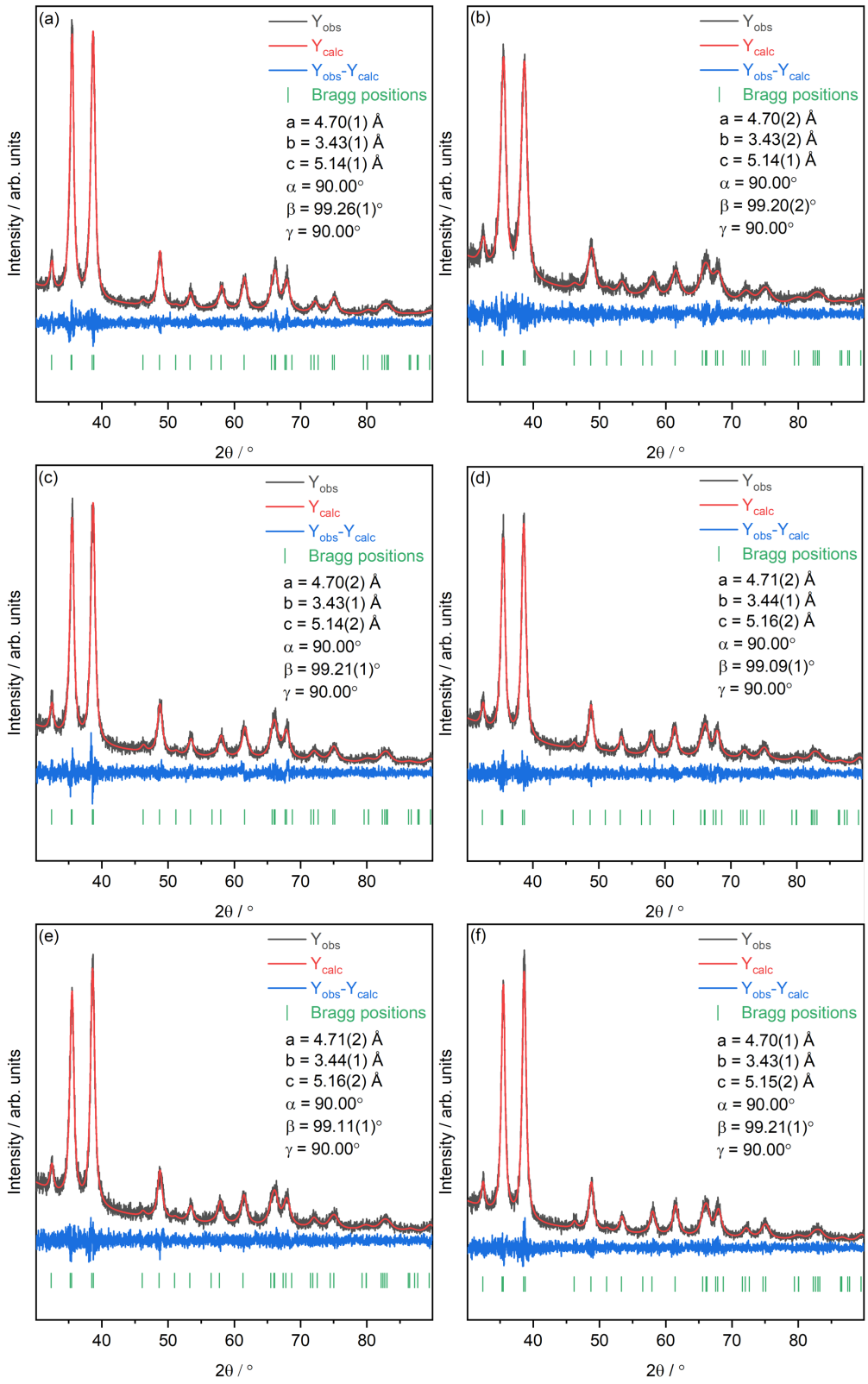

Figure S3: Le Bail refinements of the collected XRD patterns of CuO nanostructures synthesised at (a) 45, (b) 55, (c) 65, (d) 70, (e) 75, and (f) 85°C. Y_{obs} is the raw data from XRD and Y_{calc} is the Le Bail refinement.

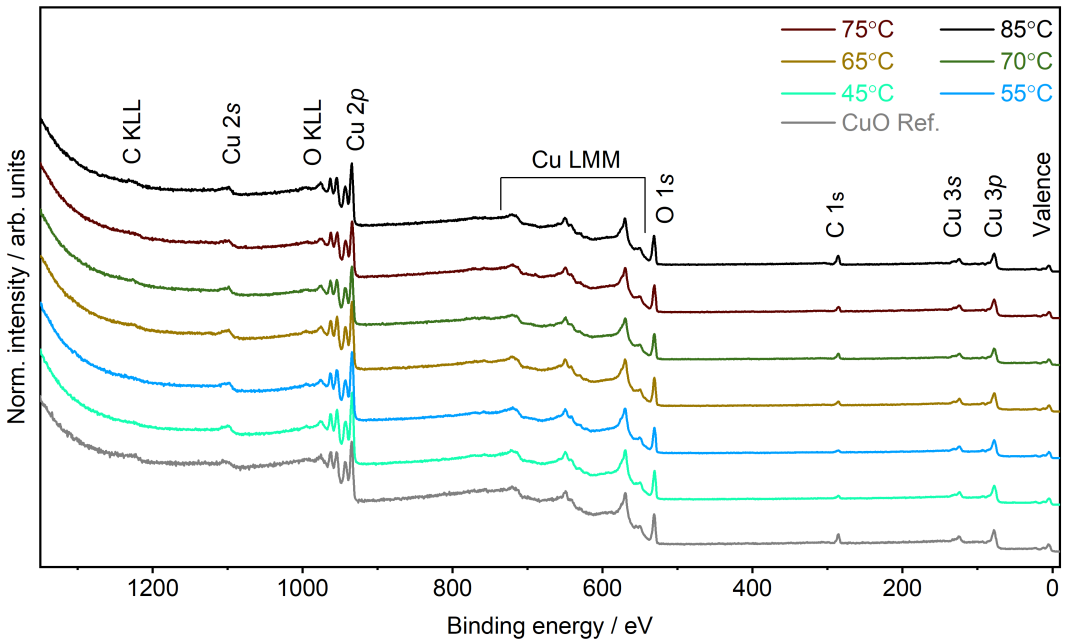

Figure S4: X-ray photoelectron survey spectra of CuO nanostructures synthesised from 45 to 85°C and of a CuO reference powder. All spectra are normalised [0 to 1] and vertically stacked.

Table S3: Relative atomic ratios between Cu:O_{Oxide} and O_{Oxide}:O_{Other} from peak fit analysis of the Cu $2p_{3/2}$ and O $1s$ XPS core level spectra for nanostructures synthesised at varying temperatures T in rel.at%. All values are given with an estimated error of ± 2 rel.at%.

T / °C	Cu : O_{Oxide}	O_{Oxide} : O_{Others}
45	48 : 52	69 : 31
55	50 : 50	69 : 31
65	49 : 51	64 : 36
70	49 : 51	53 : 47
75	53 : 47	52 : 48
85	46 : 54	56 : 44

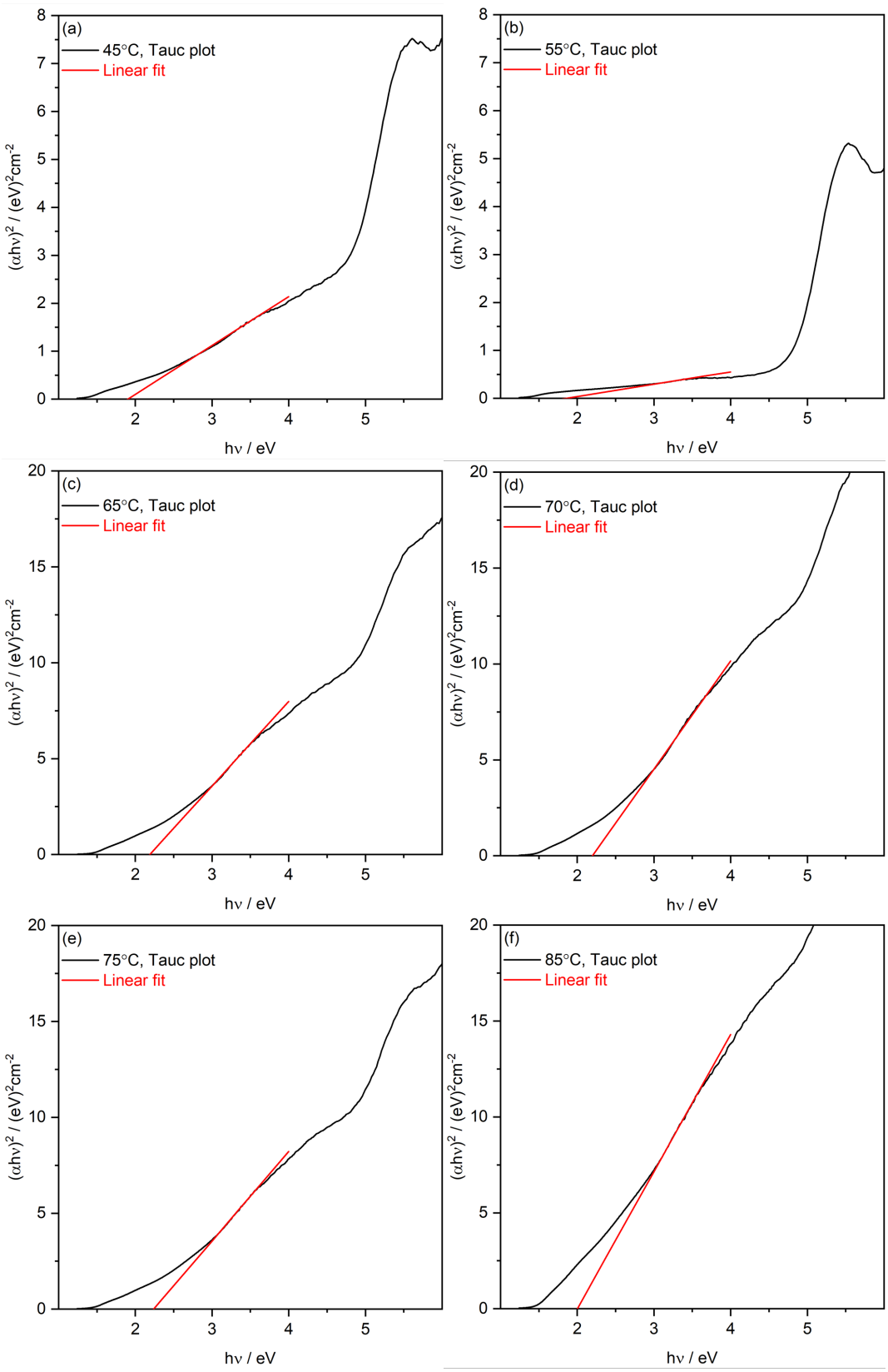

Figure S5: Tauc plots of $(\alpha hv)^2$ vs. hv for CuO nanostructures synthesised at (a) 45, (b) 55, (c) 65, (d) 70, (e) 75, and (f) 85°C. Red lines are linear fit ranges used to obtain optical band gap E_g values.

Table S4: Optical band gap E_g from Tauc analysis of UV-vis spectroscopy and VBM-E_F separation from fits to the XPS valence band spectra. All values are given with an estimated error of ± 0.10 eV.

T / °C	E_g / eV	VBM-E_F / eV
45	1.76	0.34
55	1.85	0.29
65	2.19	0.12
70	2.20	0.15
75	2.24	0.17
85	2.00	0.46