Electronic Supplementary Information

One-step Synthesis of Hierarchical Self-supported WS_2 Film for Efficient Electrocatalytic Hydrogen Evolution

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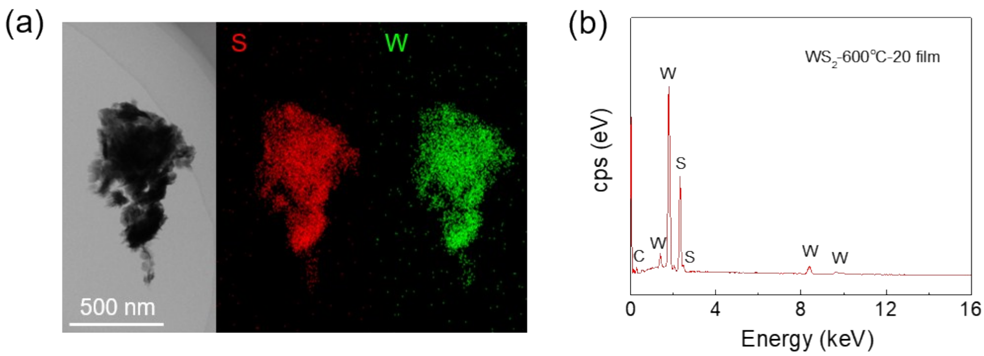

Figure S1. (a) Chemical mappings of W species and S species. (b) EDS pattern of WS_2-600°C-20 film.

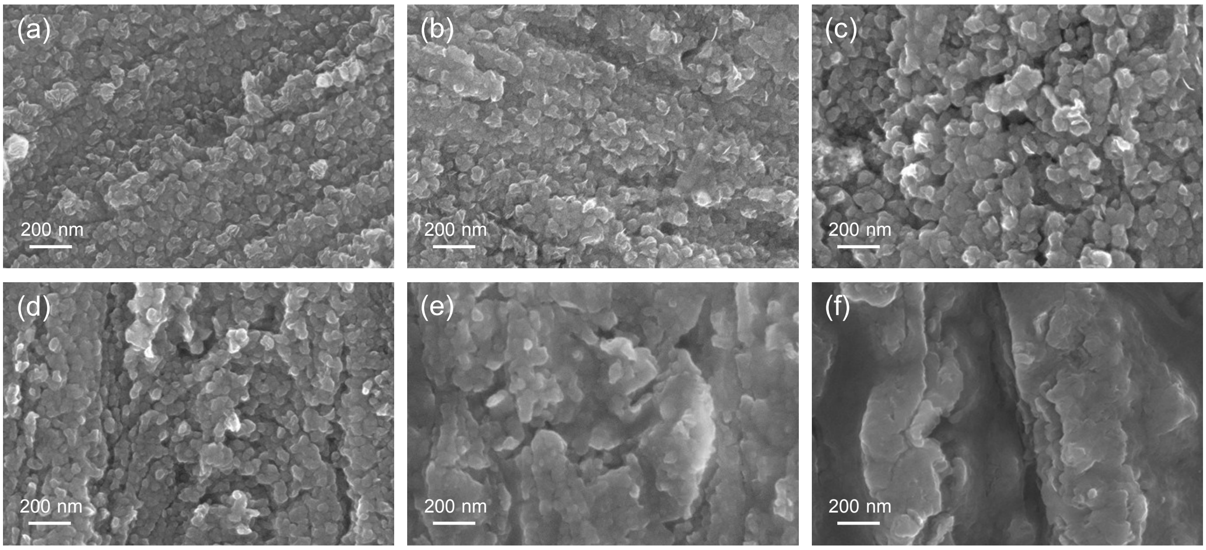

Figure S2. SEM images of (a) WS_2-500°C-20, (b) WS_2-600°C-20, (c) WS_2-700°C-20, (d) WS_2-800°C-20, (e) WS_2-900°C-20, and (f) WS_2-1000°C-20 films.

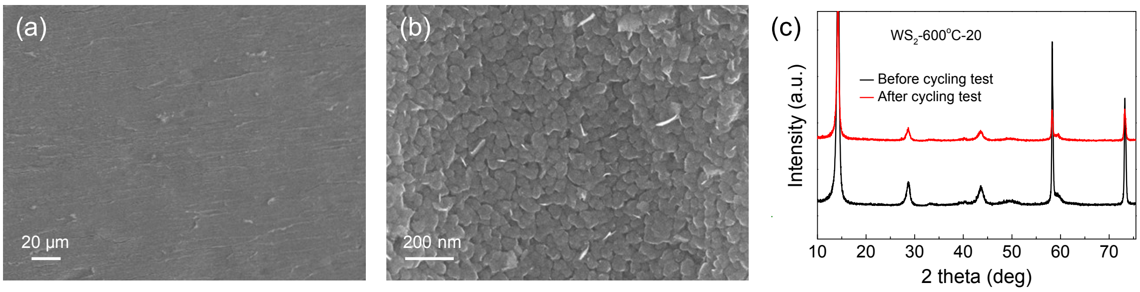

Figure S3. (a) Low- and (b) high-magnification SEM images of WS_2-600°C-20 film after cycling test. (c) Comparison of XRD patterns of WS_2-600°C-20 film before and after cycling test.

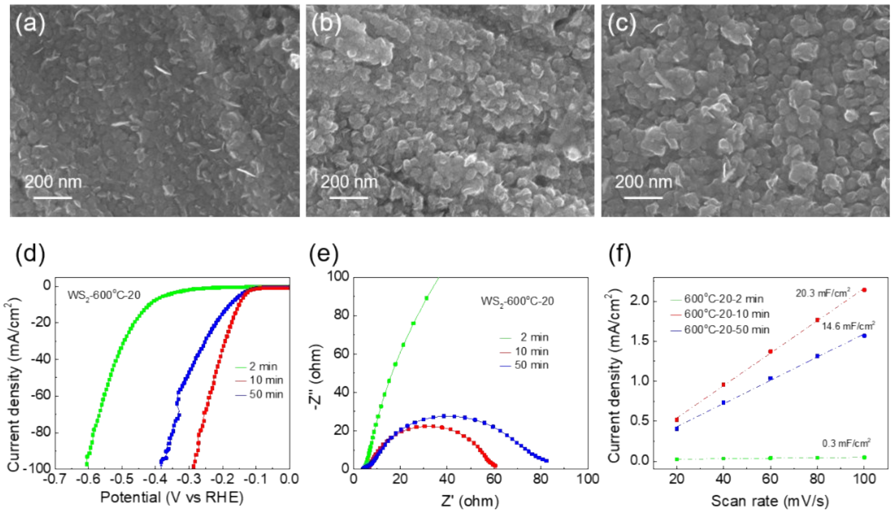

Fig S4. SEM images of (a) WS_2-600ºC-20-2min, (b) WS_2-600ºC-20-10min, (c) WS_2-600ºC-20-50min. (d) Polarization curves, (e) electrochemical impedance spectra and (f) linear fittings of the capacitive current densities at different scan rates of WS_2-600ºC-20 films with different reaction times.

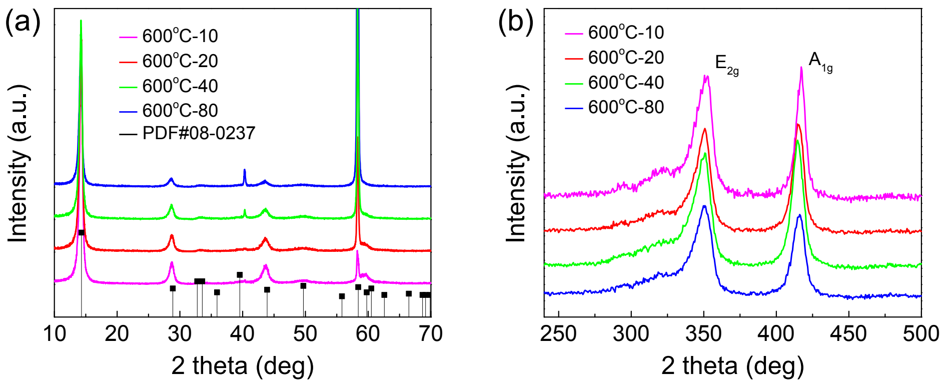

Figure S5. (a) XRD patterns, (b) Raman spectra of WS_2-600ºC films with different molar ratios of W/S.

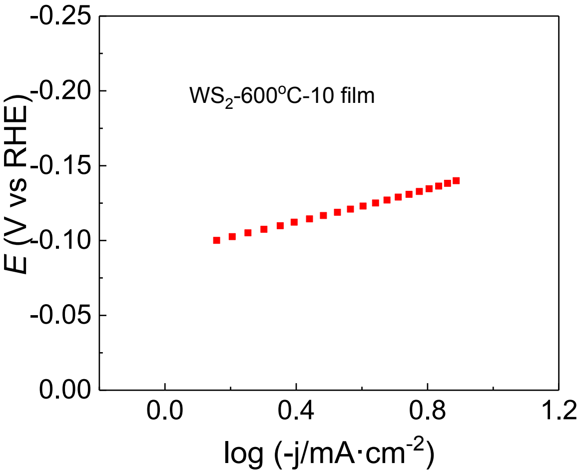

Figure S6. Tafel plot of WS_2-600^{o}C-10 film.

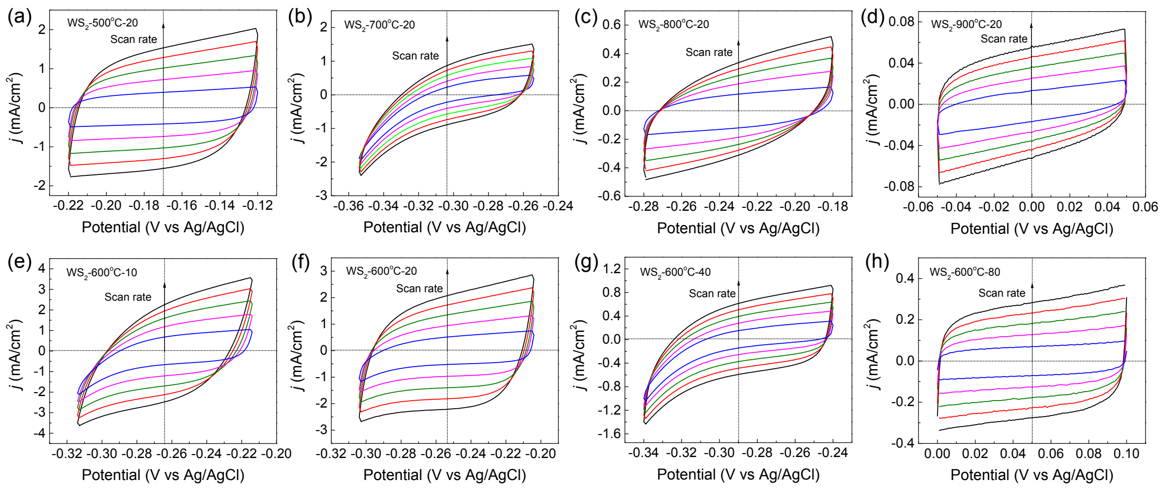

Figure S7. Electrochemical double-layer capacitance measurements of WS_2 films at different scan rates (20, 40, 60, 80, and 100 mV s^{-1}). (a) WS_2-500^{o}C-20, (b) WS_2-700^{o}C-20, (c) WS_2-800^{o}C-20, (d) WS_2-900^{o}C-20, (e) WS_2-600^{o}C-10, (f) WS_2-600^{o}C-20, (g) WS_2-600^{o}C-40, and (h) WS_2-600^{o}C-80.

Table S1. Comparison of the electrocatalytic activities of WS_2 film with reported WS_2 structures for HER.

Catalyst	Substrate	Method	Overpotential η mV/10 mA cm^{-2}	Tafel slope [mV dec^{-1}]	Stability
2H-WS_2 (this work)	W foil	SACVT	137	54	200 h
WS_2 nanoflakes [1]	ITO	exfoliation	~350	200	N/A
WS_2 nanosheets [2]	o-carbon fiber	hydrothermal	278	99	1000 cycles
WS_2 nanosheets [3]	Au foil	CVD	~320	100	1000 cycles
1T′ WS_2 nanoparticles [4]	glassy carbon	colloidal	200	50.4	46 days
2H-WS_2 nanoplates [5]	glassy carbon	thermal treatment	280	60	8 h
2H-WS_2 nanosheets [6]	glassy carbon	exfoliation	205	70	500 cycles
1T-WS_2 nanodots [7]	graphite disks	exfoliation	151	70	500 cycles
WS_2 nanoribbons [8]	glassy carbon	solvothermal	225	68	1000 cycles
WS_2 nanoflakes [9]	glassy carbon	solvothermal	100	48	10000 cycles
1T′ WS_2 nanosheets [10]	glassy carbon	exfoliation	~220	60	10000 cycles
WS_2 film [11]	carbon cloth	thermal treatment	~210	68	3 h

References

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