Supporting Information

$ZnWO_4/WO_3$ Composite for Improving Photoelectrochemical Water Oxidation

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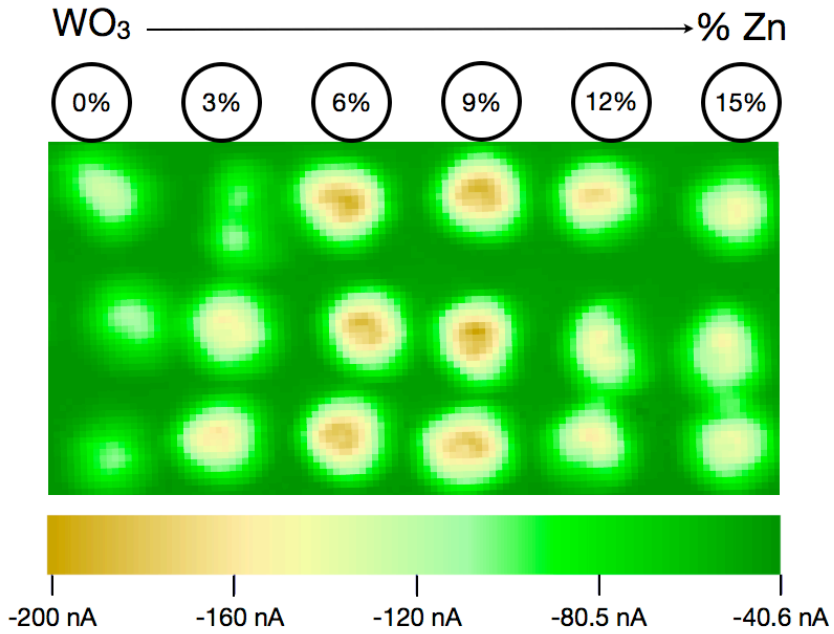
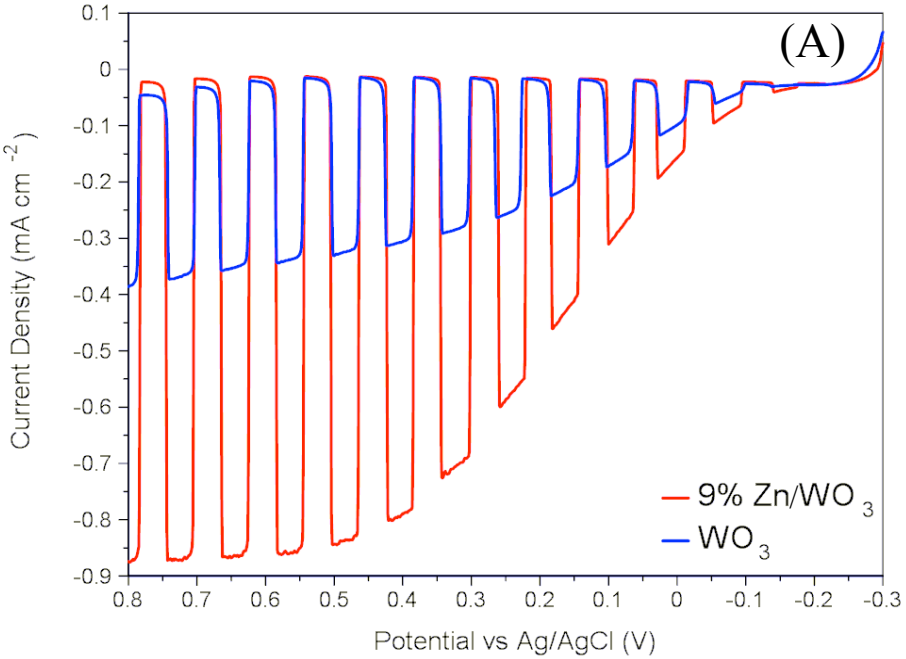


Figure S1. SPECM image of a 3x6 spot array electrode of Zn/WO_3 composites under full UV irradiation. Here each column is the exact same composition of Zn/WO_3 in order to demonstrate the reproducibility of the composites. The color represents the measured photocurrent given by the scale bar below the SPECM image. The photocurrent shown is for sulfite oxidation (0.1 M Na_2SO_4 + 0.1 M Na_2SO_3 at pH 7) measured at an applied potential of +0.2 V vs. Ag/AgCl.



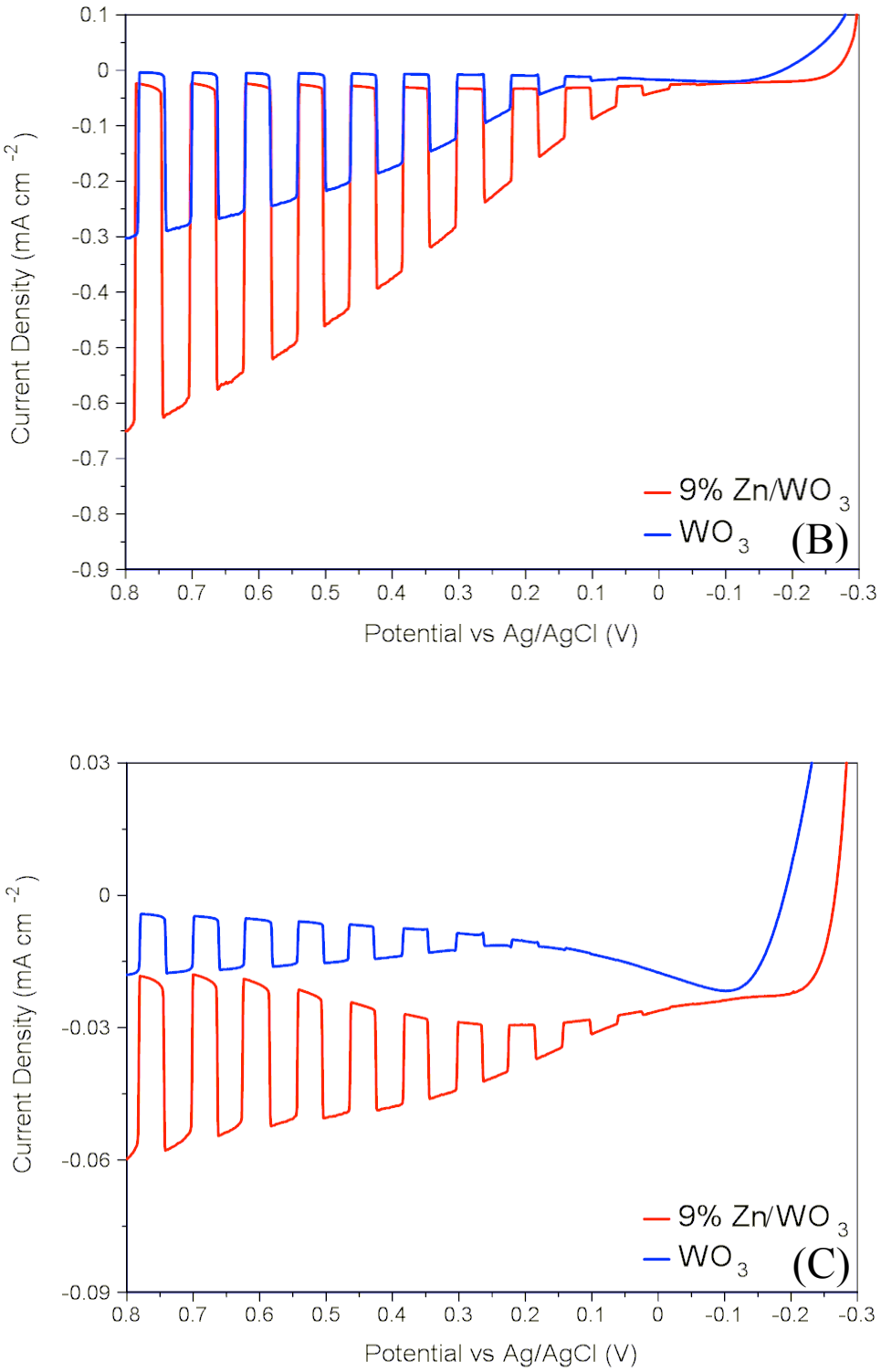


Figure S2. The photoelectrochemical response of bulk film electrodes characterized by linear sweep voltammetry with chopped light at 20 mV/s for sulfite oxidation (0.1 M Na_2SO_4 + 0.1 M Na_2SO_3 at pH 7). (A) 0.95 µm thick WO_3 and 0.97 µm thick 9% Zn/WO_3 under full UV irradiation; (B) 0.64 µm thick WO_3 and 0.66 µm thick 9% Zn/WO_3 under full UV irradiation; (C) 0.64 µm thick WO_3 and 0.66 µm thick 9% Zn/WO_3 under visible (>420 nm) irradiation.

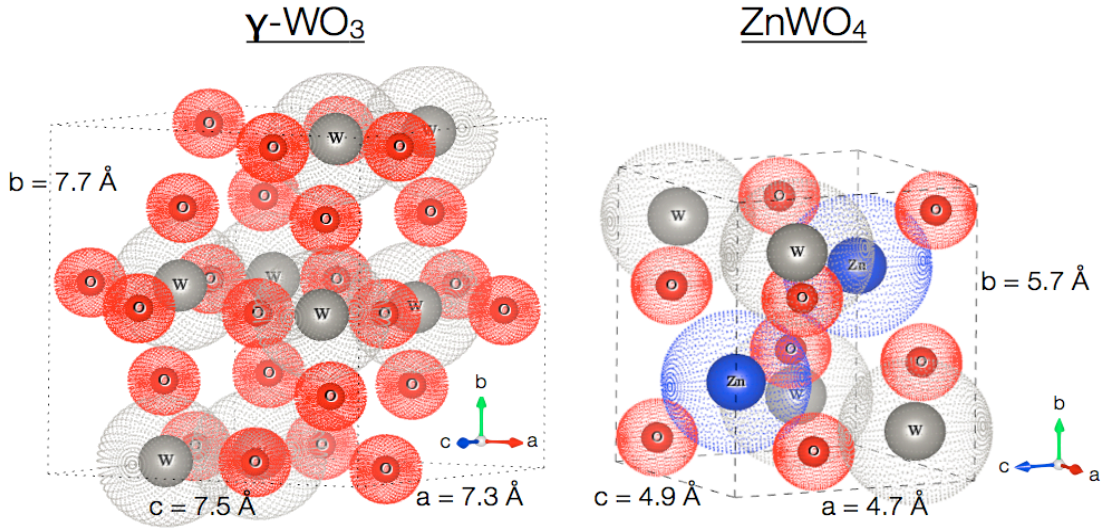
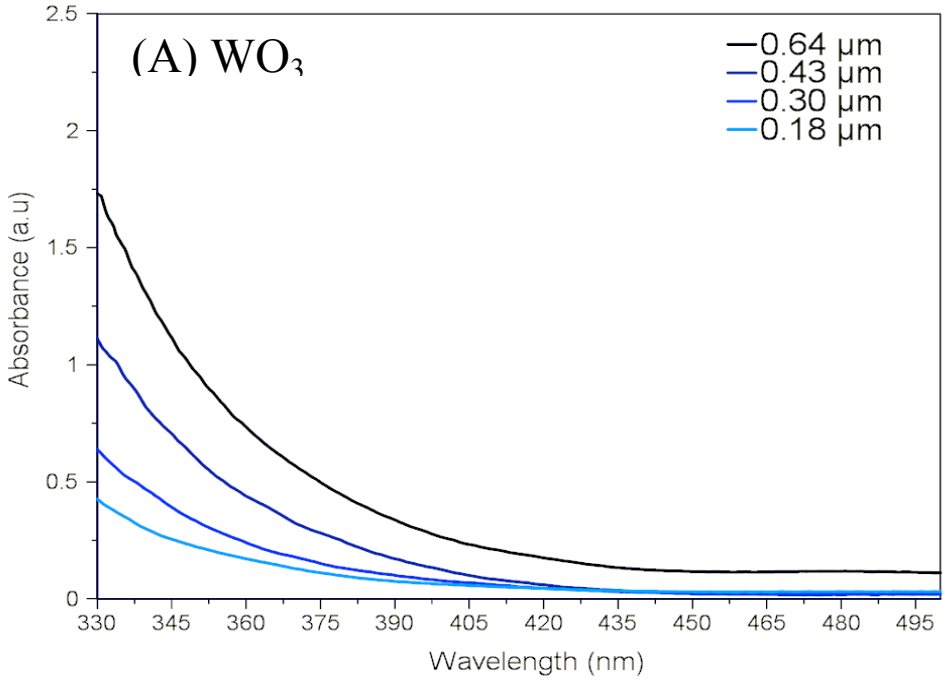


Figure S3. Structural diagrams showing the structure of the monoclinic WO_3 and monoclinic $ZnWO_4$.



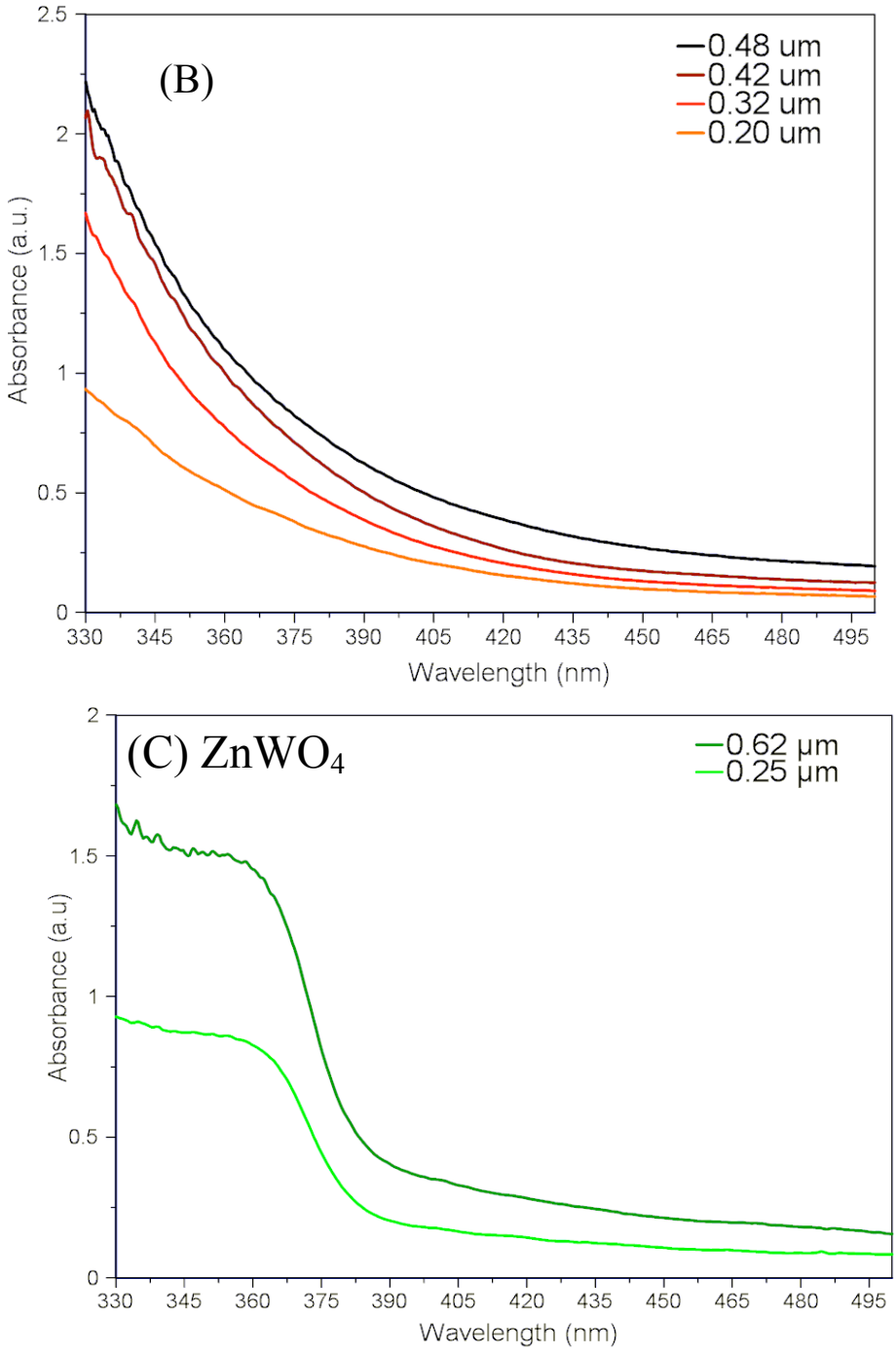


Figure S4. UV-Vis absorbance as a function of wavelength for a variety of film thicknesses for (A) WO_3, (B) 9% Zn/WO_3, and (C) $ZnWO_4$.

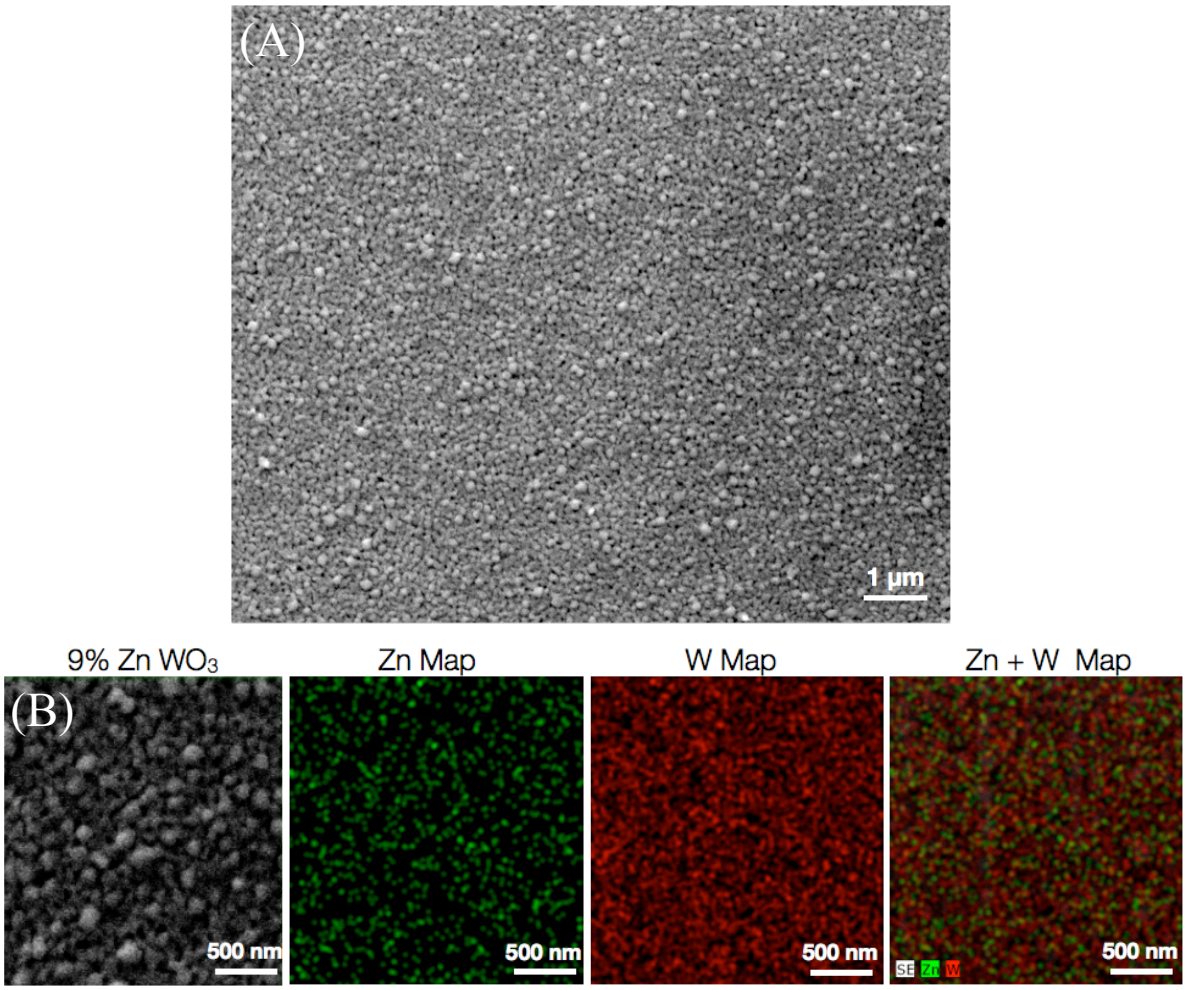


Figure S5 (A) Scanning electron microscope image of a drop-cast 9% $ZnWO_4/WO_3$ composite sample. (B) Energy dispersive X-Ray spectroscopy images showing the SEM image along with elemental maps of Zn, W, and combined Zn + W for the same 9% $ZnWO_4/WO_3$ composite sample.

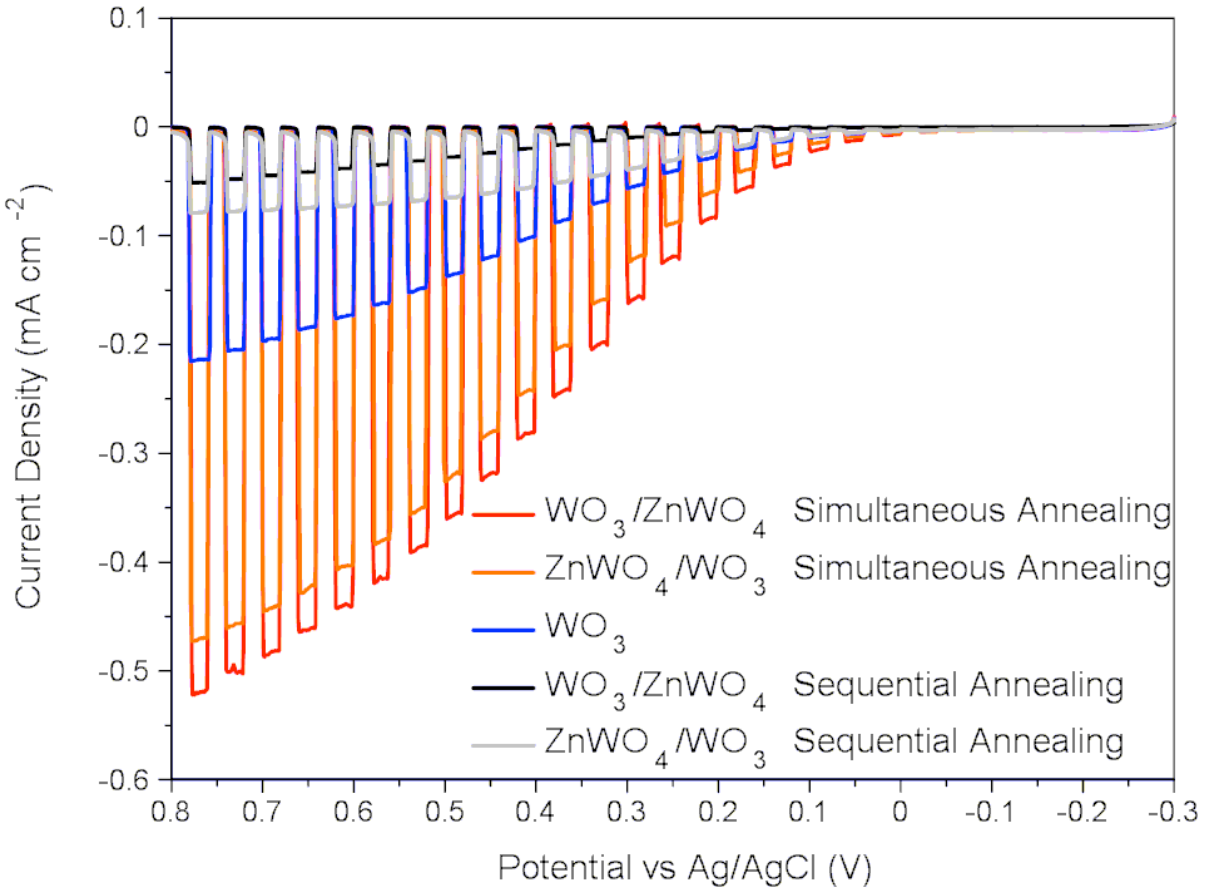


Figure S6. The photoelectrochemical response of bulk film electrodes characterized by linear sweep voltammetry with chopped light under full UV irradiation at 20 mV/s for water oxidation (0.1 M Na_2SO_4 at pH 7) for WO_3 and four $ZnWO_4/WO_3$ samples showing the order of deposition. Two sequential annealed samples one where the WO_3 was deposited annealed first, followed by the $ZnWO_4$ ($WO_3/ZnWO_4$) and one where the $ZnWO_4$ was deposited annealed first, followed by the WO_3 ($ZnWO_4/WO_3$). Also shown are two simultaneously annealed samples showing the drop-casted order ($WO_3/ZnWO_4$ vs $ZnWO_4/WO_3$).