Electronic Supplementary Information

The oriented growth of tungsten oxide in ordered mesoporous carbon and their electrochemistry performance

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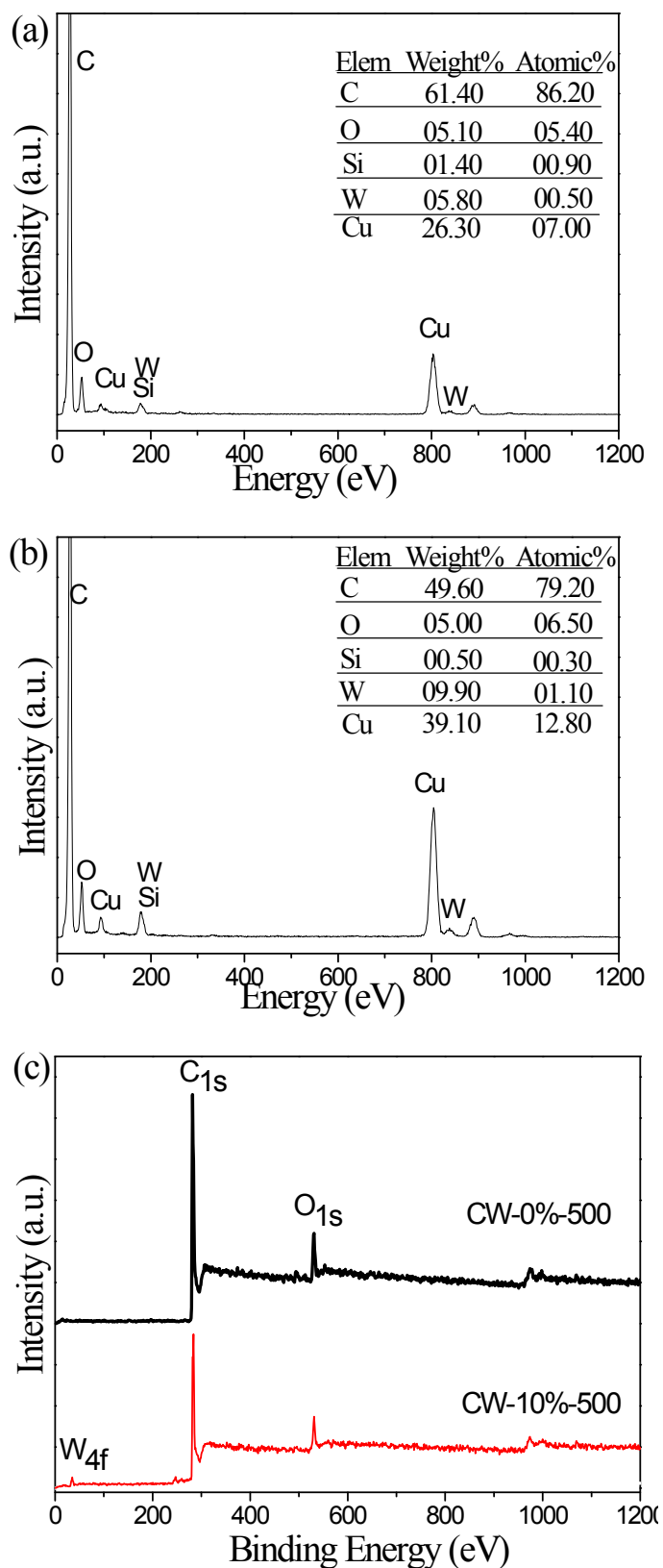
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(a)

Elem	Weight%	Atomic%
C	61.40	86.20
O	05.10	05.40
Si	01.40	00.90
W	05.80	00.50
Cu	26.30	07.00

(b)

Elem	Weight%	Atomic%
C	49.60	79.20
O	05.00	06.50
Si	00.50	00.30
W	09.90	01.10
Cu	39.10	12.80

Fig. S1 EDS of (a) CW-10%-500, (b) CW-20%-500, and (c) XPS spectrum of CW-0%-500 and CW-10%-500
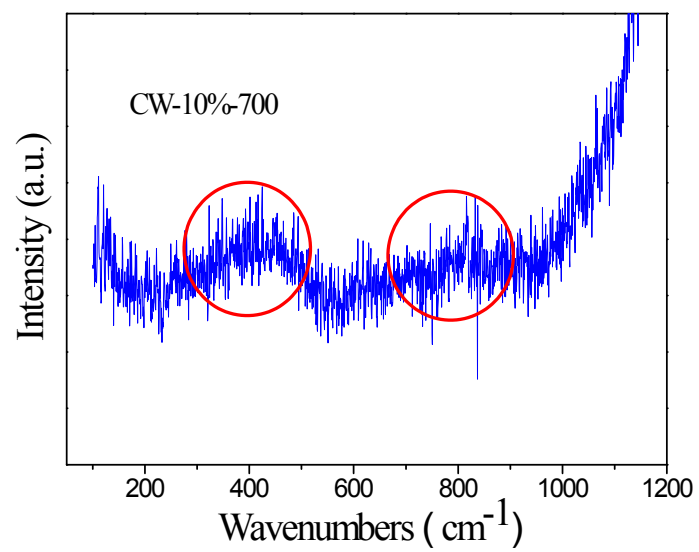
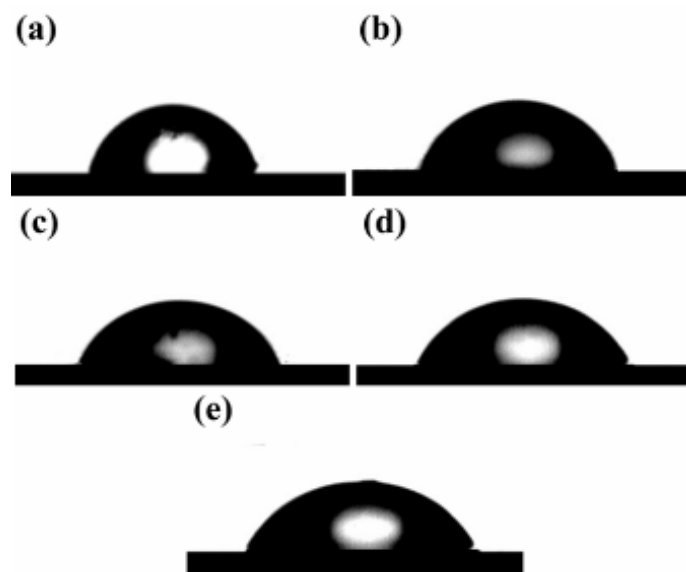**Fig. S2** Raman spectra of ordered mesoporous C-WO$_3$-10%-700 films from 100-1200 cm^{-1}.

Fig. S3. Macroscopic low-magnification photomicrographs of the static contact angle of ordered mesoporous C-WO$_3$ films: (a) CW-0%-500, (b) CW-2.5%-500, (c) CW-5%-500, (d) CW-10%-500, (e) CW-20%-500.
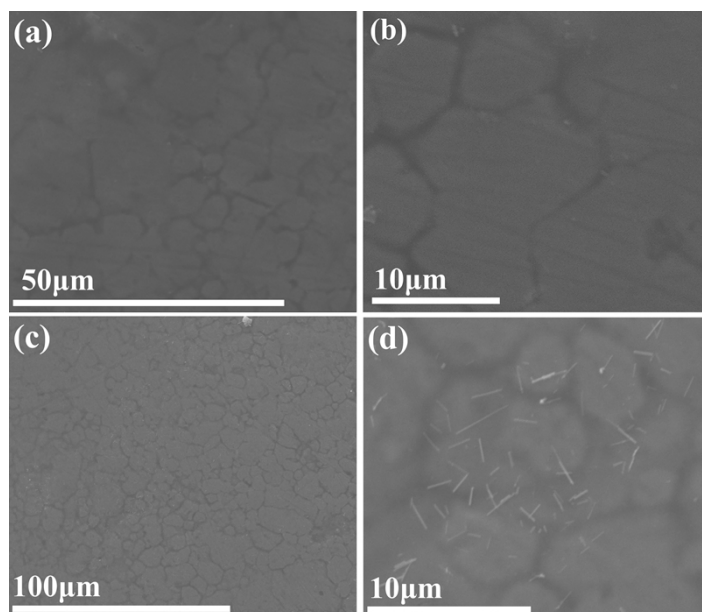
Fig. S4. SEM images of ordered mesoporous C-WO$_3$ films: (a,b) CW-10%-500, (c,d) CW-20%-500
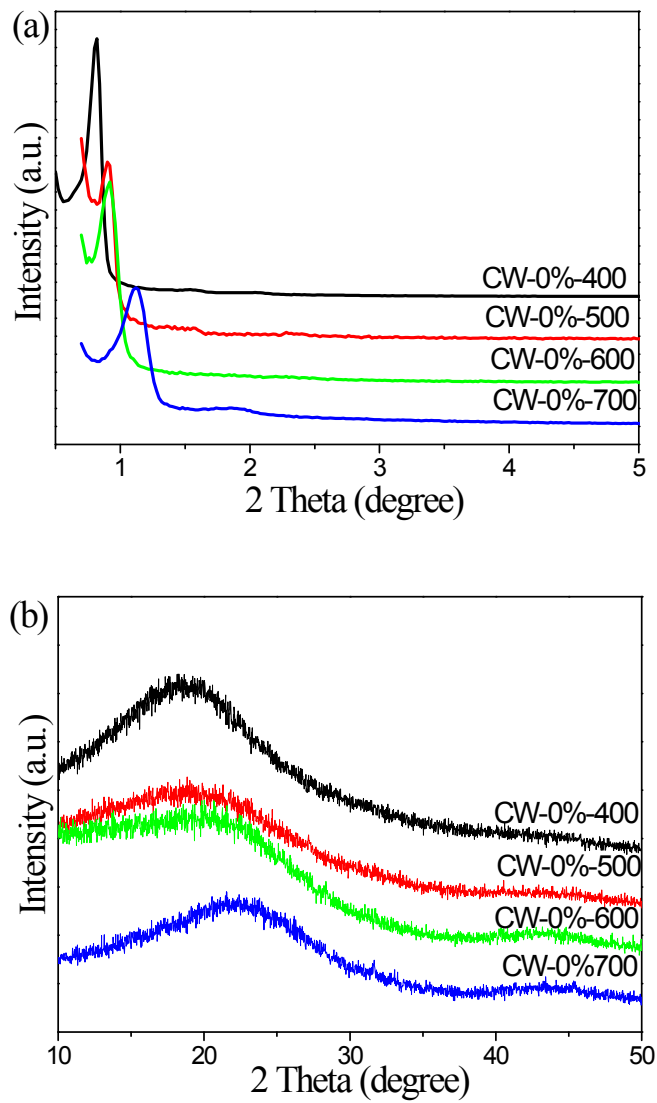
Fig. S5. (a) Small-angle XRD and (b) Wide-angle XRD patterns of CW-0%-y films, y represents the calcination temperature.
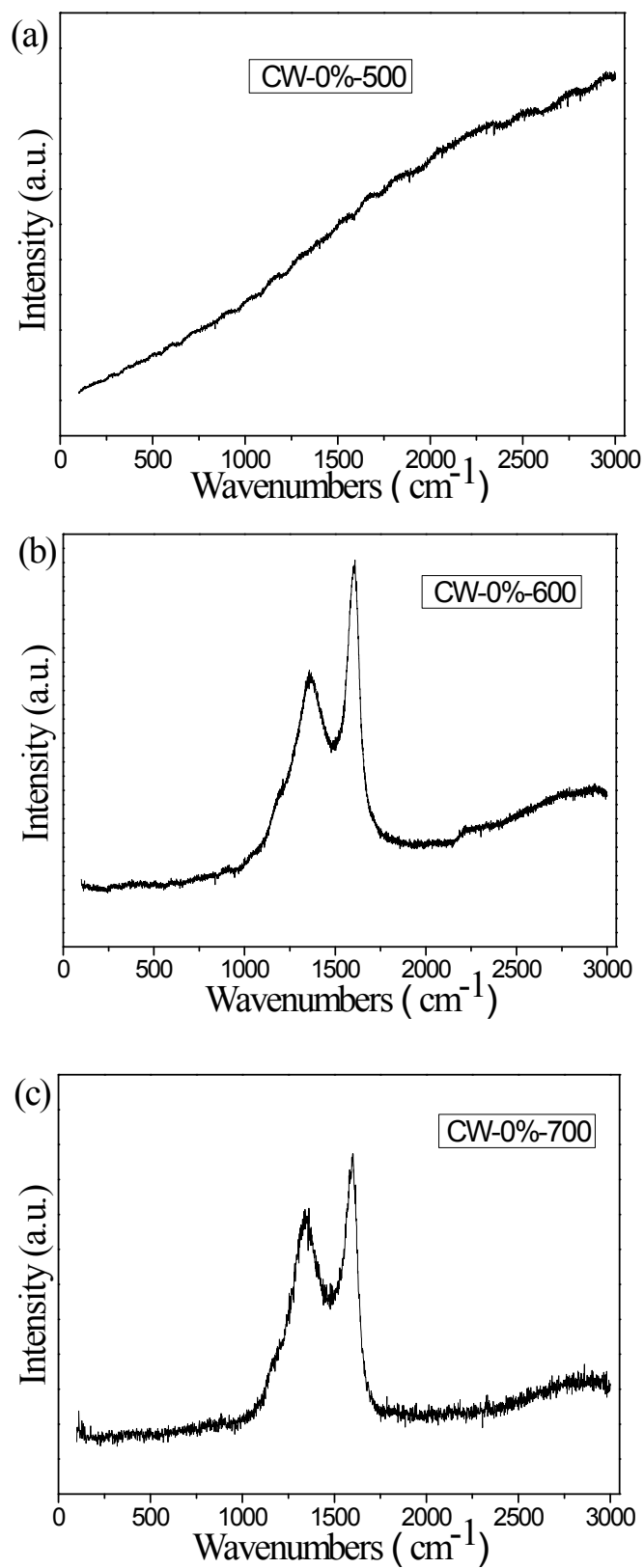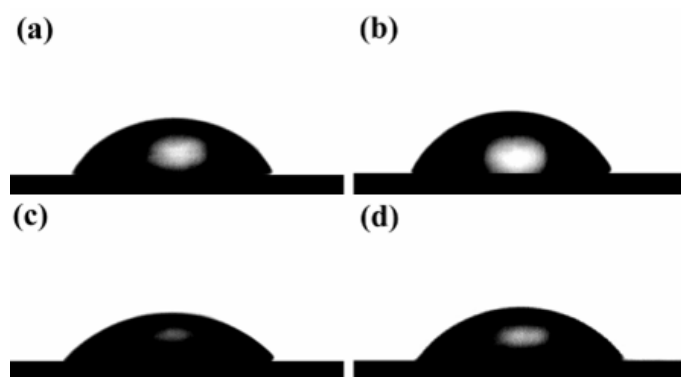
Fig. S6. Raman spectra of CW-0%-y films.

Fig. S7. Macroscopic low-magnification photomicrographs of the static contact angle of ordered mesoporous C-WO$_3$ films: (a) CW-10%-400, (b) CW-10%-500, (c) CW-10%-600, and (d) CW-10%-700.
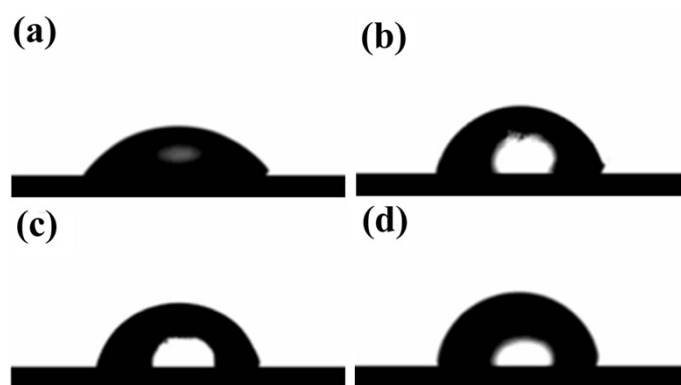

Fig. S8. Macroscopic low-magnification photomicrographs of the static contact angle of ordered mesoporous carbon films: (a) CW-0%-400, (b) CW-0%-500, (c) CW-0%-600, and (d) CW-0%-700.

Table S1. The values of contact angles with water, electrical conductivity and I_D/I_G for CW-0%-y and CW-10%-y films.

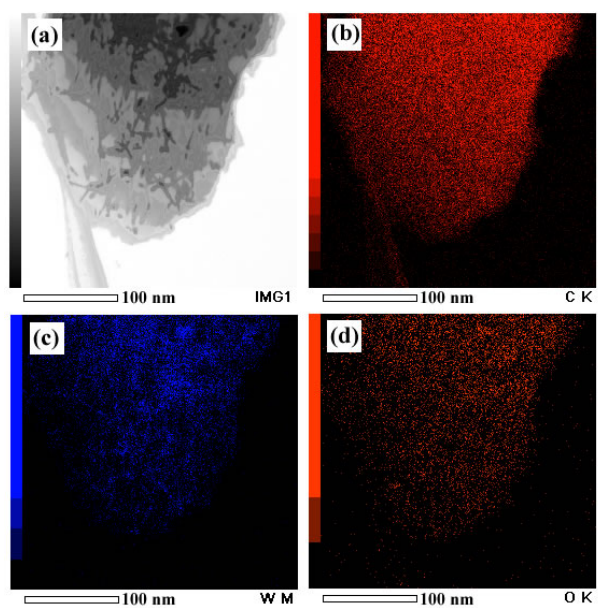| Sample	Contact angle (°)	Surface energy (N m^{-2})	G (S m^{-1})	I_D/I_G
CW-0%-400	54	46.0	6.62*10^{-4}	-
CW-0%-500	71	32.0	0.0043	-
CW-0%-600	75	29.0	0.252	0.90
CW-0%-700	81	24.7	0.741	0.86
CW-10%-400	58	42.9	0.0093	-
CW-10%-500	62	39.5	0.079	1.84
CW-10%-600	49	50.0	2.3	0.87
CW-10%-700	53	46.4	6.7	0.81

Fig. S9. STEM-maping images of CW-2.5%-600: (a) STEM image, (b) C, (c) W and (d) O.
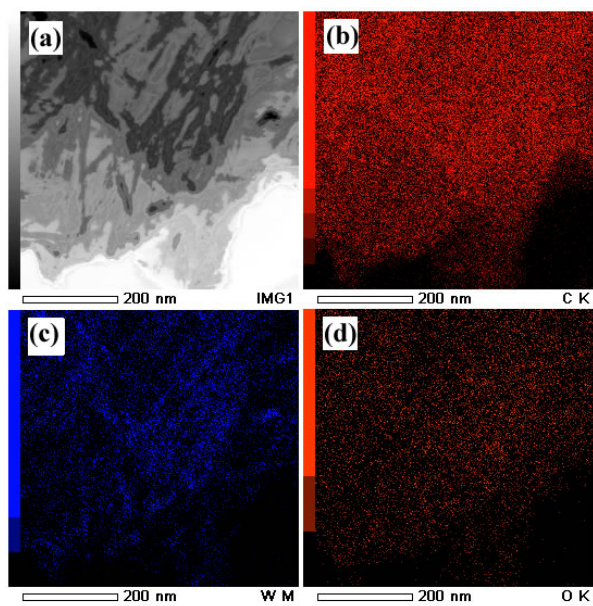
Fig. S10. STEM-maping images of CW-10%-600: (a) STEM image, (b) C, (c) W and (d) O.
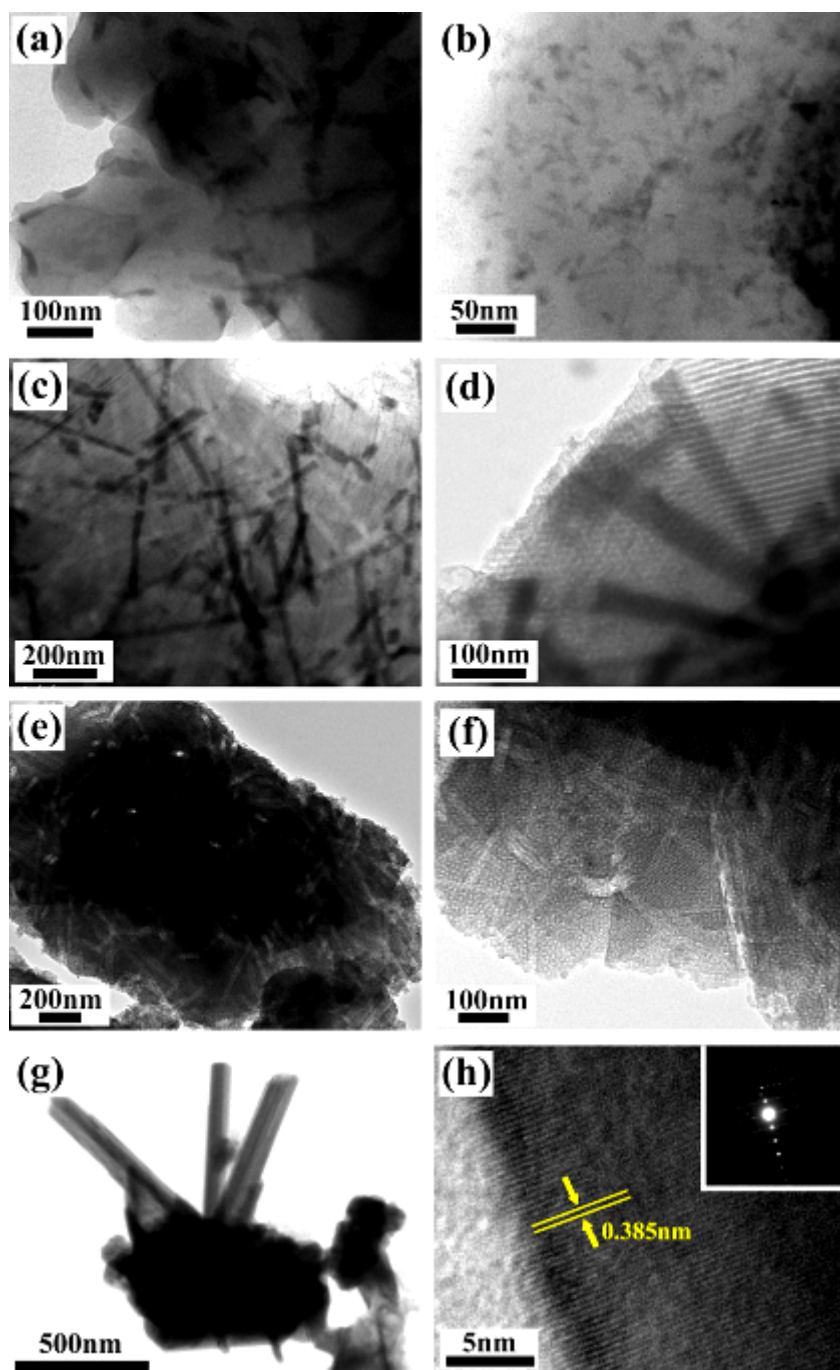
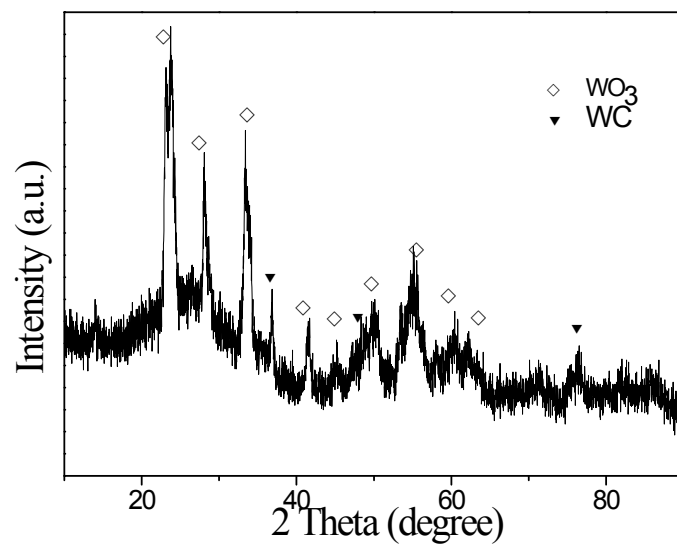**Fig. S11.** TEM images of samples: (a,b) CW-10%-100, (c,d) CW-10%-600, (e,f) CW-C and (g,h) CW-W.
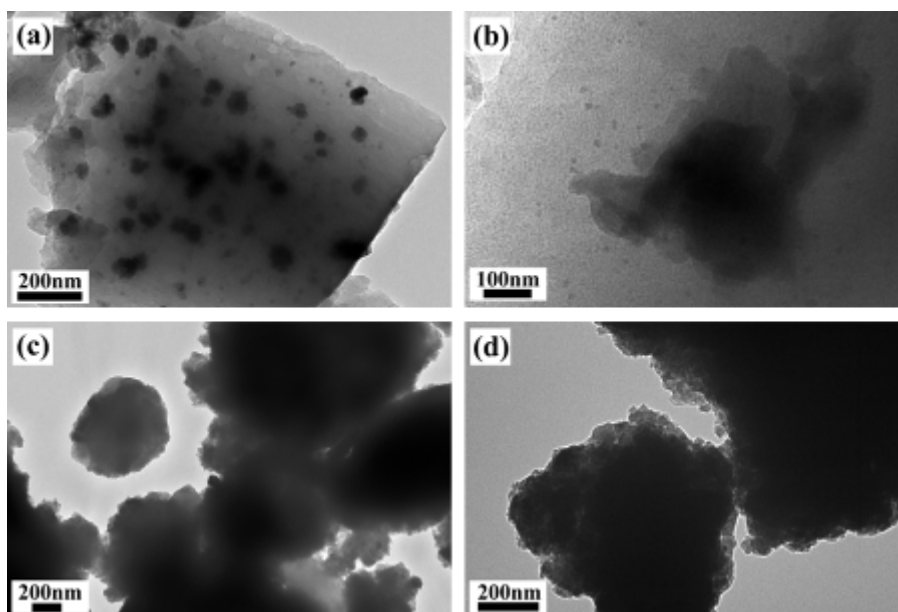
Fig. S12. Wide-angle XRD patterns of CW-W

Fig. S13. TEM images of (a,b) R1 and (c,d) R2

Table S2. The corrosion current density (i_{corr}) and the corrosion potential (E_{corr}) values for ordered mesoporous C-WO$_3$ films in 0.5 M H$_2$SO$_4$.

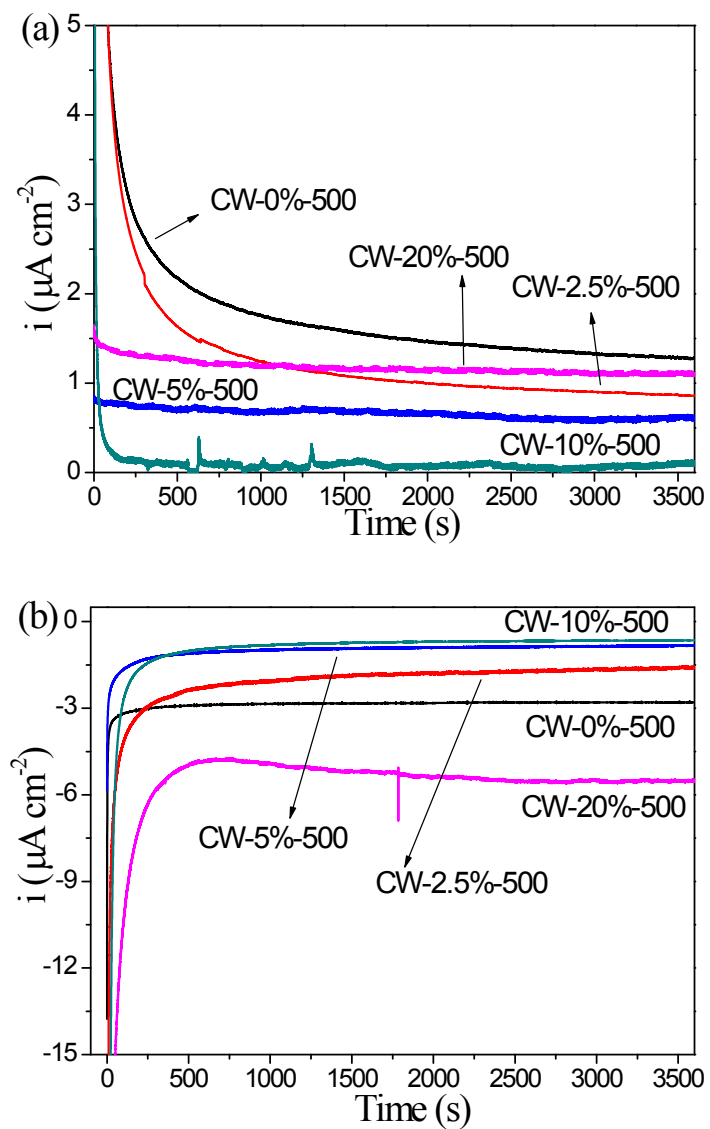| Sample	E_{corr} (mV)(SCE)	i_{corr} (μA cm^{-2})
CW-0%-500	91	0.464
CW-2.5%-500	226	0.973
CW-5%-500	236	0.519
CW-10%-500	201	0.0559
CW-20%-500	168	4.570

Fig. S14. Potentiostatic polarization curves of ordered mesoporous C-WO$_3$ films: at 600 mV (SCE) (a) and -100 mV (SCE) (b) in 0.5 mol L^{-1} H$_2$SO$_4$ solution.
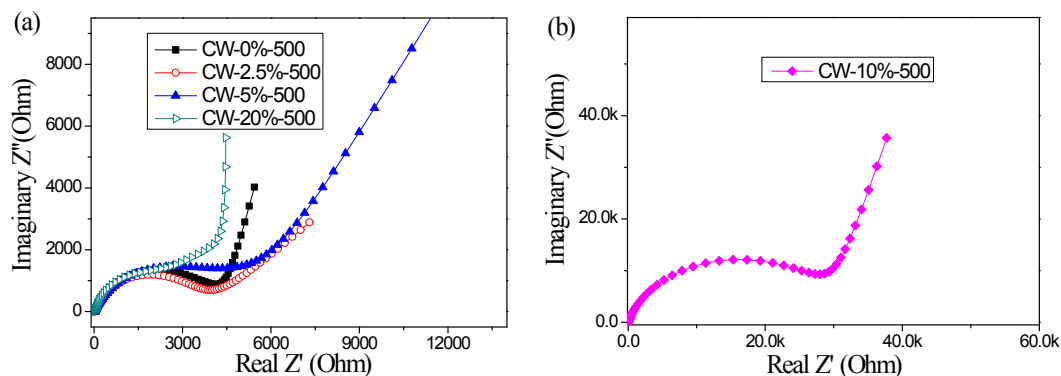
Fig. S15. Electrochemical impedance spectras of ordered mesoporous C-WO$_3$ films in 0.5 mol L^{-1} H$_2$SO$_4$ solution.
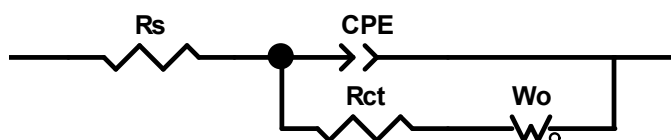

Fig. S16. Equivalent circuit representing the corrosion of ordered mesoporous C-WO$_3$ films in 0.5 mol L^{-1} H$_2$SO$_4$ solution.

Note: R$_s$ is the solution resistance, R$_{ct}$ is the charge-transfer resistance, the constant phase element (CPE) is accounted for the adsorptive double-layer capacitance of non-homogeneity interface, W$_0$ is the diffusion impedance and W$_0$-T is the Warburg coefficient.

Table S3. Fitted results of electrochemical impedance spectras.

Sample	R$_s$ (Ω cm^2)	CPE (μF cm^{-2})	R$_{ct}$ (Ω cm^2)	Wo-T
CW-0%-500	21.2	130	3802	65.8
CW-2.5%-500	23.1	22.7	2863	70.5
CW-5%-500	25.1	43.2	3574	61.5
CW-10%-500	24.7	57.4	29372	15.1
CW-20%-500	21.8	50.2	2517	200. 1

Table S4. The corrosion current density (i_{corr}) and the corrosion potential (E_{corr}) values for CW-0%-y and CW-10%-y films in 0.5 M H_2SO_4.

Sample	E_{corr} (mV)(SCE)	i_{corr} ($\mu A \ cm^{-2}$)
CW-0%-400	-91	0.664
CW-0%-500	91	0.464
CW-0%-600	7	2.13
CW-0%-700	-198	4.30
CW-10%-400	204	1.15
CW-10%-500	201	0.0559
CW-10%-600	217	0.833
CW-10%-700	161	2.53