Supporting Information

Facile Fabrication of Sandwich Structured WO_3 Nanoplate Arrays for Efficient Photoelectrochemical Water Splitting

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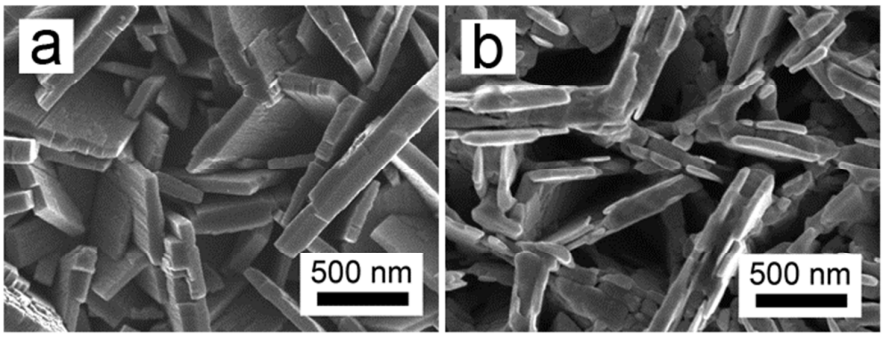

Figure S1. SEM images of (a) the hydrothermally prepared $WO_3 \cdot 0.33H_2O$ film and (b) the corresponding WO_3 annealed at 500 °C.

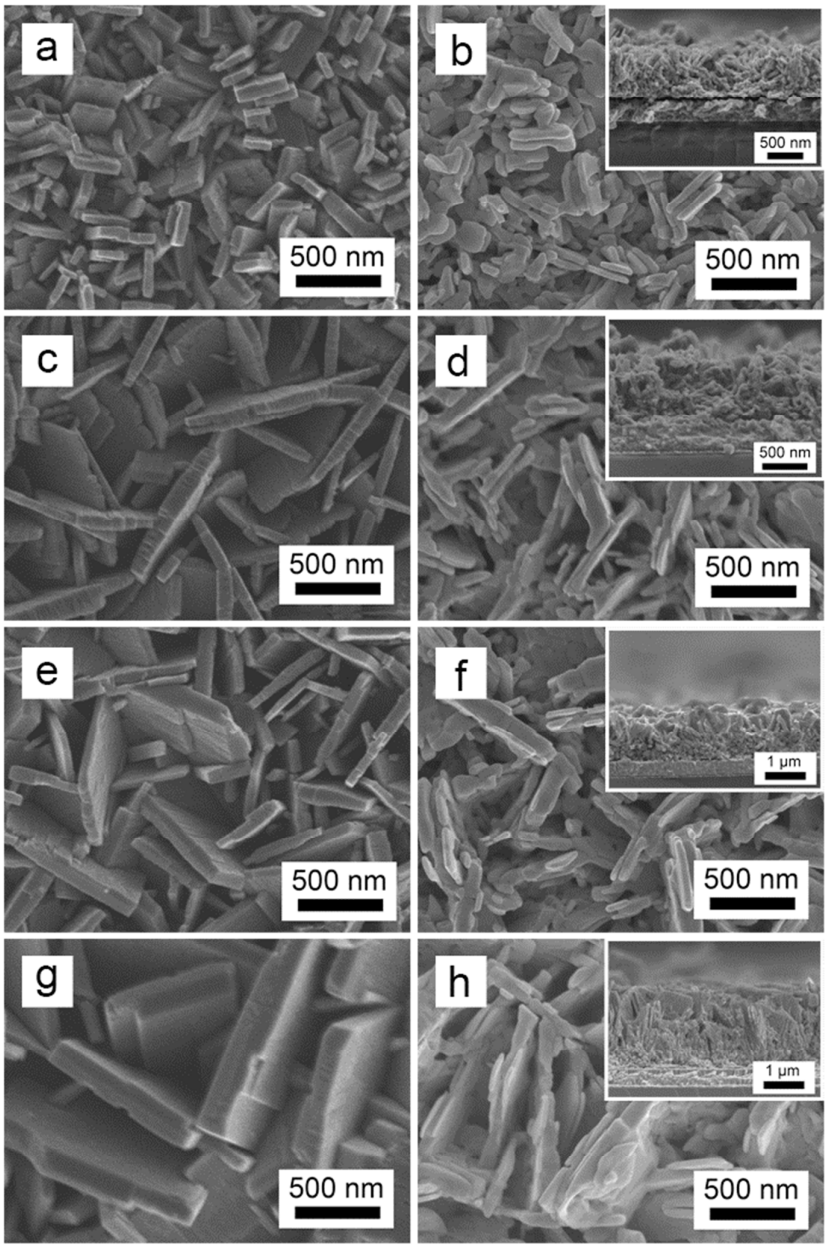

Figure S2. SEM images of $WO_3 \cdot 0.33H_2O$ films hydrothermally prepared for varied time and the corresponding WO_3 annealed at 500 °C. (a, b) 2 h, (c, d) 3 h, (e, f) 4 h, and (g, h) 6 h. Insets show the corresponding cross-section images of annealed samples**.**

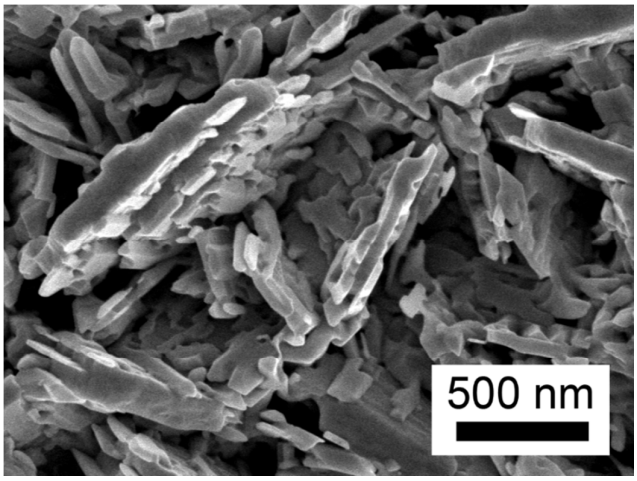

Figure S3. SEM image of the corresponding WO_3 by annealing the powder scraped from the as-prepared $WO_3 \cdot 0.33H_2O$ film at 500 °C for 1 h.

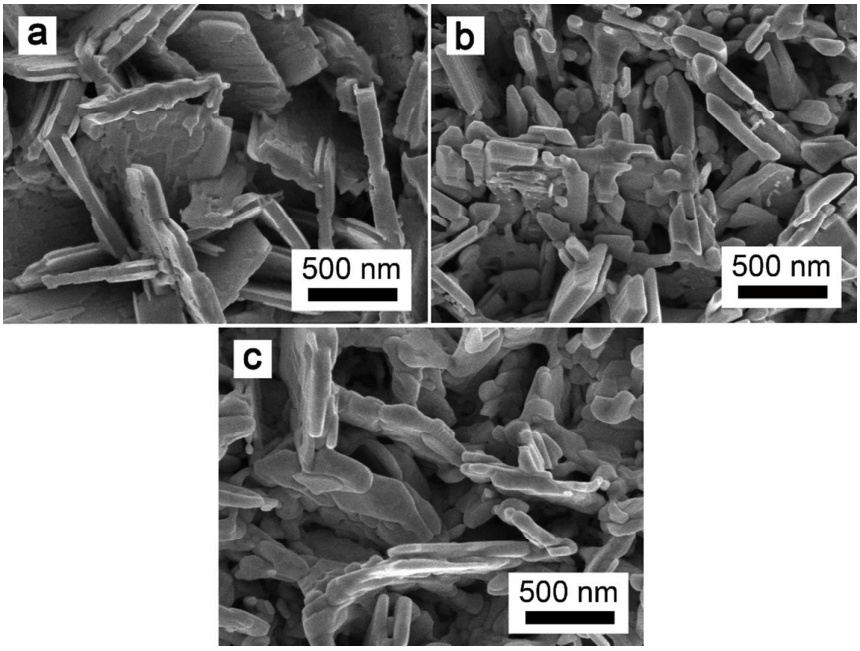

Figure S4. SEM images of WO_3 films annealed at 500 °C for (a) 0.5 h, (b) 3 h, and (c) 5 h.

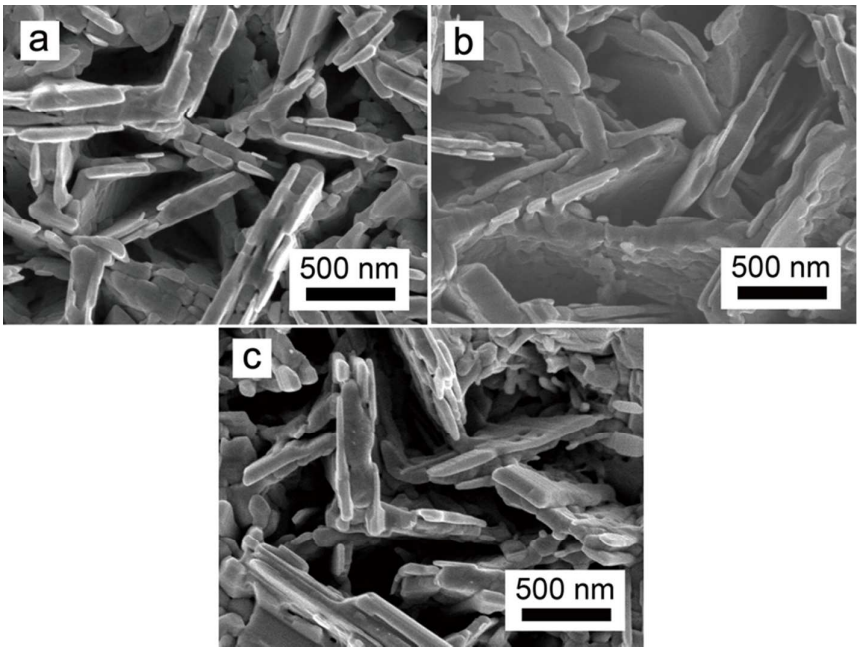

Figure S5. SEM images of WO_3 films annealed at 500 °C for 1 h using different heating rates: (a) 6 °C/min, (b) 4 °C/min, and (c) 3 °C/min.

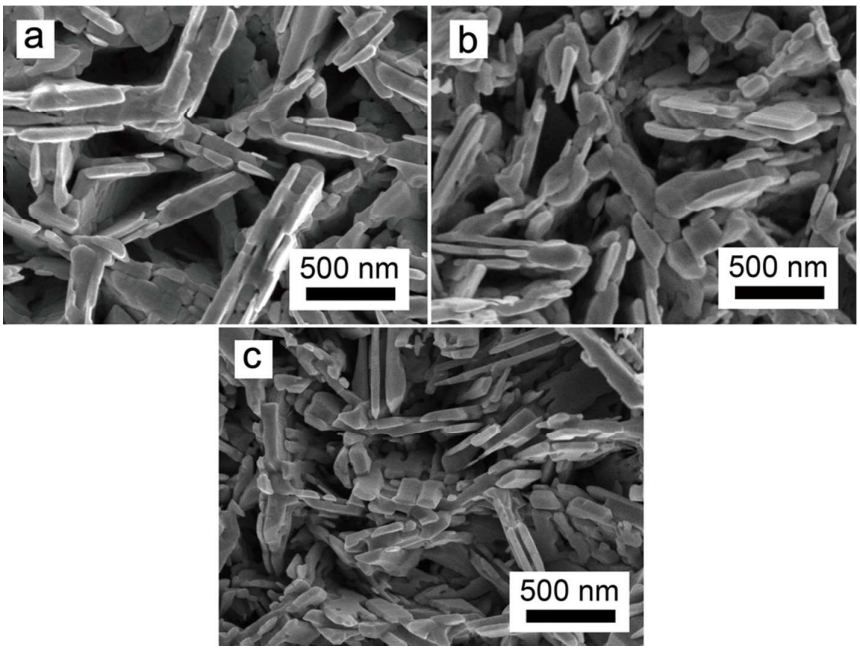

Figure S6. SEM images of WO_3 films annealed at 500 °C for 1 h using different cooling rates: (a) 2.5 °C/min, (b) 3.5 °C/min, and (c) 5 °C/min.

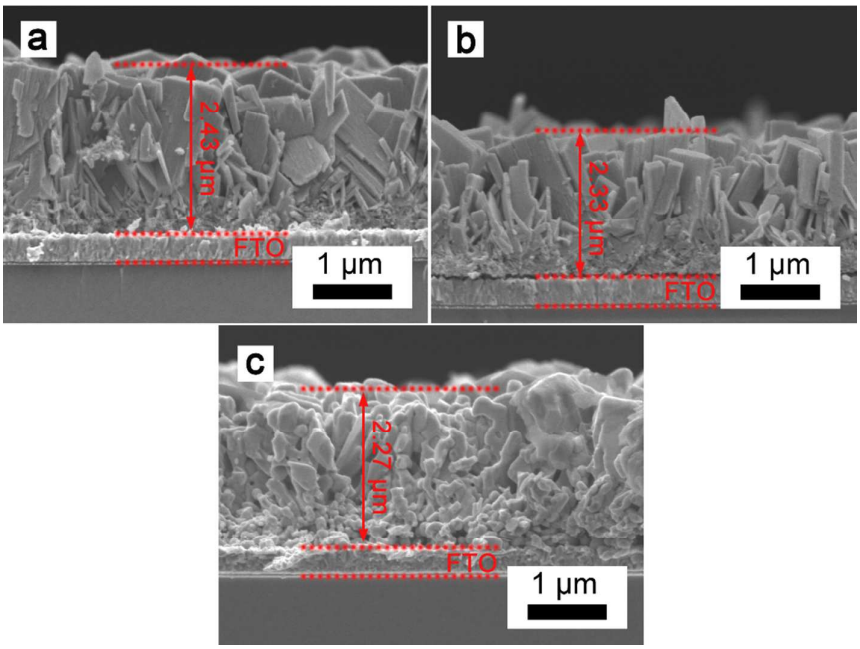

Figure S7. Cross-section SEM images of as-prepared films (a) before and after annealing at (b) 400 ℃ and (c) 600 ℃.

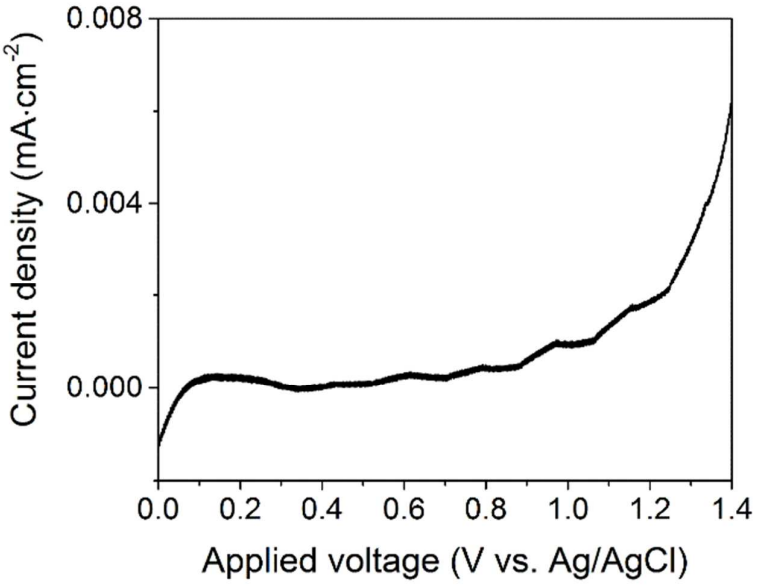

Figure S8. Linear sweep voltammetry of as-prepared $WO_3 \cdot 0.33H_2O$ photoanode under incident chopped light.

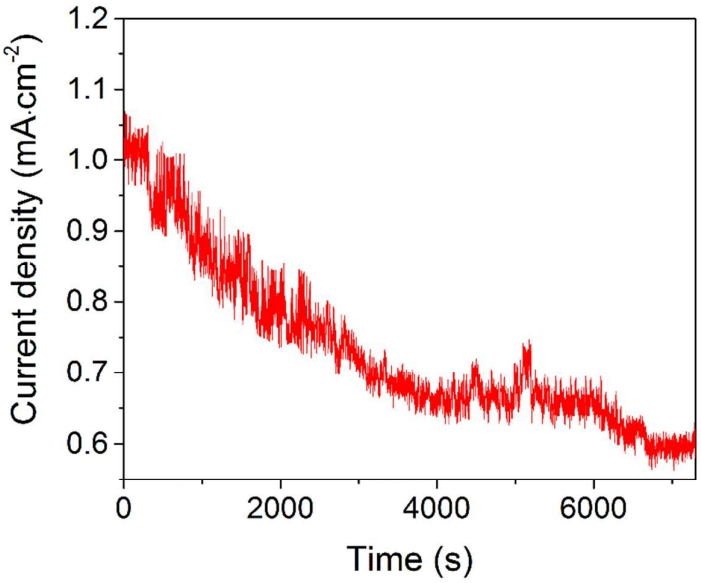

Figure S9. Photocurrent-time plot (at 0.6 V vs. Ag/AgCl) over the sandwich structured WO_3 photoanode in a three-electrode cell under simulated sunlight.

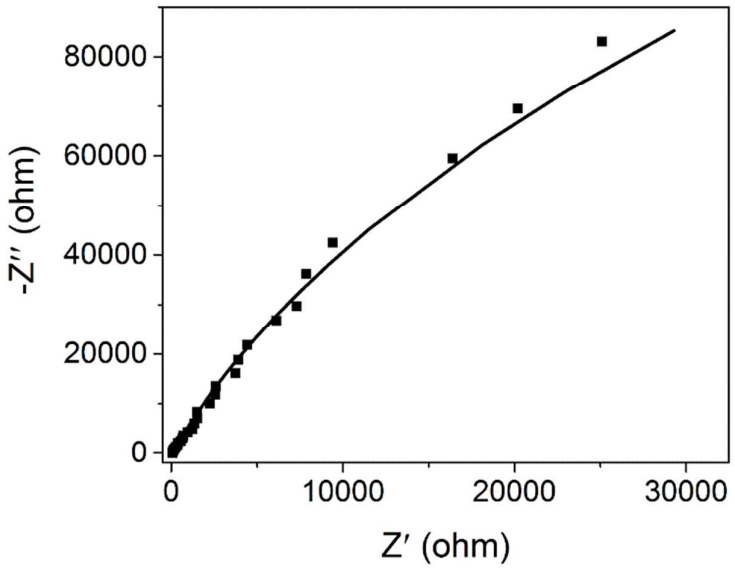

Figure S10. Nyquist experimental data and fitting plot of as-prepared $WO_3 \cdot 0.33H_2O$ photoanode.

Table S1. An overview of representative WO_3 photoanodes reported for efficient photoelectrochemical water splitting.

Fabrication method	Morphology	Electrolyte (light source)	J ($mA \cdot cm^{-2}$) (applied potential)	IPCE (%) at 400 nm (applied potential)	Ref.
Hydrothermal	Nanorod	0.5 M Na_2SO_4 (AM 1.5 G)	1.05 (1.1 V vs. SCE)	\	1
Hydrothermal	Nanorod	0.5 M Na_2SO_4 (AM 1.5 G)	2.26 (1.23 V vs. RHE)	35 (0.8 V vs. Ag/AgCl)	2
Hydrothermal	Nanoplate	0.5 M Na_2SO_4 (AM 1.5 G)	0.25 (1.23 V vs. RHE)	~11 (1.0 V vs. Ag/AgCl)	3
Hydrothermal	Plate-like	0.5 M H_2SO_4 (Xe lamp)	4.13 (1.6 V vs. Ag/AgCl)	\	4
Hydrothermal	Nanoflower	1 M H_2SO_4 (AM 1.5 G)	~1.25 (1.2 V vs. SCE)	29 (0.8 V vs. SCE)	5
Hydrothermal	Nanoflake	1 M H_2SO_4 (AM 1.5 G)	~1.1 (1.0 V vs. Ag/AgCl)	~15 (1.0 V vs. Ag/AgCl)	6
PLD	Nano-tree	1 M H_2SO_4 (AM 1.5 G)	1.85 (0.8 V vs. RHE)	63 (1.0 V vs. RHE)	7
PLD	Tree-like	0.5 M phosphate buffer (AM 1.5 G)	1.8 (1.23 V vs. RHE)	~50 (1.23 V vs. RHE)	8
Solvothermal	Flake-wall structure	0.1 M Na_2SO_4 (Xe lamp)	~1.85 (1.2 V vs. Ag/AgCl)	36 (1.2 V vs. Ag/AgCl)	9
Solvothermal	Nano-multilayer	0.1 M Na_2SO_4 (AM 1.5 G)	1.62 (1.25 V vs. Ag/AgCl)	25 (1.27 V vs. RHE)	10
Anodization	Nanorod/ nanoflake nanoparticle/ triple-layer	phosphate buffer pH = 7 (Xe lamp)	0.9 (1.2 V vs. RHE)	~28 (1.0 V vs. RHE)	11
Anodization	Nanoporous	0.5 M H_2SO_4 (Xe lamp)	3.45 (1.6 V vs. Ag/AgCl)	20 (1.2 V vs. Ag/AgCl)	12
Anodization	Nanocrystal	1 M H_2SO_4 (AM 1.5 G)	3.5 (1.5 V vs. SCE)	45 (1.5 V vs. SCE)	13
Sol-gel	Nanoparticle	3 M H_2SO_4 (AM 1.5 G)	2.7 (1 V vs. RHE)	43 (0.5 V vs. MSE)	14
Colloid deposition	Nanoparticle	1 M H_2SO_4 (Xe lamp)	3.7 (1.3 V vs. Ag/AgCl)	\	15
Colloid deposition	Nanowire	0.5 M H_2SO_4 (AM 1.5 G)	1.96 (1.23 V vs. RHE)	~50 (1.23 V vs. RHE)	16

Polystyrene colloid templates	Inverse opal	1 M H_2SO_4 (Xe lamp)	0.95 (1.2 V vs. Ag/AgCl)	\	17
Reactive magnetron sputtering	Nanocrystal	0.5 M $NaClO_4$ (Mercury-Xe lamp)	2.5 (1.0 V vs. Ag/AgCl)	\	18
Hydrothermal	Nanoplate	0.5 M Na_2SO_4 (AM 1.5 G)	1.88 (1.3 V vs. Ag/AgCl)	65 (1.0 V vs. Ag/AgCl)	This work

SCE: saturated calomel electrode; RHE: reversible hydrogen electrode; MSE: mercurous sulfate electrode.

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