

SUPPLEMENTARY INFORMATION

Improving the photoelectrochemical water splitting performance of CuO photocathode by using the CuBi₂O₄ protective layer

Nguyen Hoang Lam¹, Nguyen Tam Nguyen Truong^{1*}, Nam Le¹, Kwang-Soon Ahn¹, Younjung Jo², Chan Duk Kim^{2*}, and Jae Hak Jung^{1*}

¹ School of Chemical Engineering, Yeungnam University, 280 Daehak-Ro, Gyeongsan 38541, Republic of Korea;

² Department of Physics, Kyungpook National University, Daegu, 702-701, Republic of Korea.

*corresponding authors: tamnguyentn@ynu.ac.kr (N.T.N.T), duks@knu.ac.kr (C.D.K) and jhjung@ynu.ac.kr (J.H.J)

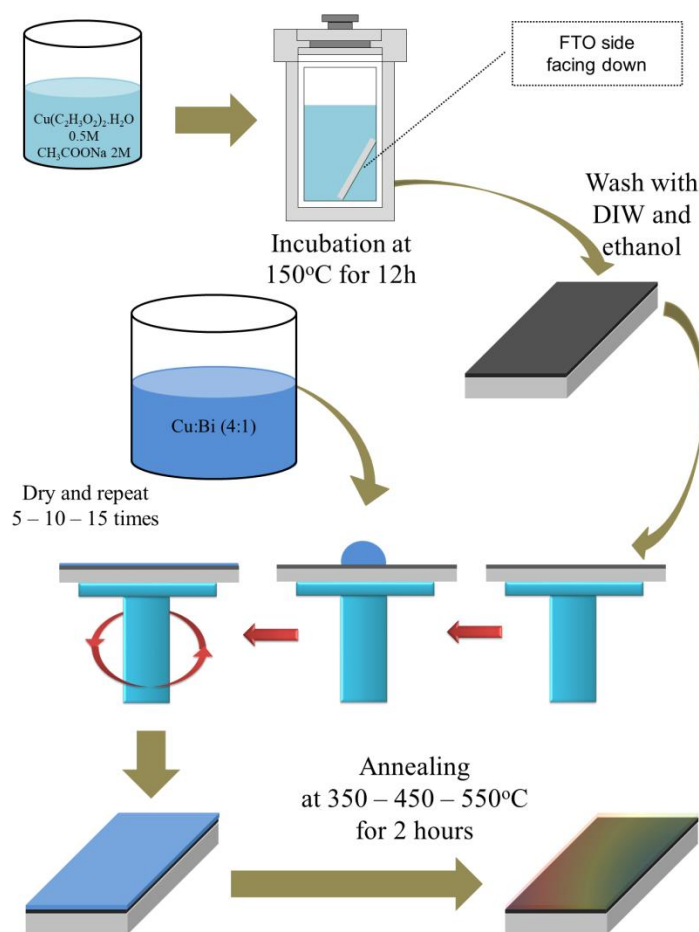


Figure S1. The experimental summary diagram

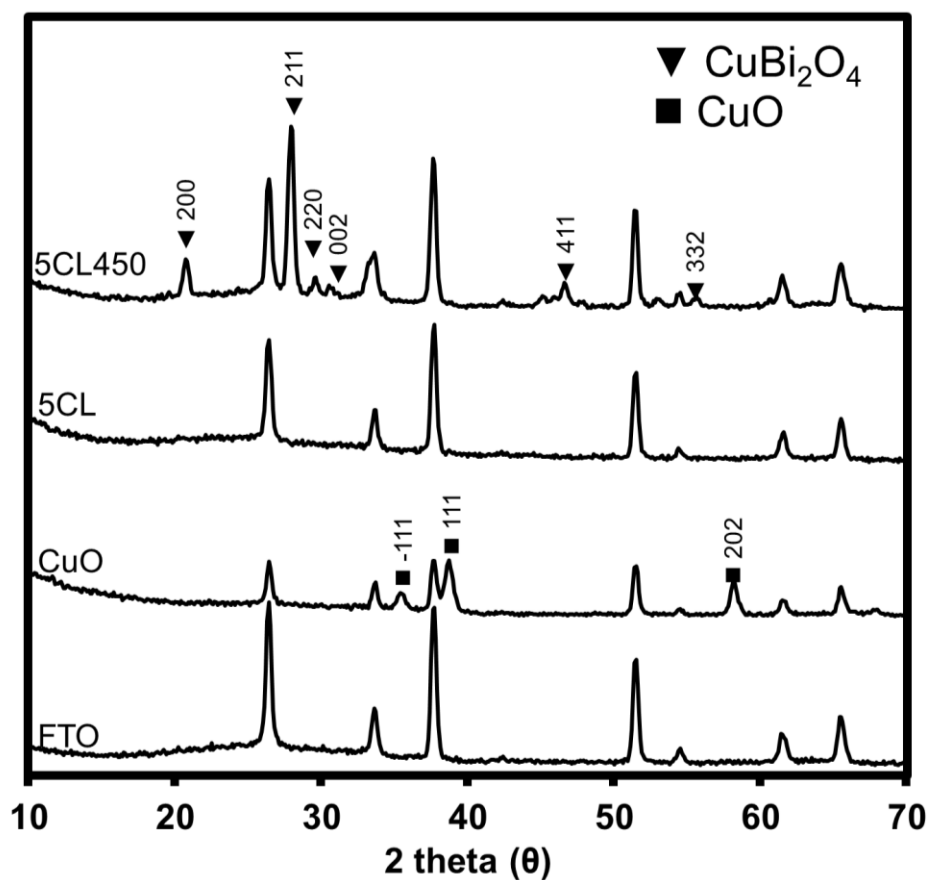


Figure S2. XRD spectrum of CuO thin film; CuBi_2O_4 before and after annealing (5 coats with annealing temperature of 450 °C) on FTO substrate. The blue square dots represent the peaks of CuO crystals (ICDD No#00-041-0254), the red triangular dots represent the peaks of CuBi_2O_4 crystals (JCPDS No.42.0334)

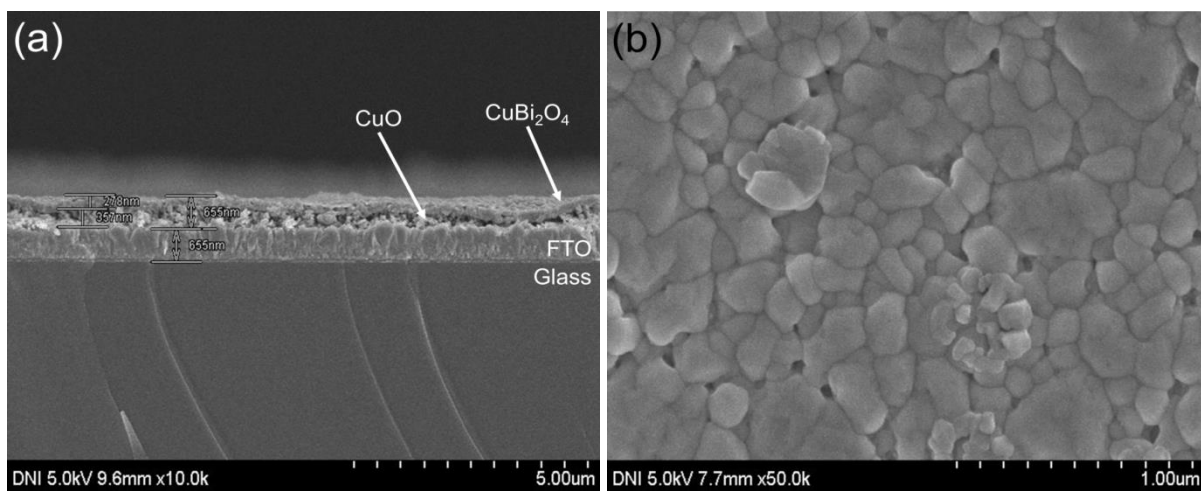
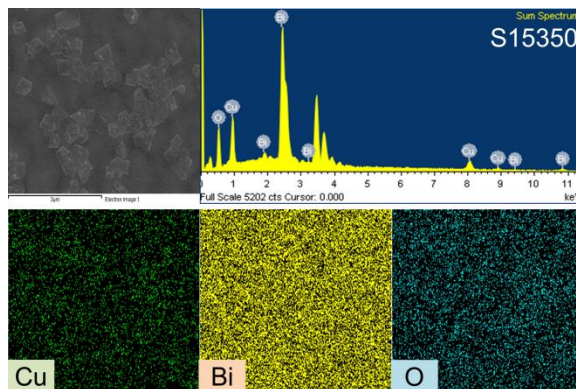
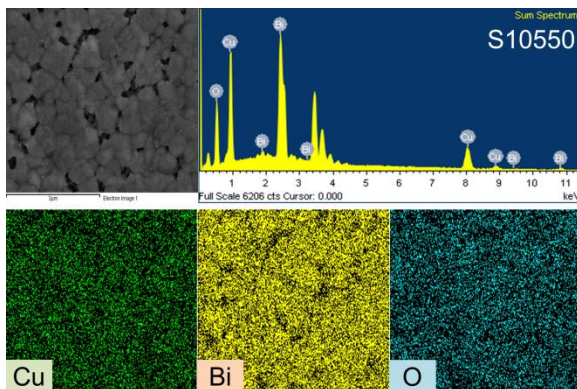
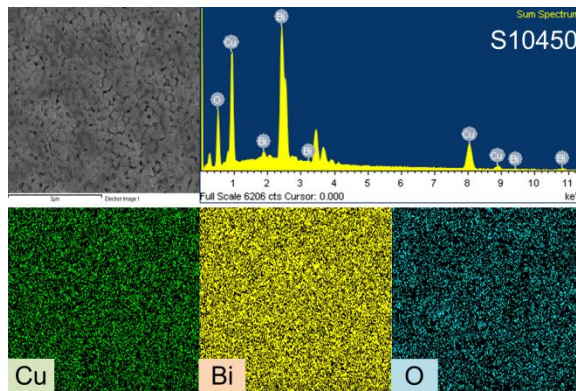
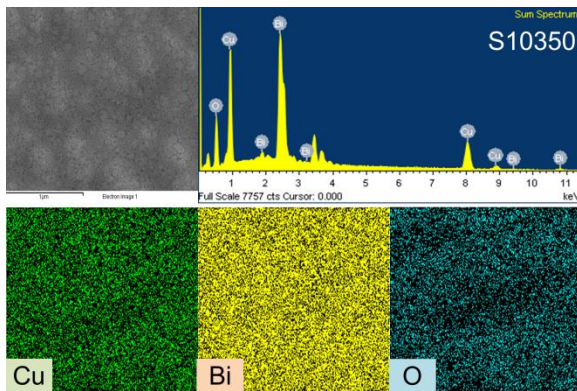
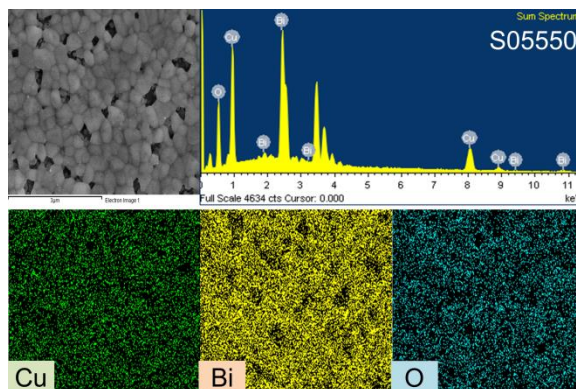
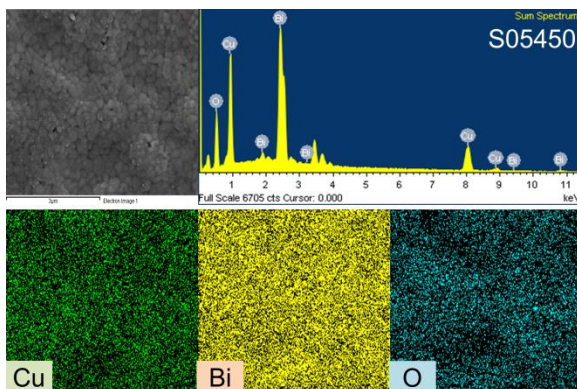
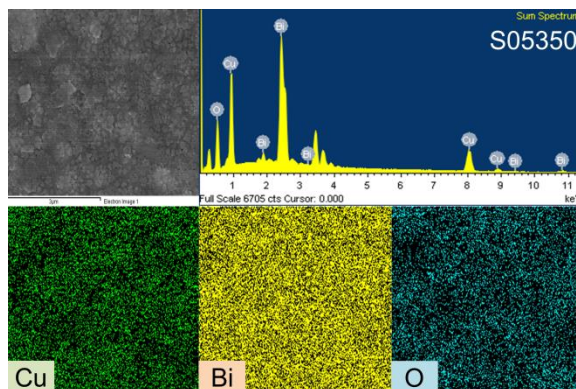
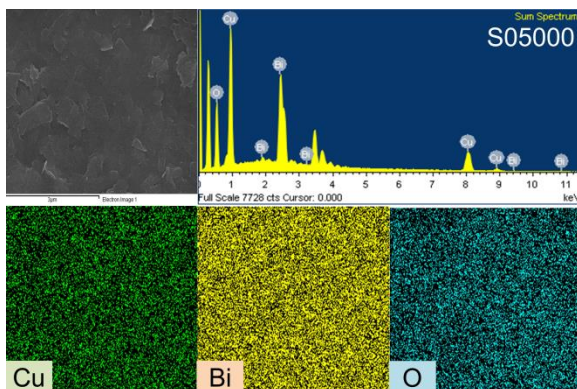


Figure S3. (a) Cross-section view and (b) plane view SEM image of FTO/CuO/CuBi₂O₄ with 15 coating layers and annealing at 450 °C (sample S15450)



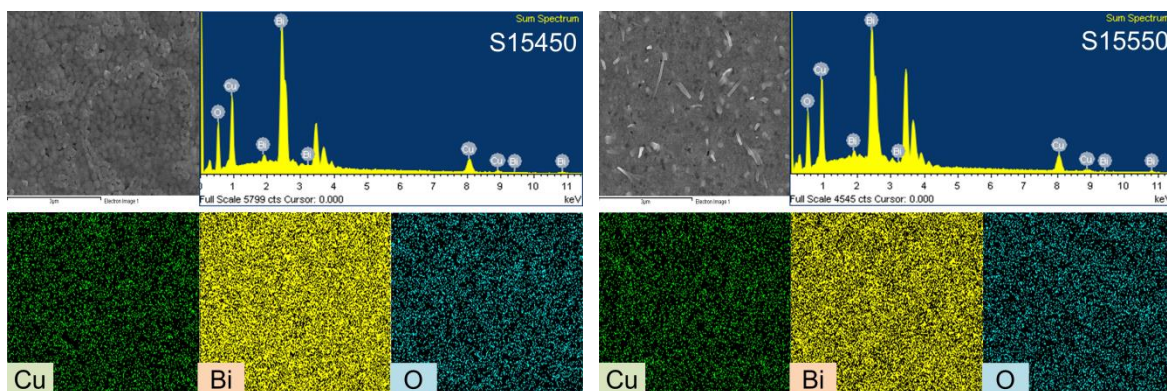


Figure S4. Top-down SEM-EDS mapping image of FTO/CuO/CuBi₂O₄ photocathode. Each sample has 5 images; the top-left image is the EDS study area; the figure on the top-right is a histogram of the elements; the elements Cu, Bi, and O are shown in the three below figures, shown on the left - in green, in the middle - in yellow, and on the right - in blue, respectively.

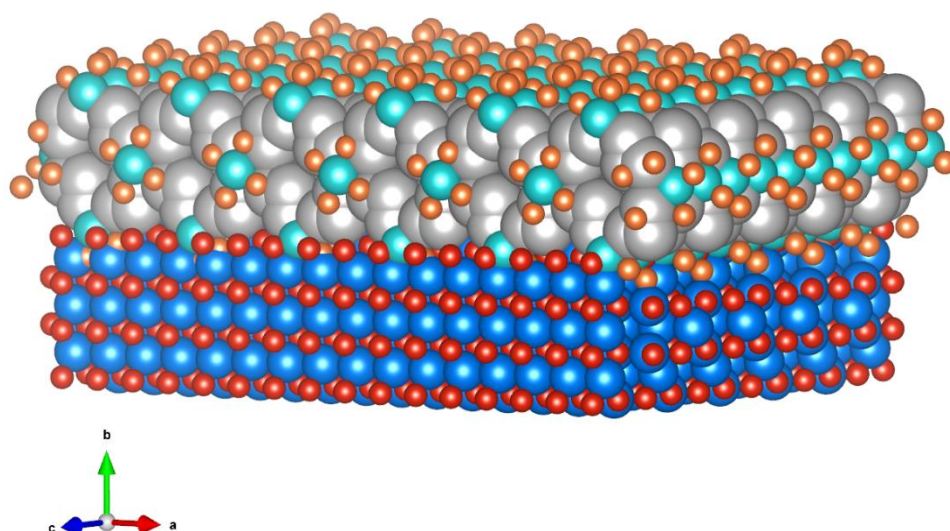


Figure S5. The heterojunction can be defined and modelled by VESTA software. Blue dots are Cu element in CuO, red dots are O element in CuO; Grey, cyan, and orange dots are Cu, Bi, and O elements in CuBi_2O_4 structure, respectively.

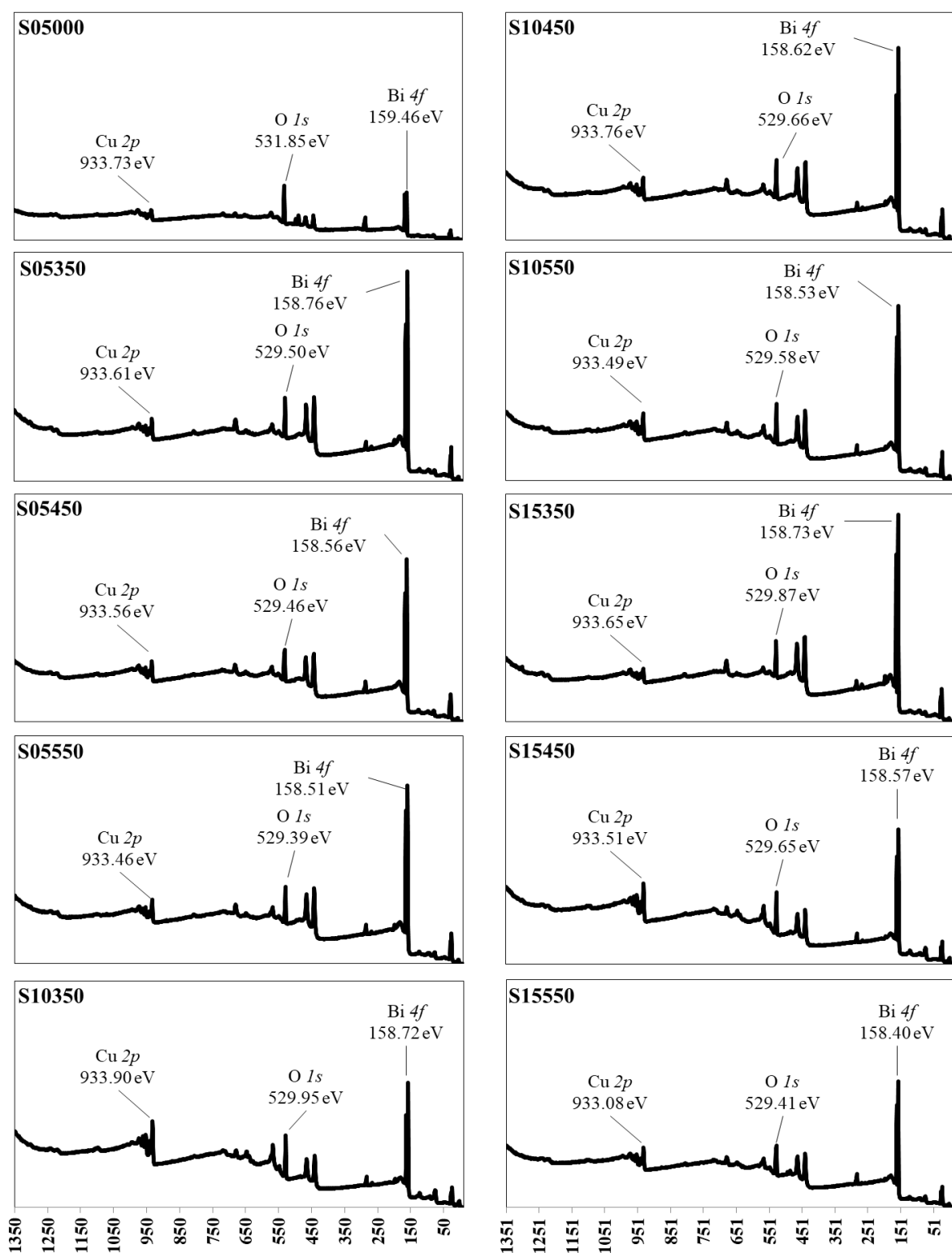


Figure S6. The survey XPS spectra of FTO/CuO/CuBi₂O₄ photocathodes

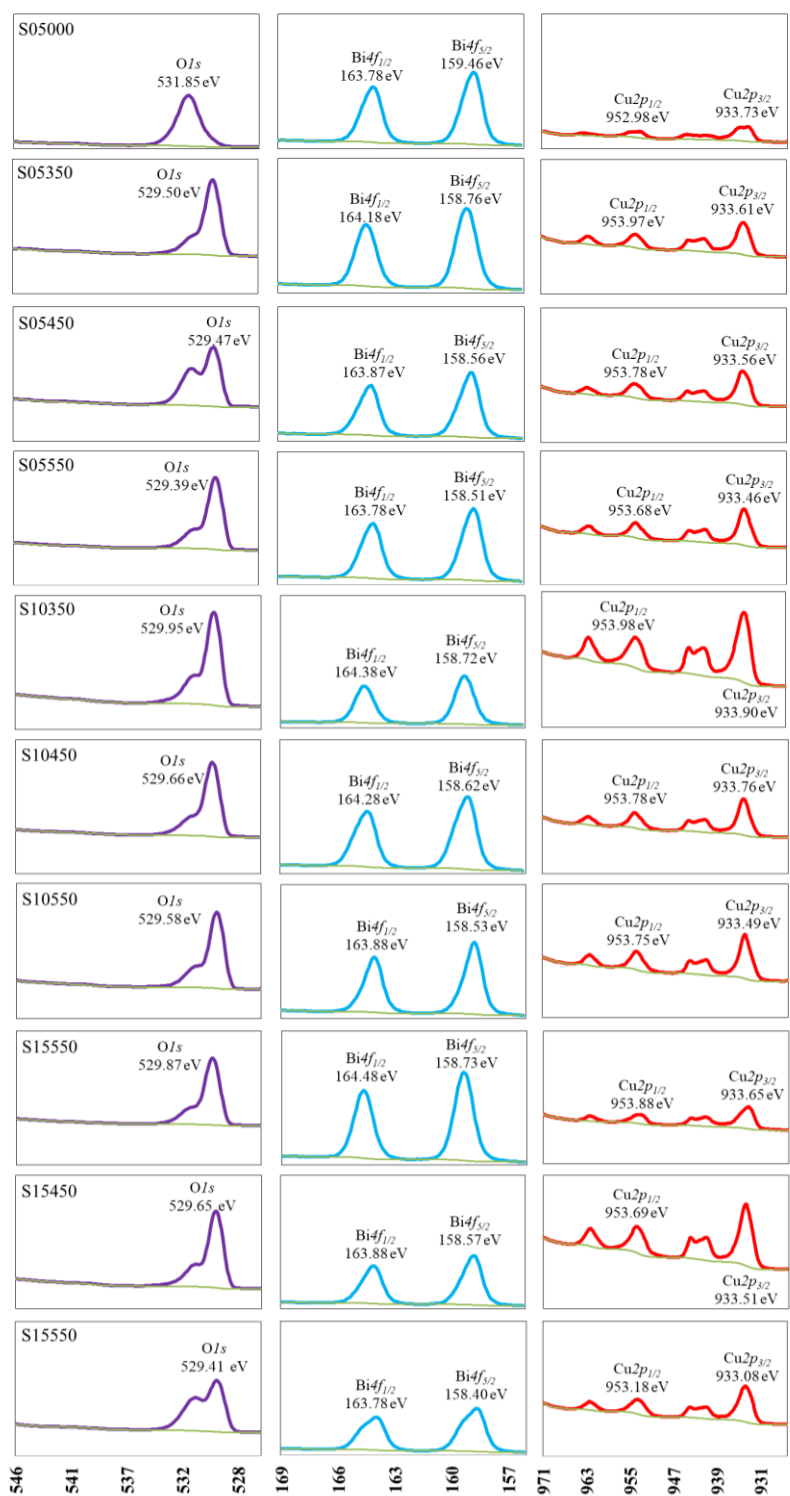


Figure S7. High-resolution XPS spectra of FTO/CuO/CuBi₂O₄ photocathodes

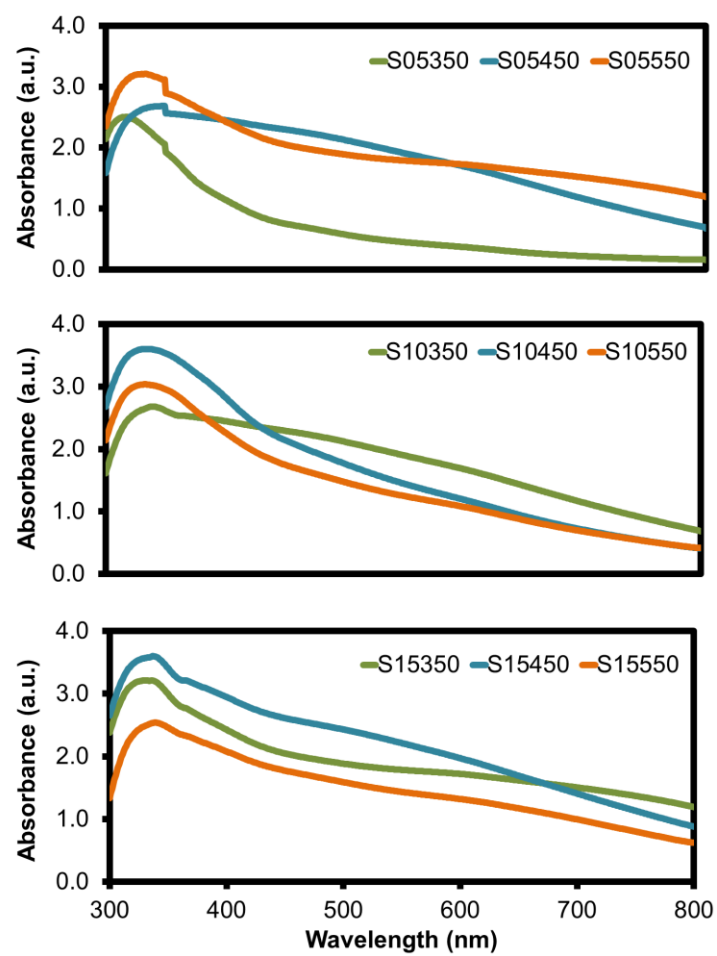


Figure S8. UV-Vis absorbance spectra of FTO/CuO/CuBi₂O₄ photocathodes

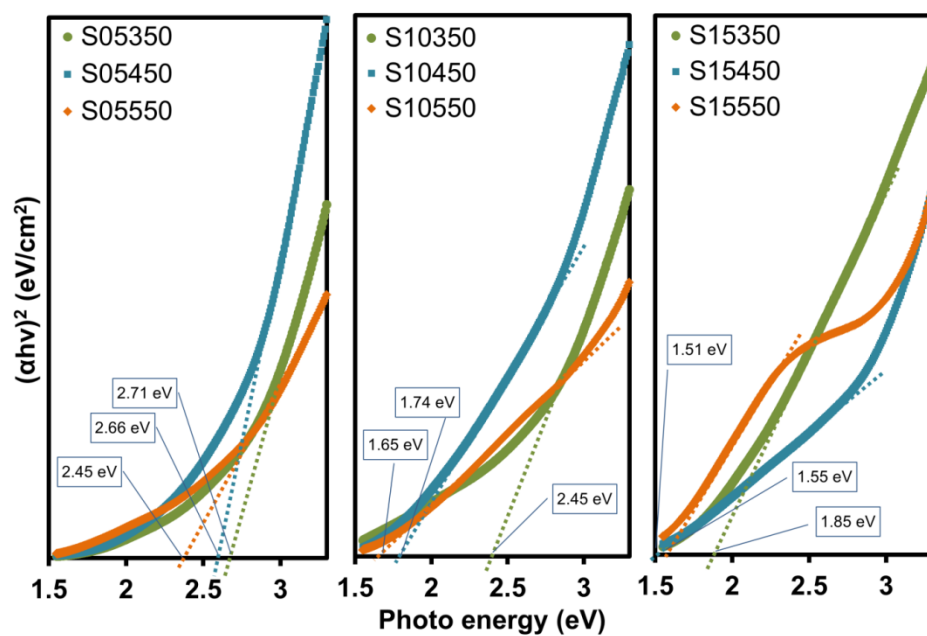


Figure S9. Bandgap estimation of FTO/CuO/CuBi₂O₄ photocathodes

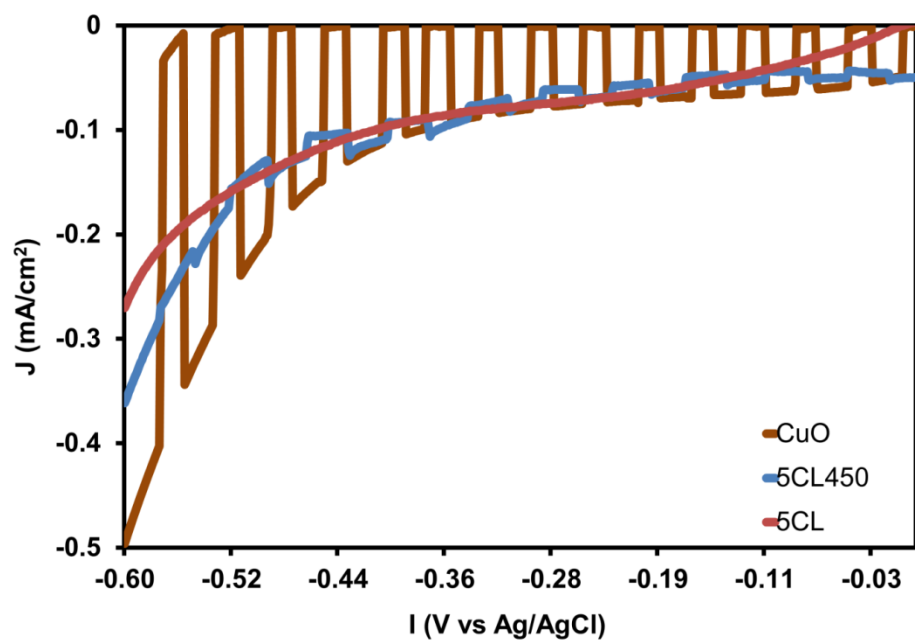


Figure S10. The chopped-illumination response of CuO, 5CL450, and 5CL electrode at -0.6 V potential in 0.1 M Na_2SO_4 electrolyte (pH 6.8).

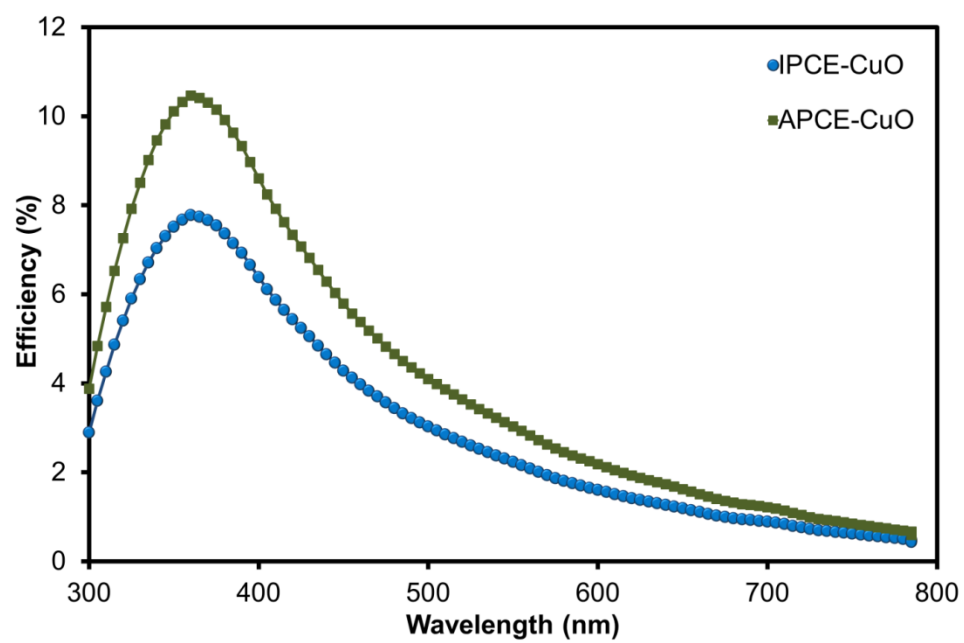


Figure S11. The IPCE and APCE of CuO photoelectrode