Electronic Supplementary Material (ESI) for Dalton Transactions.
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Supporting Information

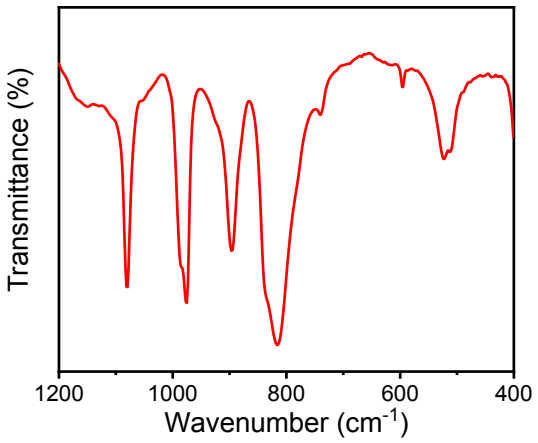

Fig. S1 Infrared spectrum of $(C_4H_9N)_3PW_{12}O_{40}$.

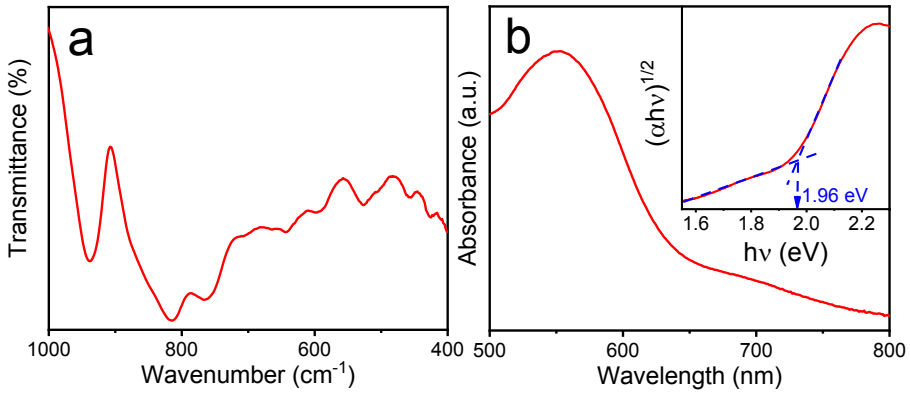

Fig. S2 (a) Infrared spectrum of $Na_{10}[\{Co(H_2O)_3\}_2\{CoBi_2W_{19}O_{66}(OH)_4\}]$ and (b) absorbance spectra (Inset shows a Tauc-plot) of $Ag_{10}[\{Co(H_2O)_3\}_2\{CoBi_2W_{19}O_{66}(OH)_4\}]$.

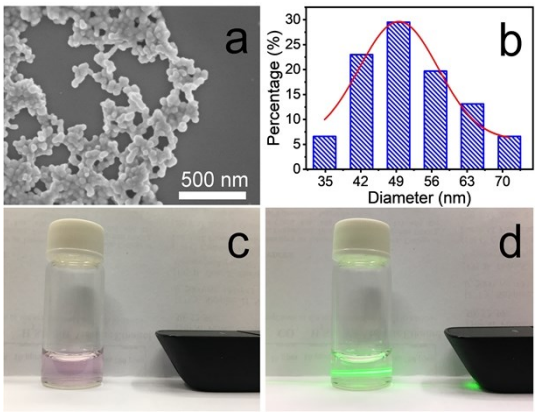

Fig. S3 (a) SEM image of the CoPOM nanoparticles, (b) histograms of the diameter distribution of CoPOM nanoparticles and (c, d) Tyndall effect of CoPOM nanoparticles. Here, the CoPOM nanoparticles in Figure S10 were prepared by dropping on a silicon wafer.

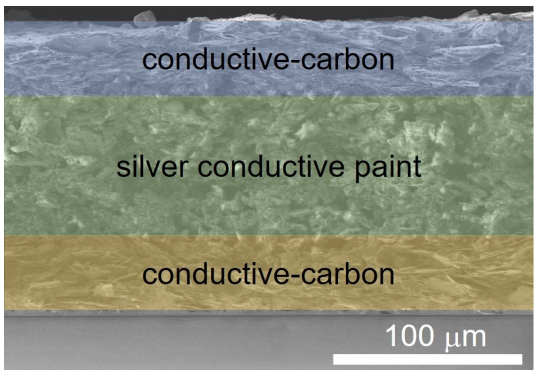

Fig. S4 SEM cross-sectional image of the perovskite photoanode.

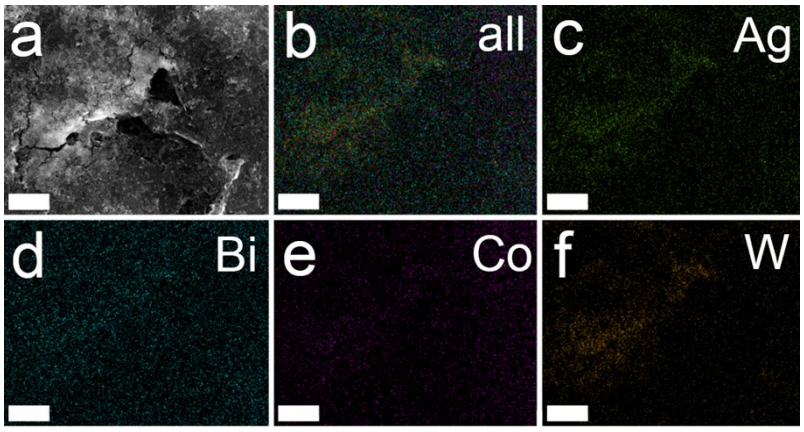

Fig. S5 (a) SEM image of the perovskite photoanode and (b-f) corresponding EDS elemental mappings (Ag, Bi, Co and W). Note the white scale bar correspond to 2 μm.

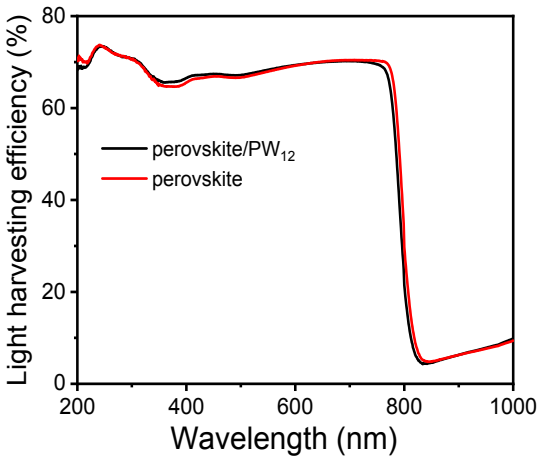

Fig. S6 Wavelength-dependent light harvesting efficiency (LHE) of the mesoporous ZrO_2 filled by perovskite with PW_{12} and without PW_{12}.

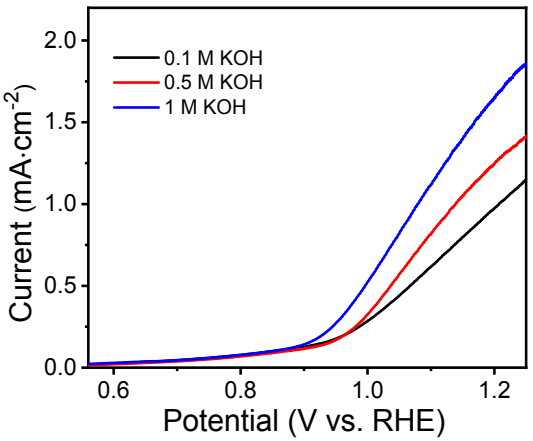

Fig. S7 Current-potential plots for perovskite photoanodes in KOH solution with different concentration.

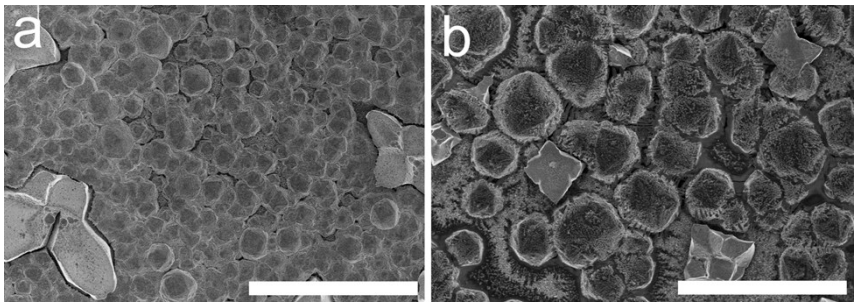

Fig. S8 Grain size distributions of the (a) pristine perovskite and (b) perovskite-PW_{12} deposited on mesoporous TiO_2 layer. Note the white scale bar correspond to 50 μm.

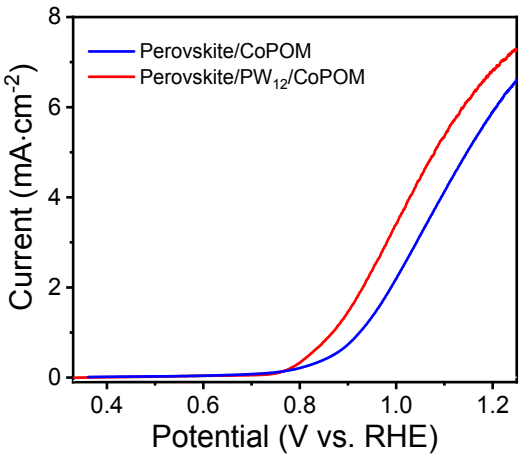

Fig. S9 Current-potential plots for perovskite/CoPOM and perovskite/PW_{12}/CoPOM photoanodes.

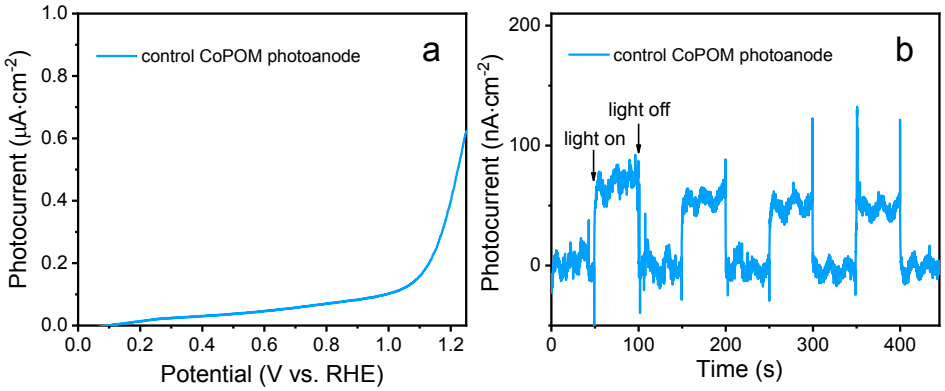

Fig. S10 (a) Current-potential plot and (b) transient photocurrent of a control CoPOM photoanode.

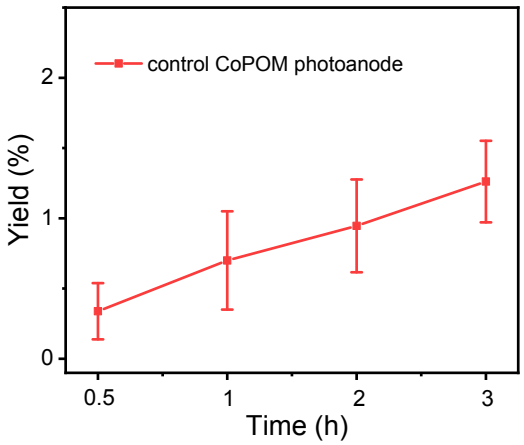

Fig. S11 Yield of benzene oxidation to phenol of a control CoPOM photoanode.

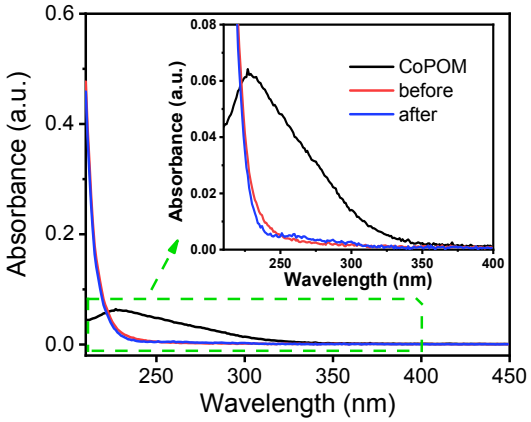

Fig. S12 UV-vis absorbance of CoPOM dispersion and before and after the reaction electrolyte.

After the UV-vis absorbance measurement of the electrolyte before and after the reaction, no obvious difference was found in the measurement plots in Fig. S12. Comparing the measurement plot of CoPOM dispersion, we considered that during the reaction, CoPOM did not leaching or the amount of leaching was very trace.

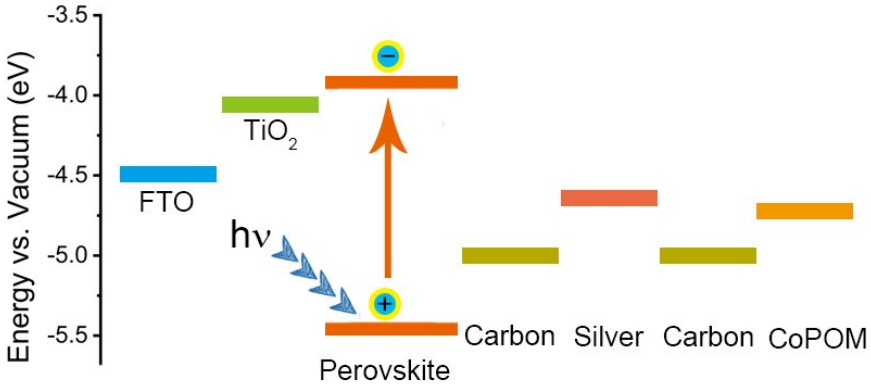

Fig. S13 Energy levels (vs. Vacuum) of the components in the perovskite photoelectrode.