

Formation of nanostructured porous Cu/Au surfaces: the influence of cationic sites on (electro)-catalysis

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Supplementary Information

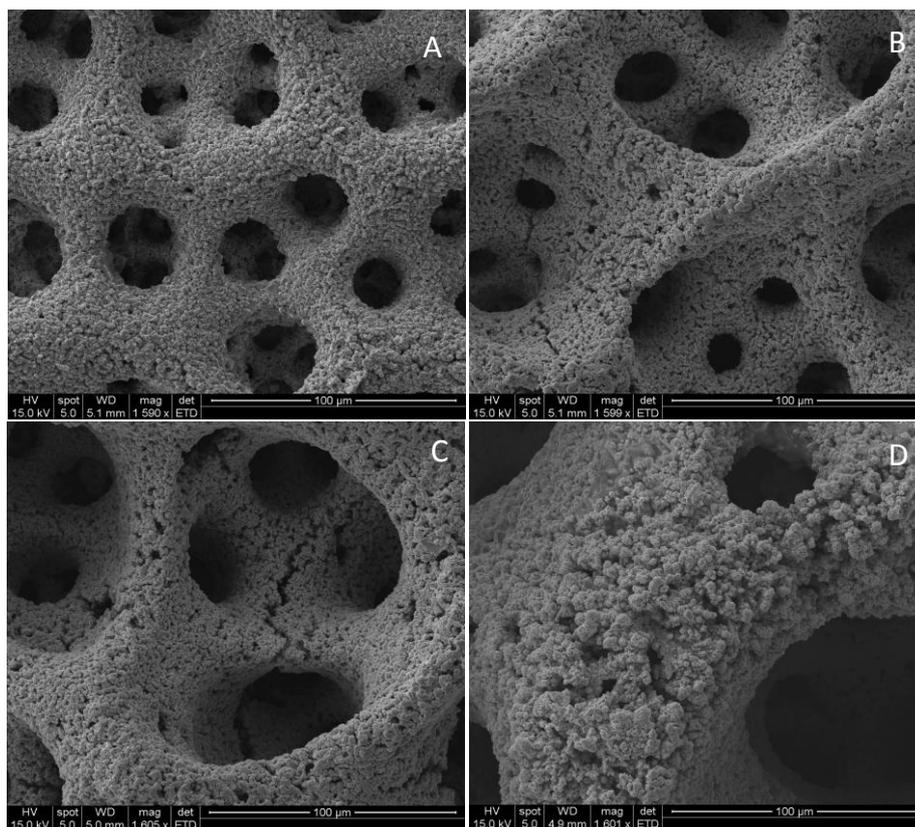


Figure S1. SEM images of Cu/Au electrodeposited at a current density of 3 A cm^{-2} from a solution of 0.4 M CuSO_4 containing 5 mM KAuBr_4 in $1.5 \text{ M H}_2\text{SO}_4$ for (a) 5, (b) 10, (c) 15 and (d) 30 sec.

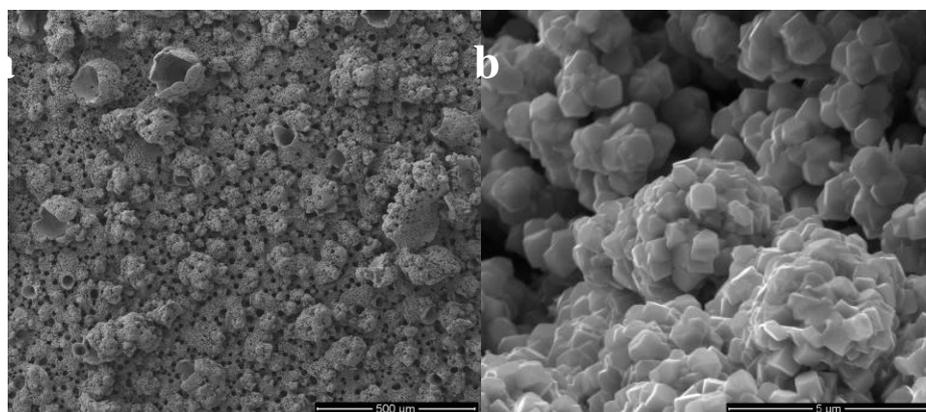


Figure S2. SEM images of Cu/Au electrodeposited at a current density of 3 A cm^{-2} from a solution of 0.4 M CuSO_4 containing 50 mM KAuBr_4 in $1.5 \text{ M H}_2\text{SO}_4$ for 15 sec.

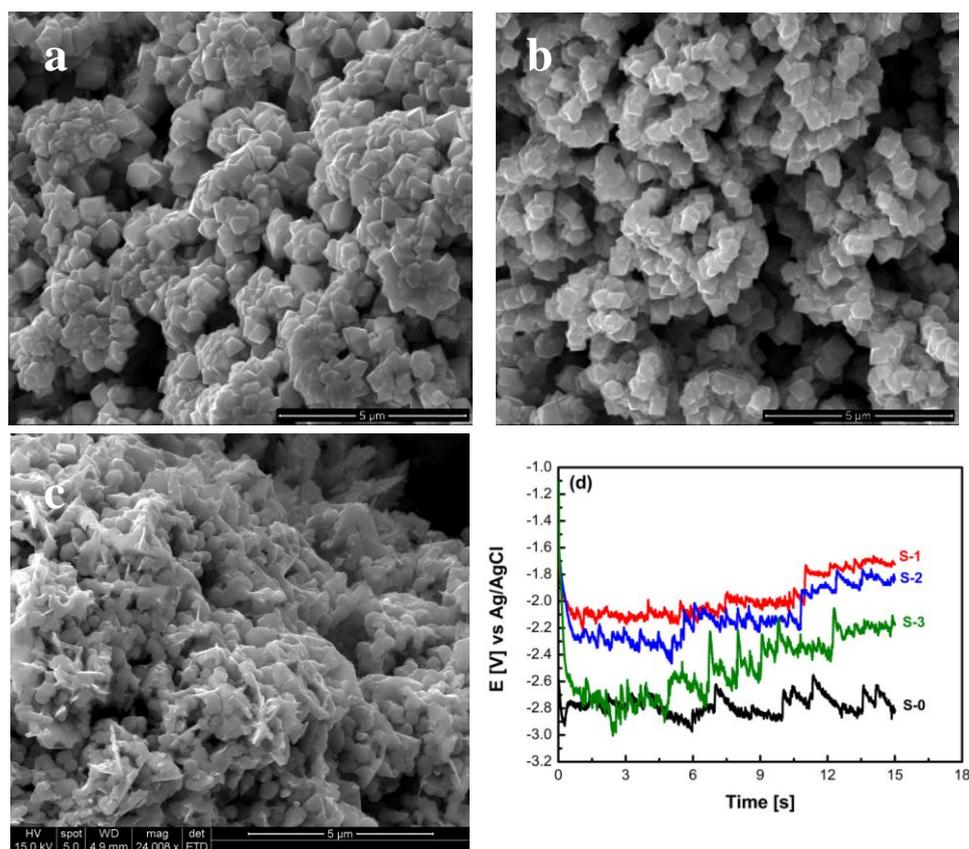


Figure S3. SEM images of Cu/Au electrodeposited at a current density of 3 A cm⁻² from a solution of 0.4 M CuSO₄ containing (a) 5, (b) 10 and (c) 20 mM KAuBr₄ in 1.5 M H₂SO₄ for 15 sec, (d) corresponding E-time plots recorded during the galvanostatic deposition process for S-0, S-1, S-2 and S-3.

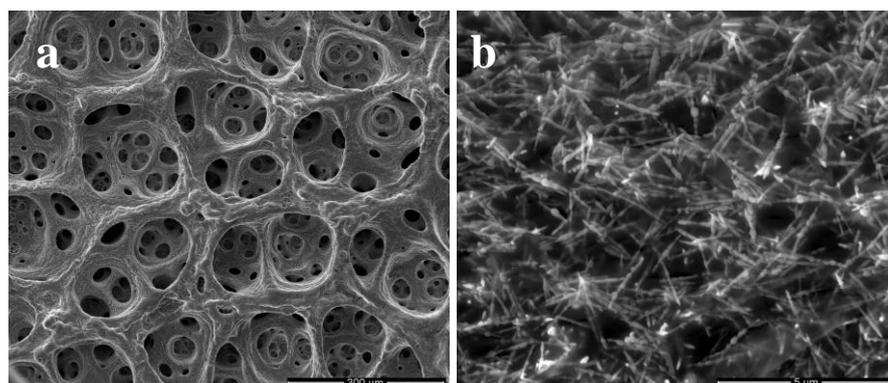


Figure S4: SEM images of Cu/Au electrodeposited at a current density of 3 A cm⁻² from a solution of 0.4 M CuSO₄ containing 10 mM KBr in 1.5 M H₂SO₄ for 15 sec.

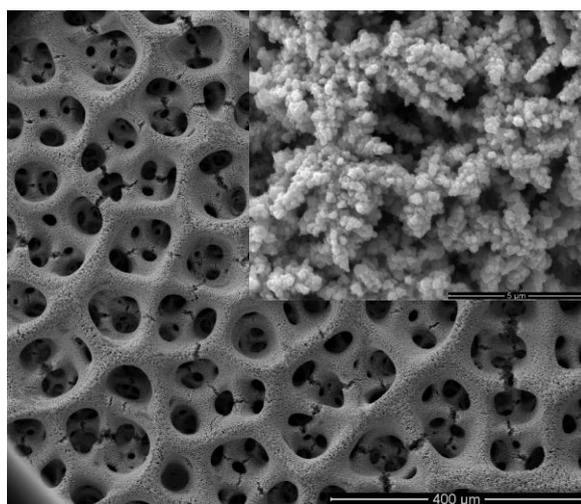


Figure S5: SEM images of Cu/Au electrodeposited at a current density of 3 A cm^{-2} from a solution of 0.4 M CuSO_4 containing 10 mM HAuCl_4 in $1.5 \text{ M H}_2\text{SO}_4$ for 15 sec.

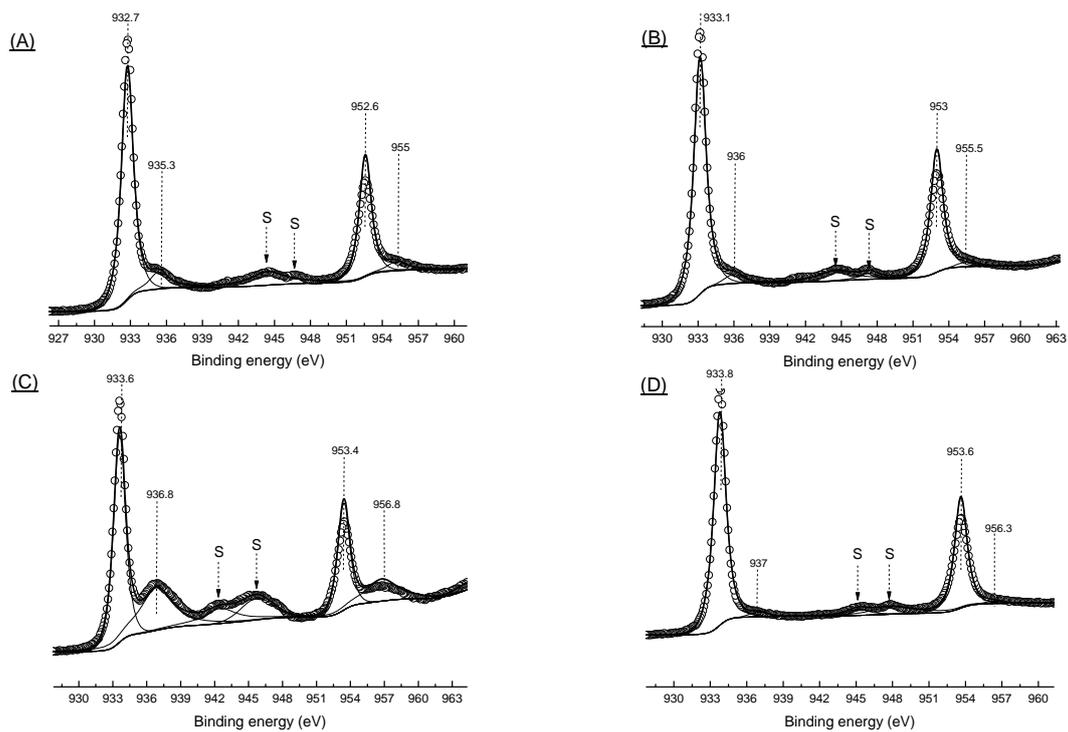


Figure S6-1. Copper 2p core level X-ray photoemission spectra recorded from the Cu/Au samples S-1(A), S-2(B), S-3 (C) and S-4 (D). Experimental spectra are shown as circles, individual components are shown as lines and solid thick lines represent the best fit curves

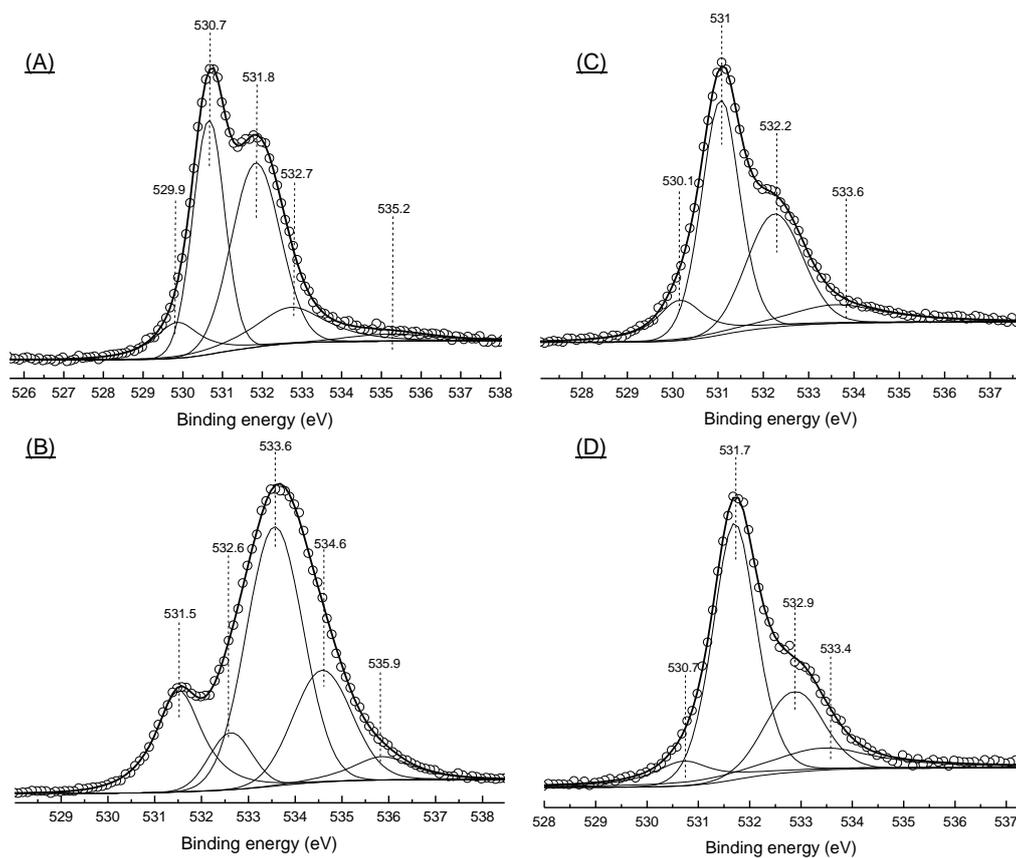


Figure S6-2. Oxygen 1s core level X-ray photoemission spectra recorded from the Cu/Au samples S-1(A), S-2(B), S-3 (C) and S-4 (D). Experimental spectra are shown as circles, individual components are shown as lines and solid thick lines represent the best fit curves

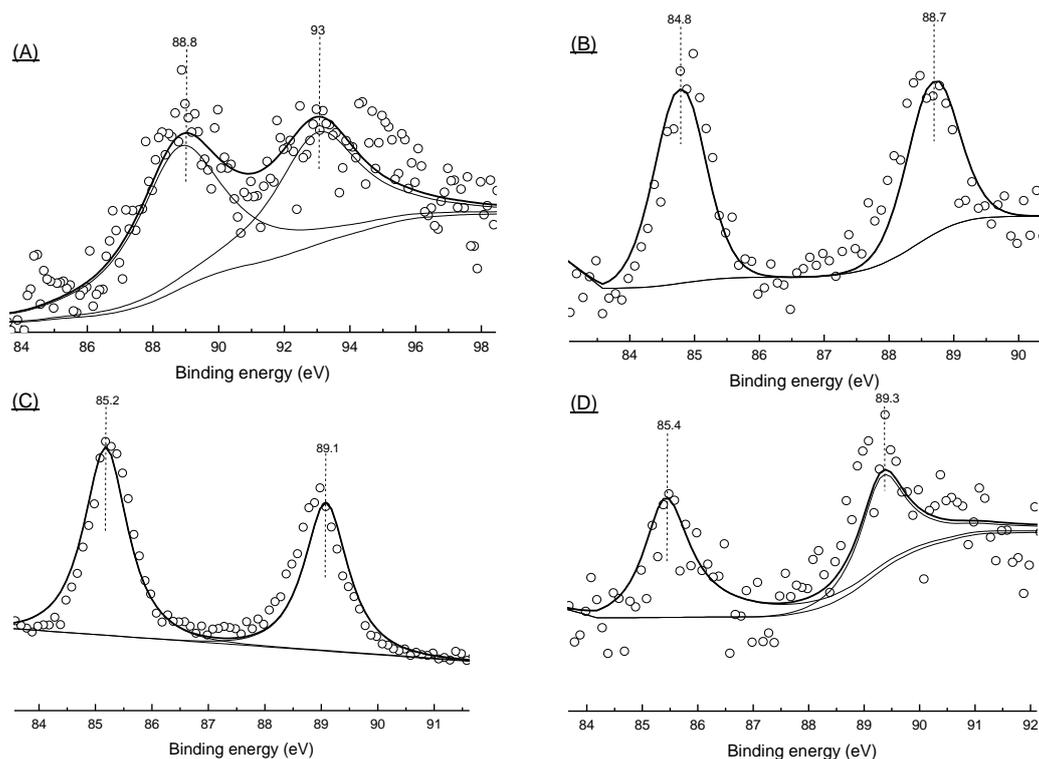


Figure S6-3. Gold 4f core level X-ray photoemission spectra recorded from the Cu/Au samples S-1(A), S-2(B), S-3 (C) and S-4 (D). Experimental spectra are shown as circles, individual components are shown as lines and solid thick lines represent the best fit curves

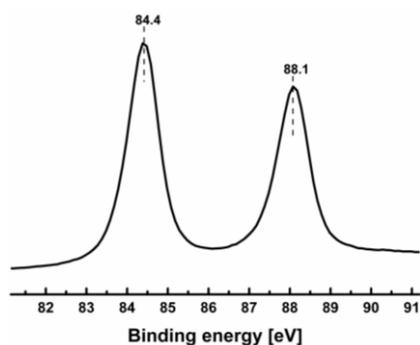


Figure S7: XPS Au 4f spectrum of honeycomb gold electrodeposited on to an evaporated gold surface at a current density of 2 A cm^{-2} from a solution of 0.1 M KAuBr_4 in $1.5 \text{ M H}_2\text{SO}_4$ for 30 sec.

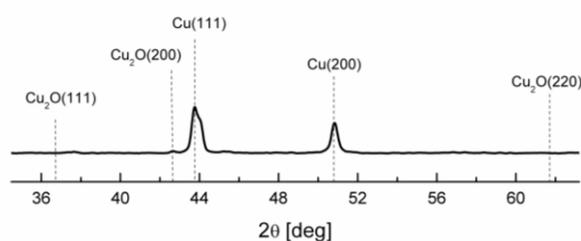


Figure S8: XRD pattern of porous copper electrodeposited at a current density of 3 A cm^{-2} from a solution of 0.4 M CuSO_4 in $1.5 \text{ M H}_2\text{SO}_4$ containing 10 mM KBr for 15 sec.

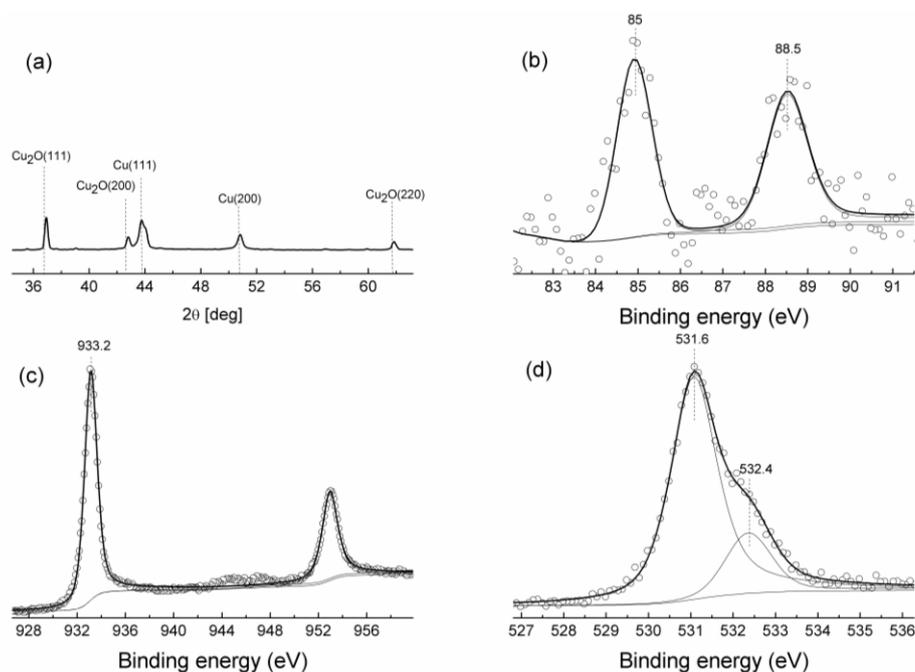


Figure S9: Porous Cu/Au electrodeposited from electrodeposited at a current density of 3 A cm^{-2} from a solution of 0.4 M CuSO_4 in $1.5 \text{ M H}_2\text{SO}_4$ containing 10 mM H AuCl_4 for 15 sec. (a) XRD pattern and XPS core level spectra of (b) Au 4f, (c) Cu 2p 7/2 and (d) O 1s energy levels.

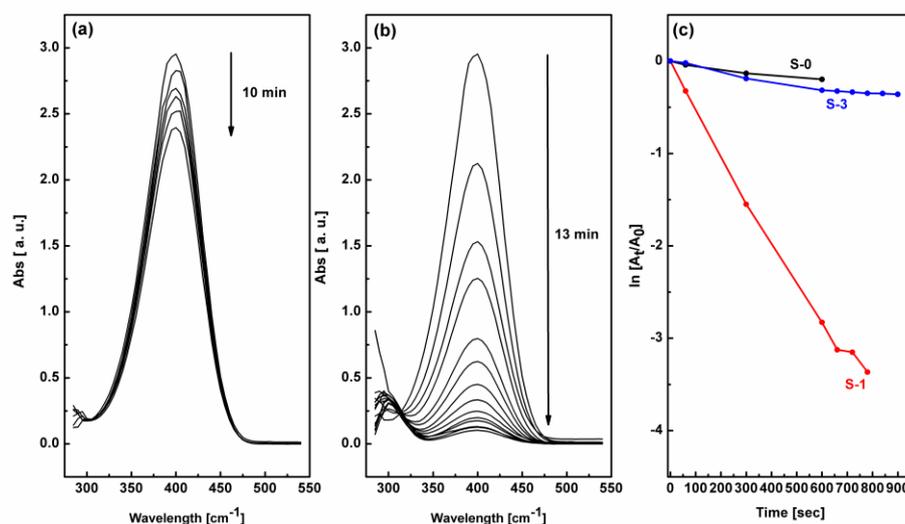


Figure S10. Time dependent UV-vis spectra recorded for the reduction of 4-nitrophenol with NaBH₄ catalysed by (a) honeycomb Cu (S-0) and (b) honeycomb Cu/Au (S-1), (c) plot of ln(A_t/A₀) versus time for samples S-0, S-1 and S-3. Note: The electrodeposition time employed here was 5 s.

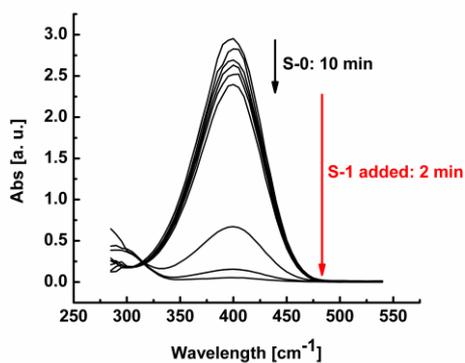


Figure S11. Time dependent UV-vis spectra recorded for the reduction of 4-nitrophenol with NaBH₄ catalysed by honeycomb Cu (S-0) and after the addition of honeycomb Cu/Au (S-1) to the reaction mixture after 10 min.

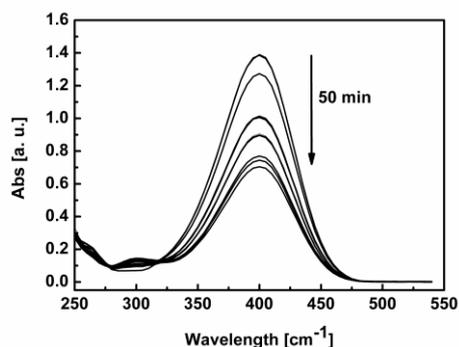


Figure S12. Time dependent UV-vis spectra recorded for the reduction of 4-nitrophenol with NaBH_4 catalysed by honeycomb Cu/Pd. The Cu/Pd sample was prepared by electrodeposition on to a copper foil electrode at a current density of 3 A cm^{-2} for 15 s from a solution of 0.4 M CuSO_4 and 1.5 M H_2SO_4 containing 10 mM $\text{Pd}(\text{NO}_3)_2$.

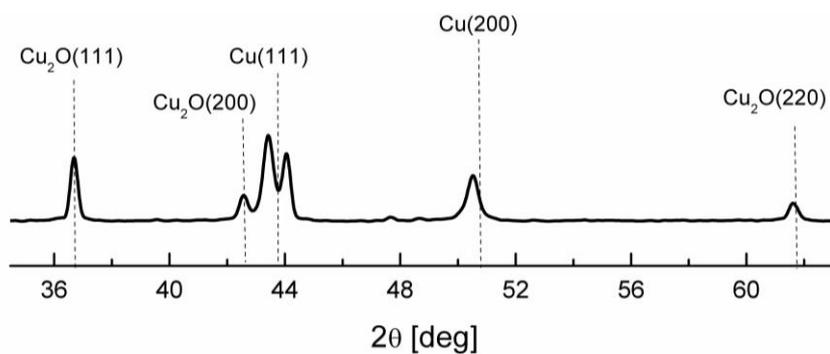


Figure S13: XRD pattern of Cu/Au (S-2) after immersion in NaBH_4 for 5 min.