Electronic Supplementary Material (ESI) for Faraday Discussions.

Supporting information

A facile two-step method for fabrication of plate-like WO_3 photoanode under mild conditions

Nan Wang,[a,b] Jian Zhu,[a,b] Xiaojia Zheng, [a,b] Fengqiang Xiong, [a,b] Baokun Huang, [a] Jingying Shi*[a] and Can Li*[a]

a State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Dalian National Laboratory for Clean Energy, Chinese Academy of Sciences, 457 Zhongshan Road, Dalian 116023, China

b University of Chinese Academy of Sciences, Beijing, 100049, China

*Corresponding authors: Prof. Can Li: canli@dicp.ac.cn

Dr. Jingying Shi: jingyingshi@dicp.ac.cn

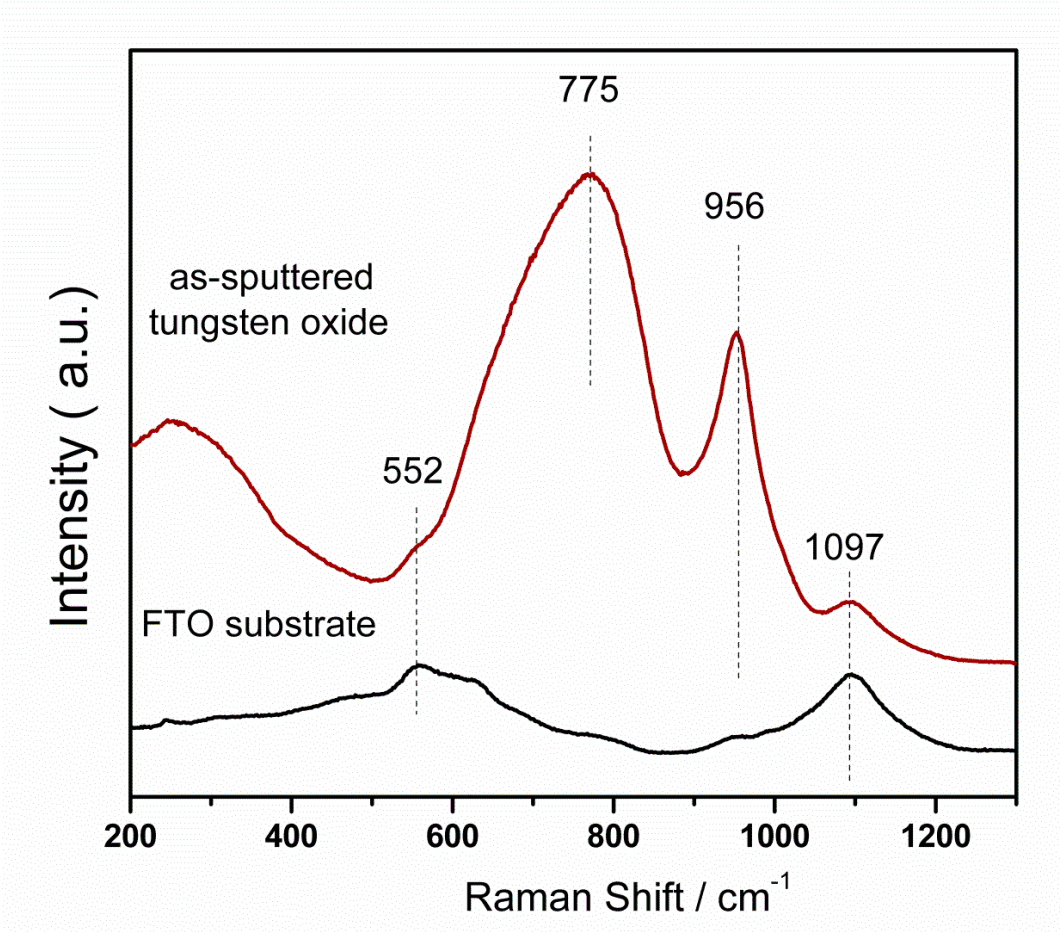

Fig. S1 Raman spectra of blank FTO substrate and as-sputtered tungsten oxide film.

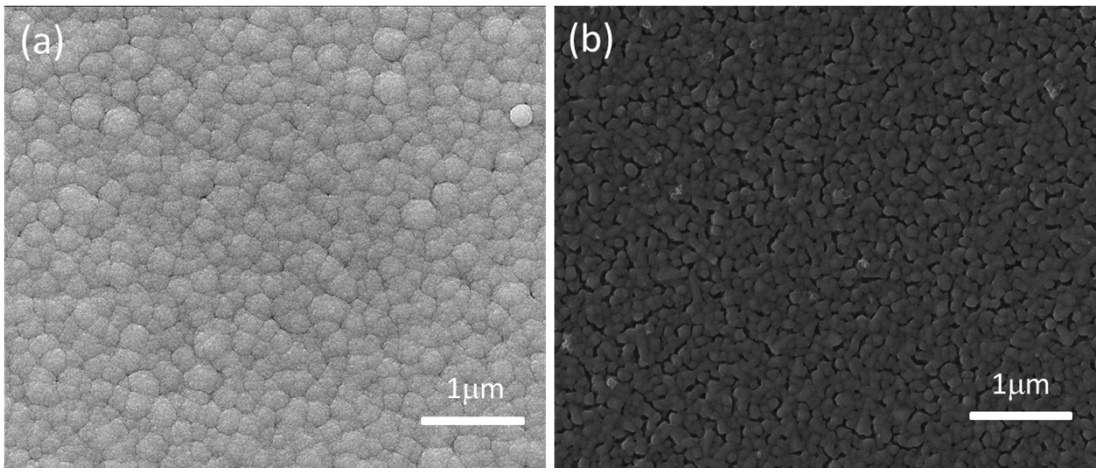

Fig. S2 SEM images of the (a) as-sputtered amorphous tungsten oxide film and (b) after etching in 1 M H_2SO_4 for 6 h.

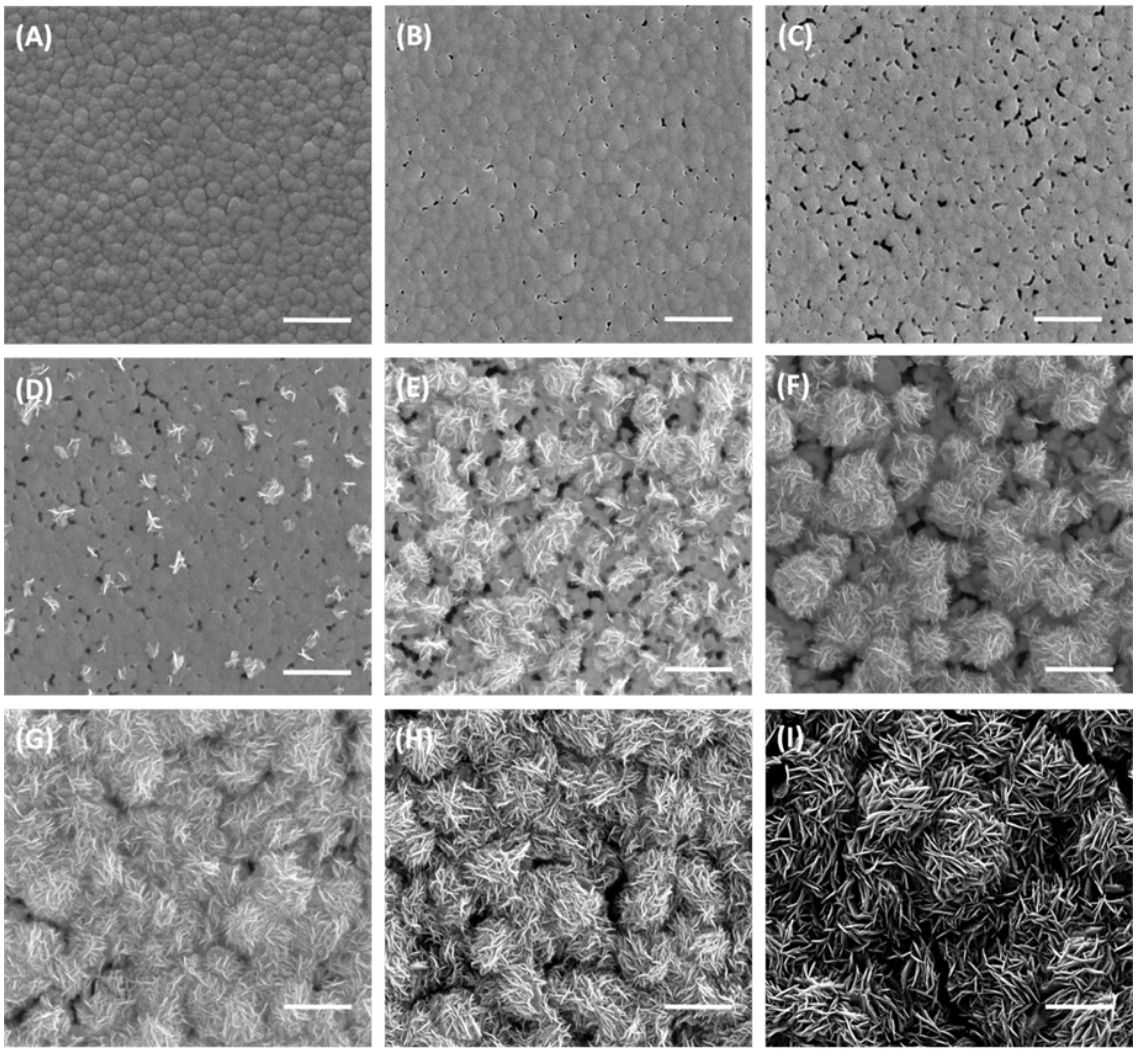

Fig. S3 SEM images of amorphous W-Al-O films after different chemical etching duration in 1M H_2SO_4. (A) 0 h, (B) 1 h, (C) 2 h, (D)3 h, (E) 4 h, (F) 5 h, (G) 6 h, (H) 8 h and (I) 8 h (calcined in air at 500 ^oC for 2 h); scale bar : 1 μm.

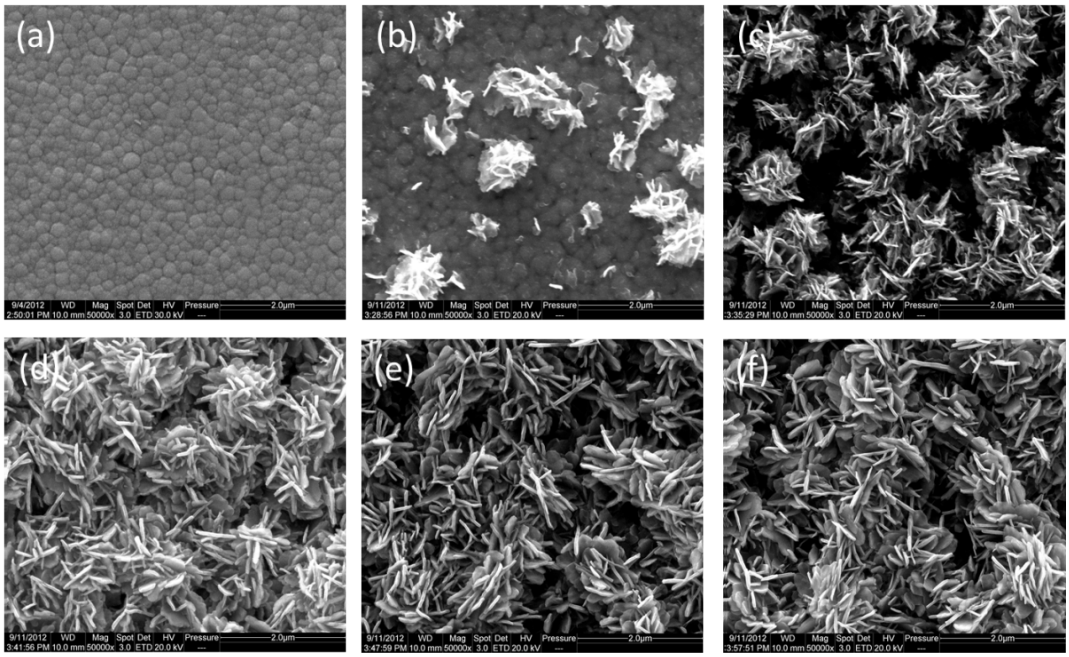

Fig. S4 SEM images of amorphous W-Zn-O films after different chemical etching duration in 1M HNO_3. (a) 0 h, (b) 1 h, (c) 2 h, (d)3 h, (e) 4 h and (f) 5 h; scale bar : 2 μm.

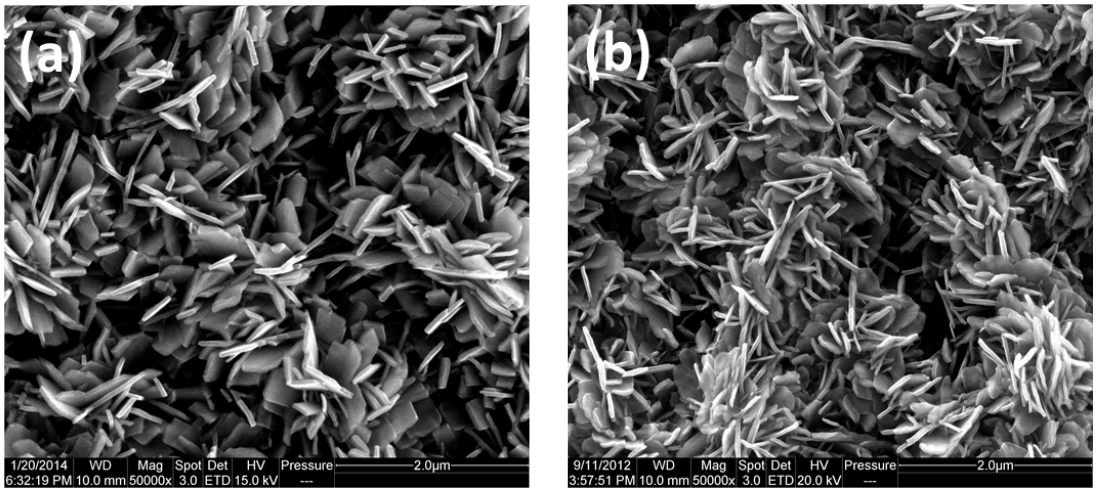

Fig. S5 SEM images of as-sputtered amorphous W-Zn-O film after chemical etching in (a) 1 M HCl, (b) 0.5 M H_2SO_4; scale bars = 2 μm

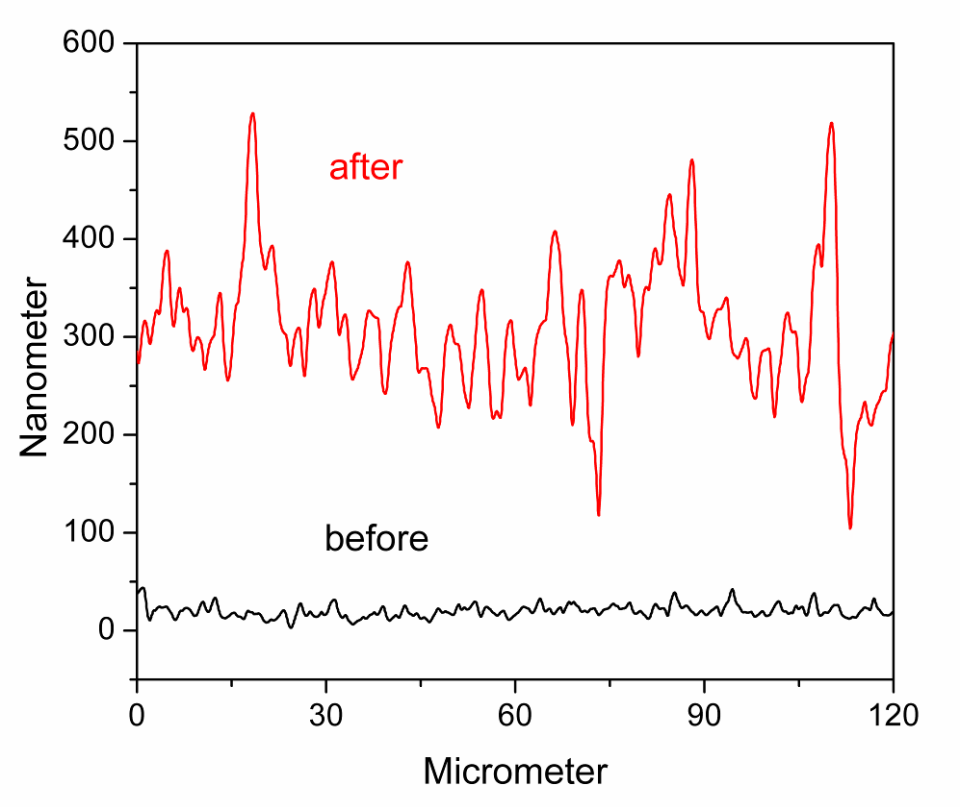

Fig. S6 Surface roughness of the films before and after etching.

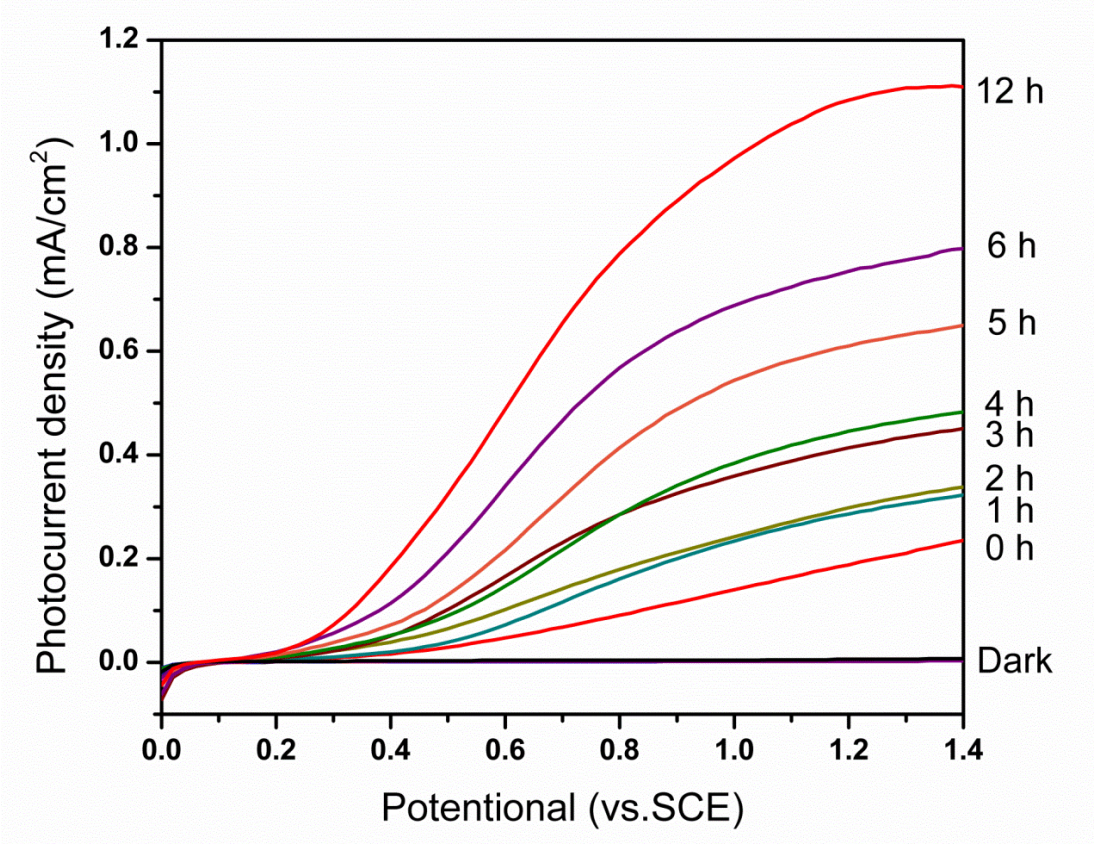

Fig. S7 Linear sweep voltammetric curves of photoelectrodes obtained at various intervals of etching process after annealing in air at 500 ^{o}C for 2h under light and in dark. Electrolyte: 0.5 M Na_2SO_4 (pH 3.0) aqueous solution; Light source: AM 1.5G 100 mW·cm^{-2}; Scan rate: 20 mV/s.

Table S1. ICP-AES measurements of element contents in aqueous solutions prepared from the complete dissolve of the as-sputtered and as-etched (for 12 h) W-Cu-O, W-Zn-O films in 1 M KOH.

W-Cu-O film	W (μg/mL)	Cu (μg/mL)	Cu/W Molar Ratio (%)
As-sputtered	90.59	9.86	32.65%
After etching	91.21	0.098	0.30%
W-Zn-O film	W (μg/mL)	Zn (μg/mL)	Zn/W Molar Ratio (%)
As-sputtered	81.59	5.11	17.72%
After etching	80.19	0.01	0.03%

Table S2. The fitted values of Rs, Rp, CPE-T and CPE-P

Sample	**Rs**	**Rp**	**CPE-T × 10^{-4}**	**CPE-P × 10^{-1}**
Compact WO_3	25.99	1576	1.27	9.3
Plate-like WO_3	28.83	655.5	1.11	9.38