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Supplementary Material

Decoration of ultralong carbon nanotubes with Cu_2O nanocrystals: a hybrid platform for enhanced photoelectrochemical CO_2 reduction

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Figures:

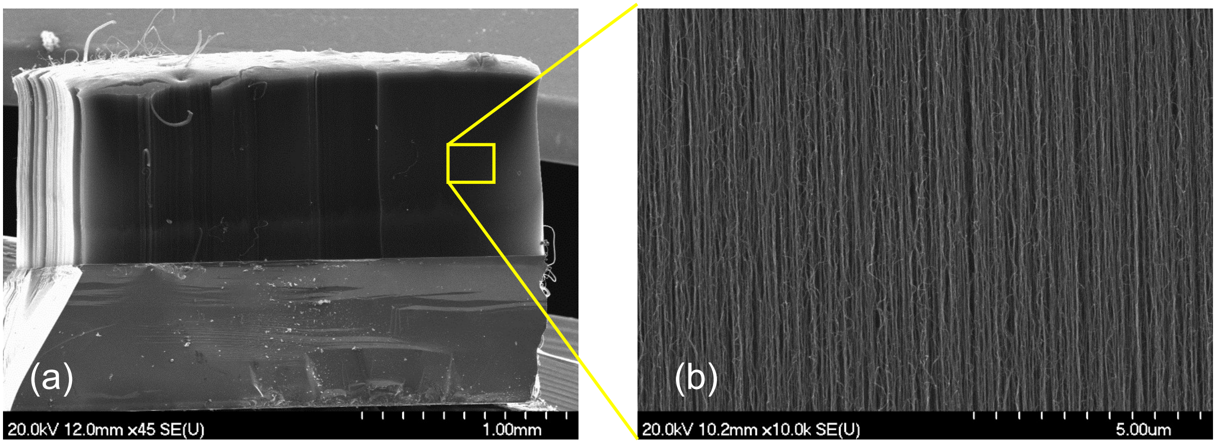

Fig. S1 SEM images of the CVD synthesized MWCNT arrays at different magnifications.

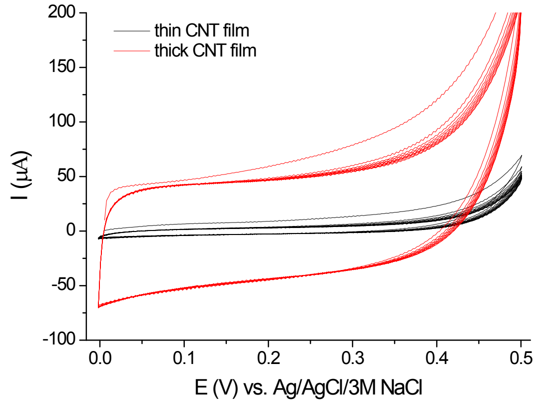

Fig. S2 CV traces of two CNT/ITO films with different CNT loading (10 and 50 μg cm^{-2}) registered at 50 mV s^{-1} sweep rate in the same Cu-lactate solution (pH=9) which was used for the subsequent electrodeposition.

Slightly modified Randles equivalent circuit was applied to evaluate the data from electrochemical impedance measurements (Fig. S3). This circuit consists of an active solution (electrolyte) resistance (R_S) coupled in series with the parallel combination of the Faradaic impedance and the double-layer capacitance. Faradaic impedance of such electrode is commonly described with series combination of the charge transfer resistance (R_{CT}) and a Warburg element (W). The double layer capacitance was defined by a constant phase element. Capacitance of the cell (capacitor formed from the working and counter electrodes) was also introduced in the model, since it has significant contribution to the impedance at high frequencies (typically above 100 kHz). In the case of the CNT-containing electrode, the model was improved with an additive, parallel combined capacitance element to describe the new electrode-electrolyte surface.

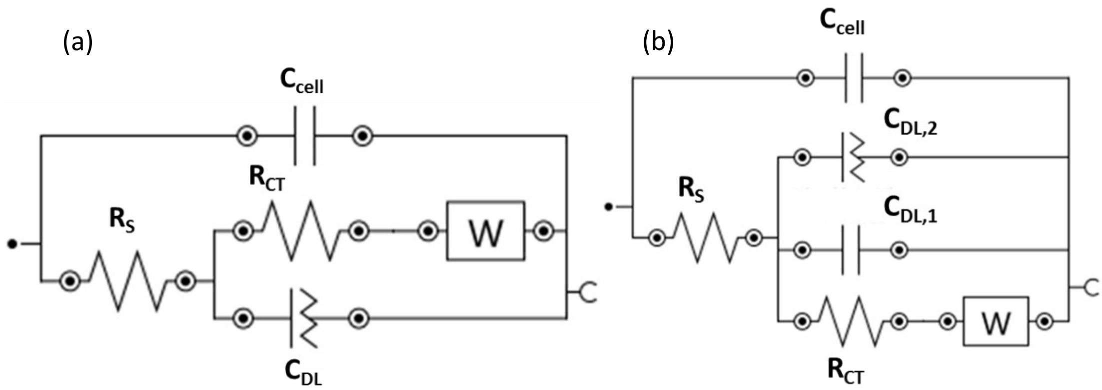

Fig. S3 Equivalent circuits used for the fitting of the impedance spectra for: (a) Cu_2O and (b) CNT/Cu_2O electrodes.

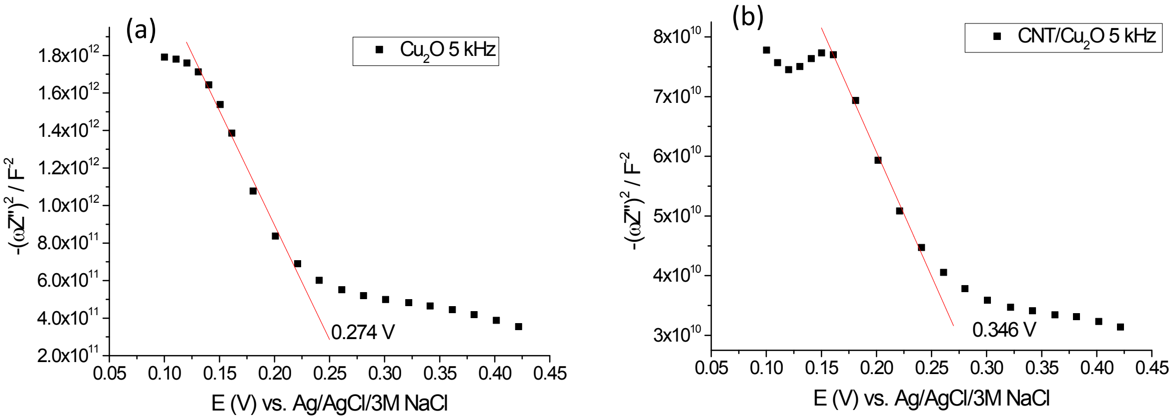

Fig. S4 Mott-Schottky plots recorded in 0.1 M sodium acetate solution at 5 kHz for (a) Cu_2O and (b) CNT/Cu_2O electrodes.

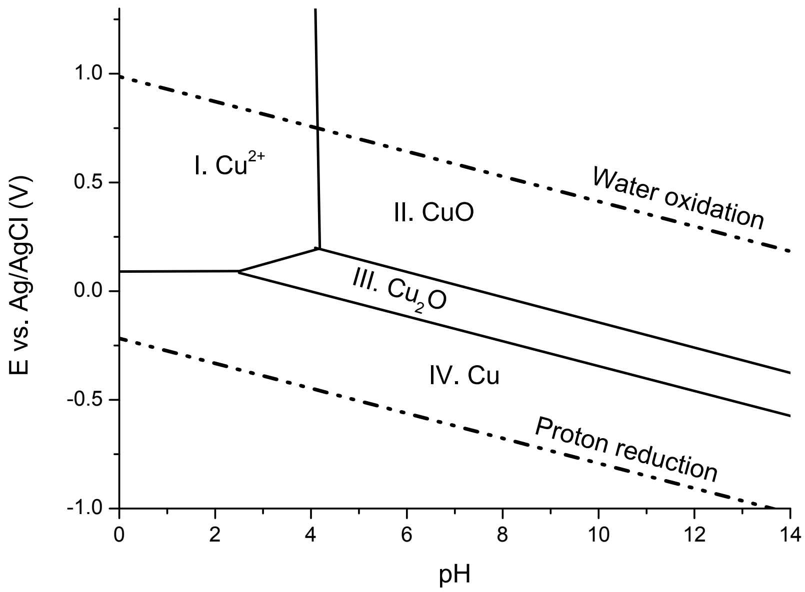

Fig. S5 Pourbaix diagram of Cu.

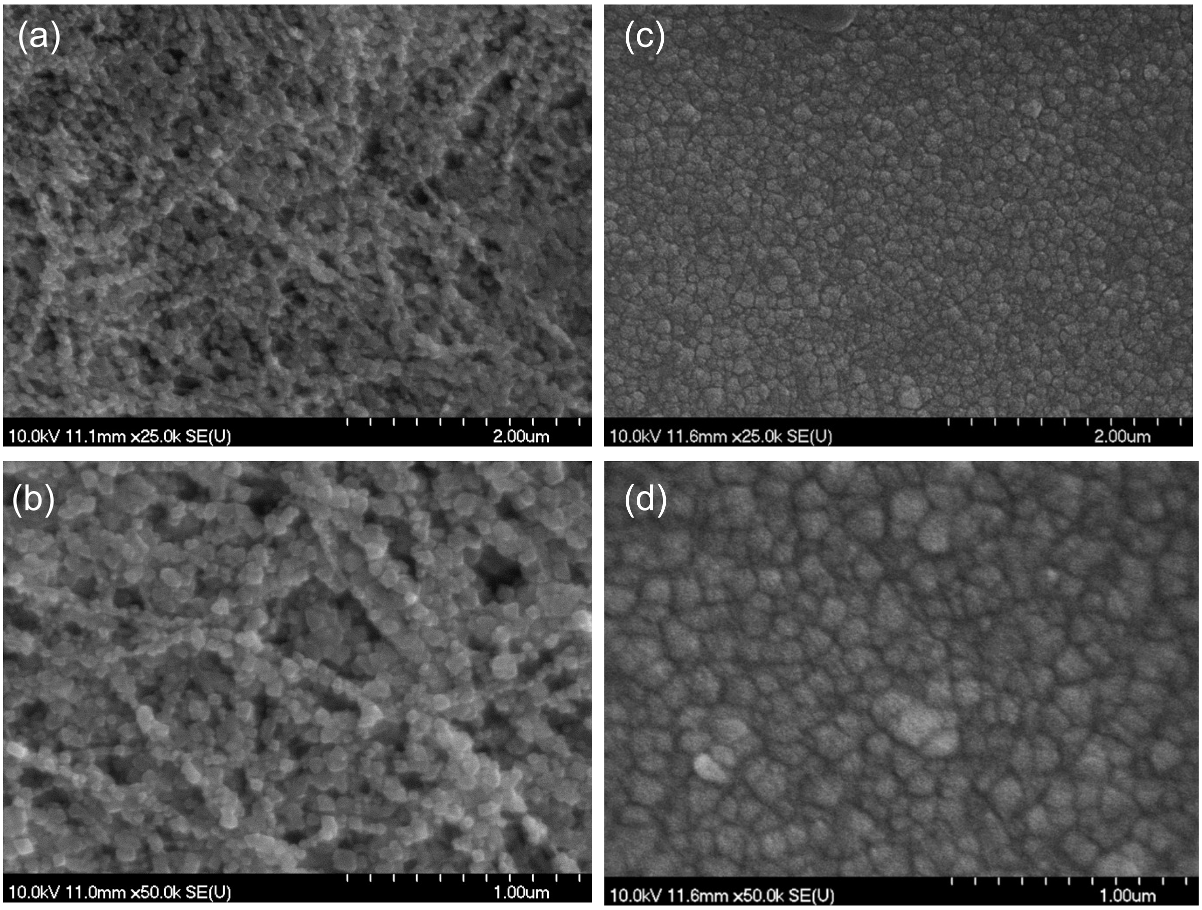

Fig. S6 Comparison of SEM images recorded for Cu_2O/CNT (a, b) and Cu_2O (c, d) films deposited with 200 mC charge.