Supporting Information

Ag-Decorated MoS_x Laminar Film Electrocatalyst Made with Simple and Scalable Magnetron Sputtering Technique for Hydrogen Evolution: A Defect Model to Explain the Enhanced Electron Transport

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Table S1. RF sputtering parameters for Ag/MoS_x films

No.	Parameters	Description
1.	Substrates	Si, CFP
2.	Sputtering power	70 W
3.	Working pressure	9×10^{-3} torr
4.	Working gas	Ar: 10 sccm
5.	Temperature substrate	300 ^{o}C
6.	Deposition time	60 min

Table S2. EDS composition analyses of Ag/MoS_x-*n* at *n*= 0, 1, 2, 3, and 4

n	Ag (At.%)	Mo (At.%)	S (At.%)	$\frac{[Mo]}{[S]}$	$\frac{[Ag]}{[Ag]+[Mo]}$
0	-	52.56	47.44	1.11	-
1	1.54	53.76	44.69	1.20	0.028
2	4.16	59.47	36.37	1.64	0.065
3	10.31	56.75	32.94	1.72	0.15
4	16.82	37.83	45.35	0.84	0.30

*Oxygen content is excluded here, but evaluated with XPS analysis.

The effect of different amounts of nano-Ag on morphology was studied using FE-SEM. As shown in Figure S1, there is no big difference in morphology for different mixtures. All sample had the lamellae structure.

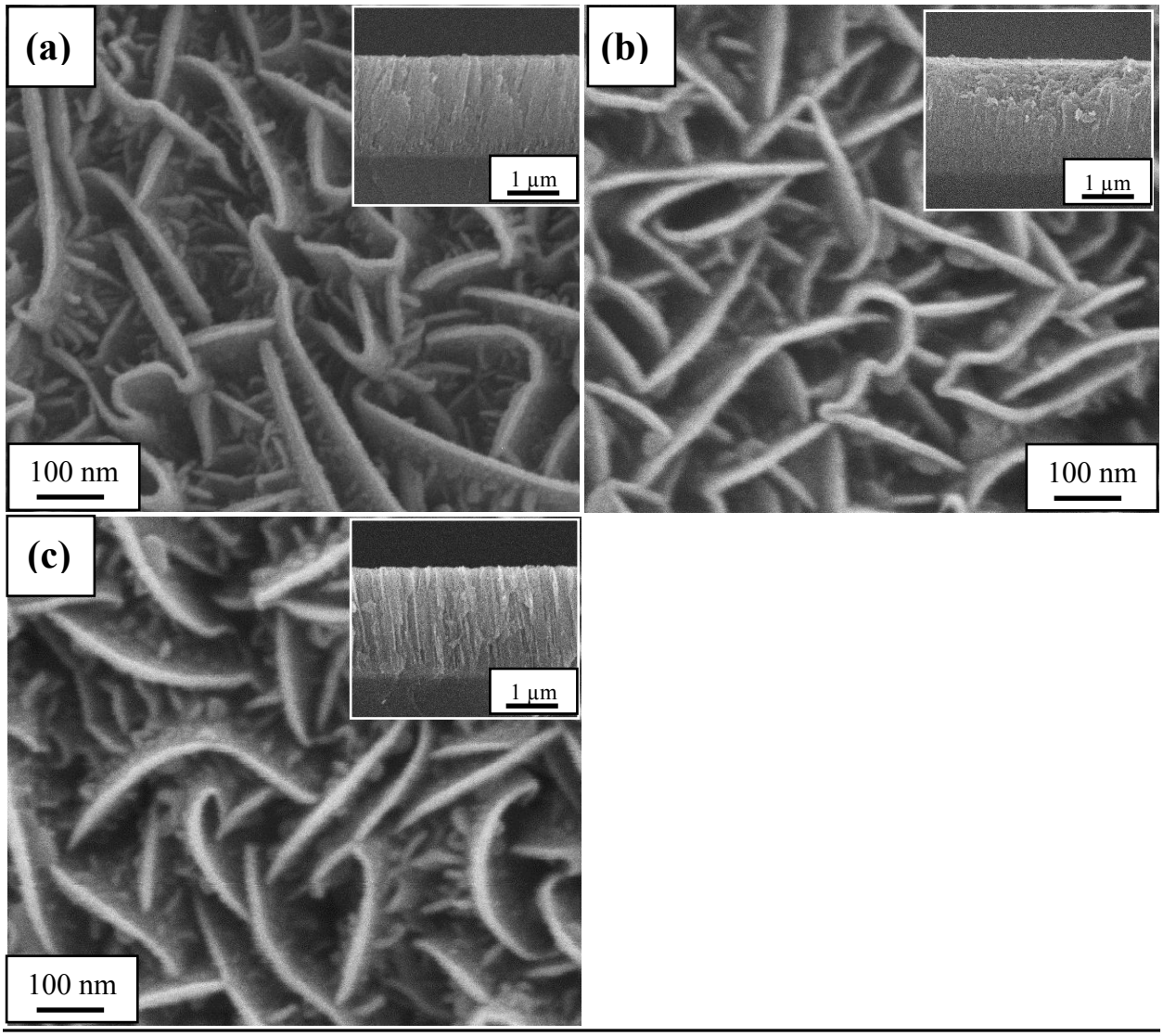


Figure S1. SEM surface images of (a) AMS-1 (b) AMS-2, and (c) AMS-4 thin films along with their corresponding cross-sectional images.

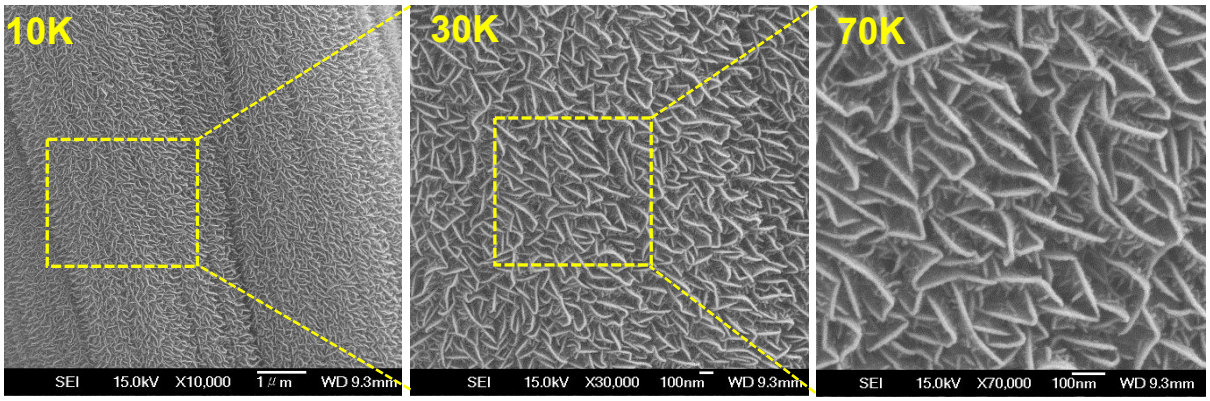


Figure S2. Representative SEM images of AMS-3 for different magnifications.

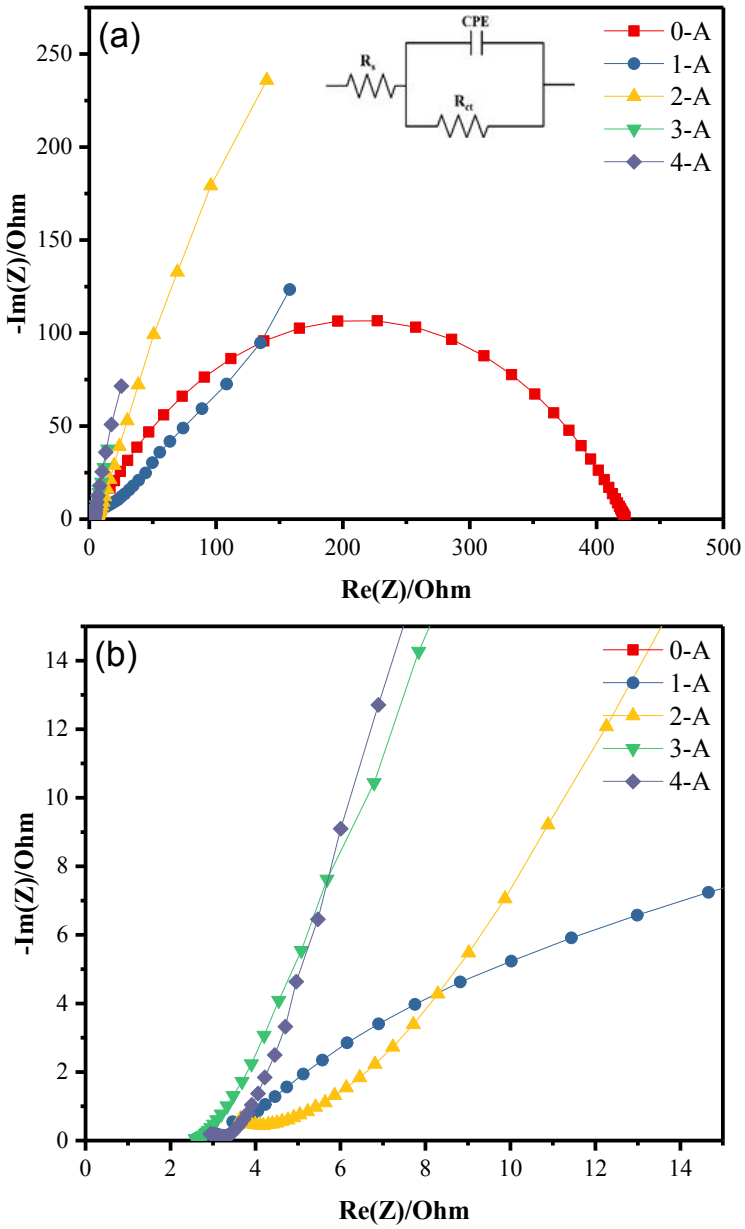


Figure S3. (a) a full range and (b) the low-frequency range of EIS spectra of AMS-*x* thin films with *x*= 0, 1, 2, 3, and 4 with the measurements conducted in 0.5 M sulfuric acid.

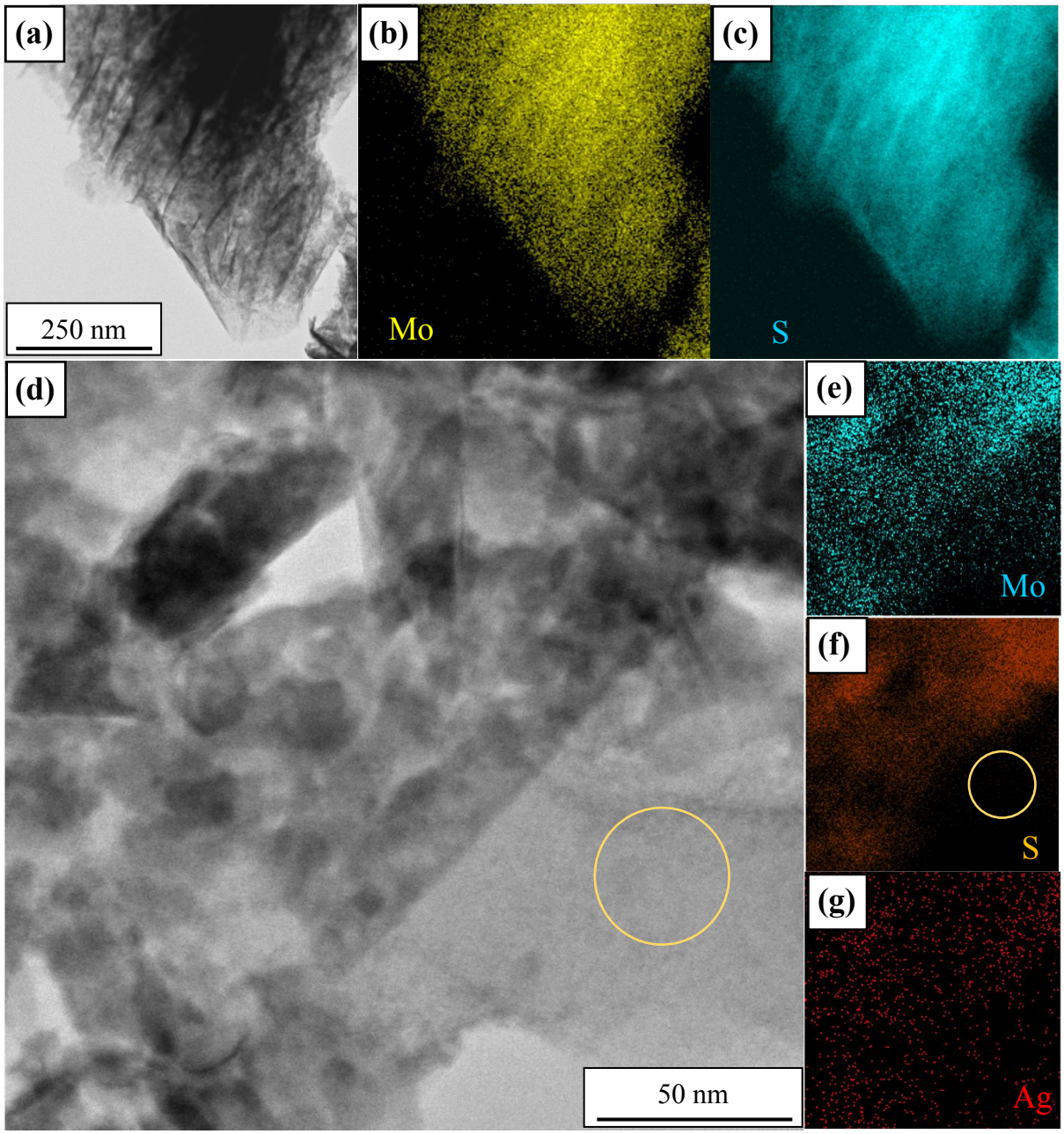


Figure S4. TEM (a,d) bright-field images and elemental mappings of (b,e) Mo and (c,f) S elements for (a-c) AMS-0 and (d-f) AMS-3. (g) Ag mapping in AMS-3.

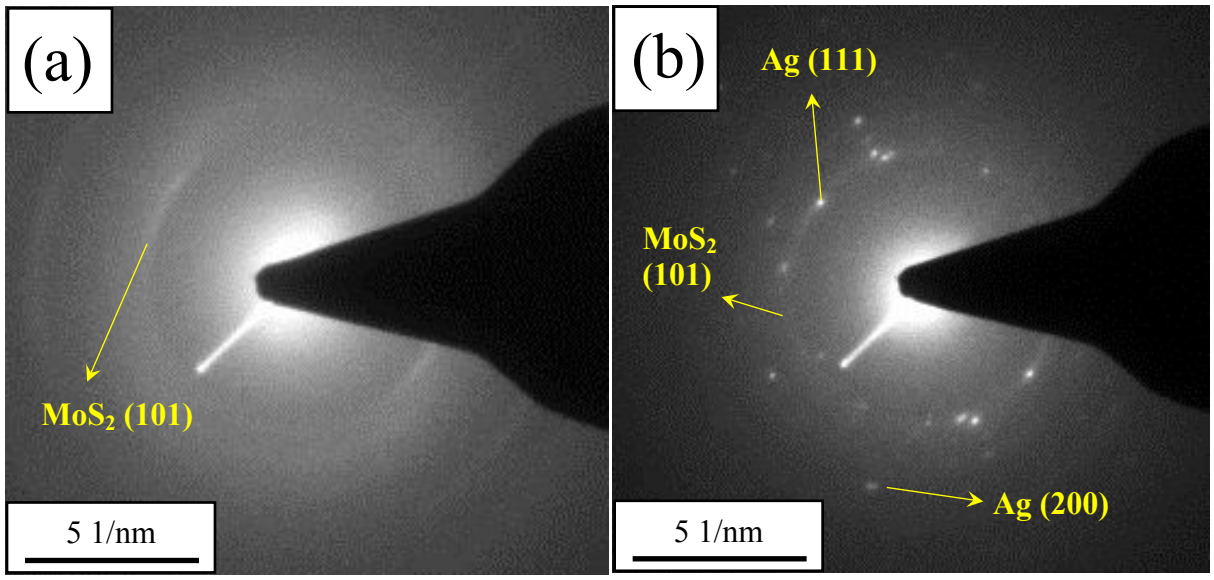
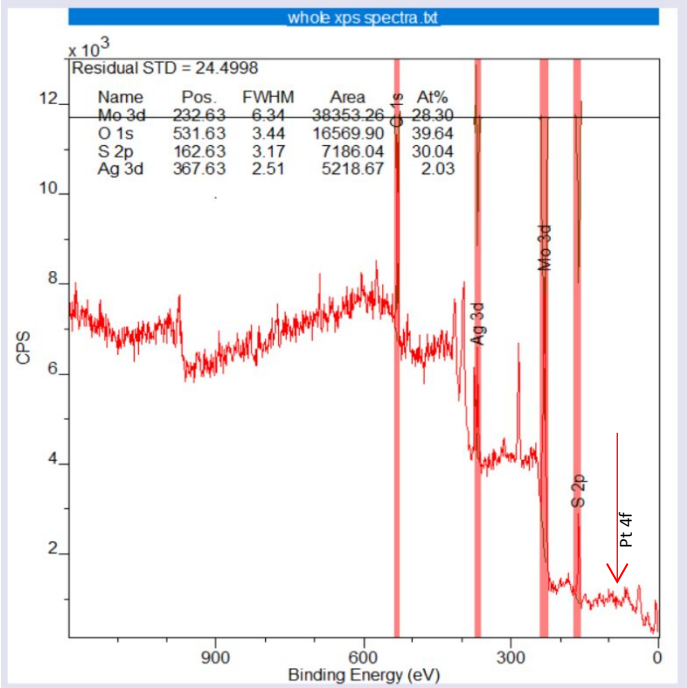


Figure S5. Selected area diffraction ring patterns of (a) AMS-0 and (b) AMS-3.

(a)



(b)

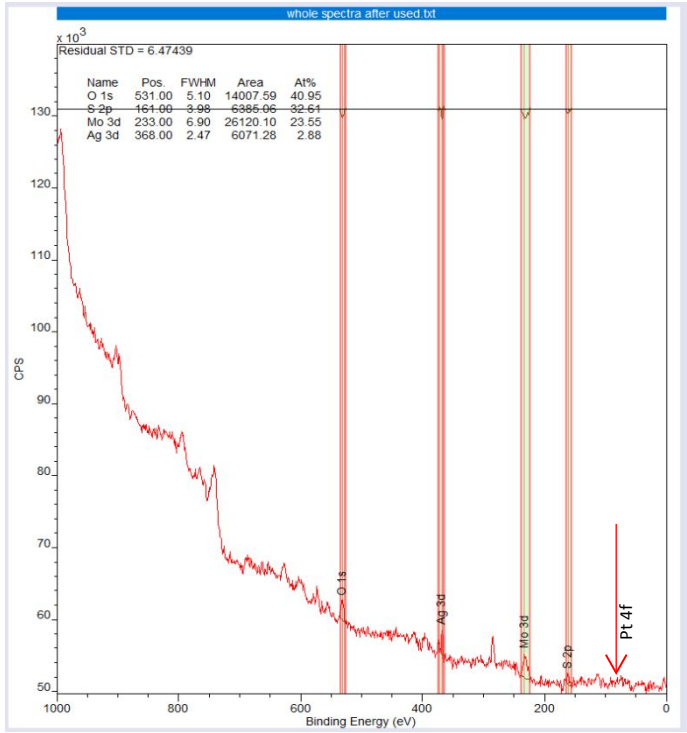


Figure S6. The XPS whole scans for AMS-3 (a) before and (b) after the electrolytic water splitting. The data were analyzed by CasaXPS software.

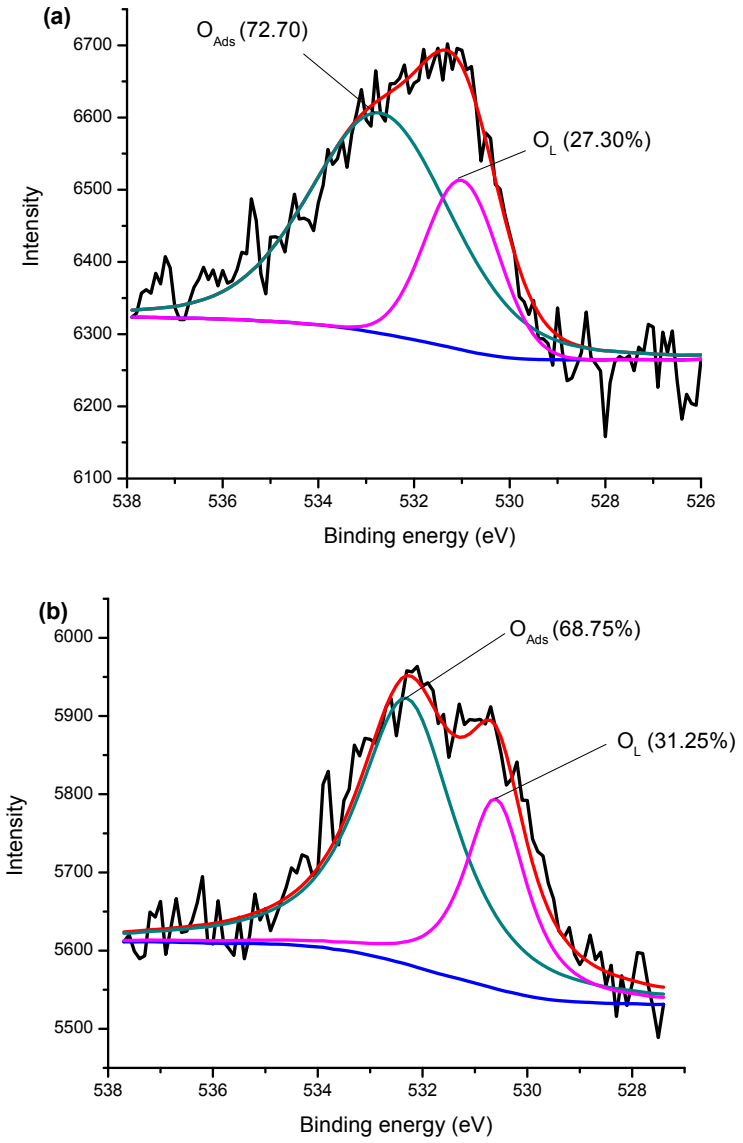


Figure S7. High-resolution XPS spectra of O1s peaks for (a) as-deposited and (b) after-used AMS-3 films.

Cyclic voltammogram (CV) was based upon electrochemical double-layer capacitive (C_{dl}) measurement with different scan rates of 20 to 100 mV/s and window potentials from 0.1 to 0.4 V. The CV measurements were done for CFP and AMS-*x* (*x*= 0, 1, 2, 3, and 4). All the results of CV measurements were shown in Figure S8.

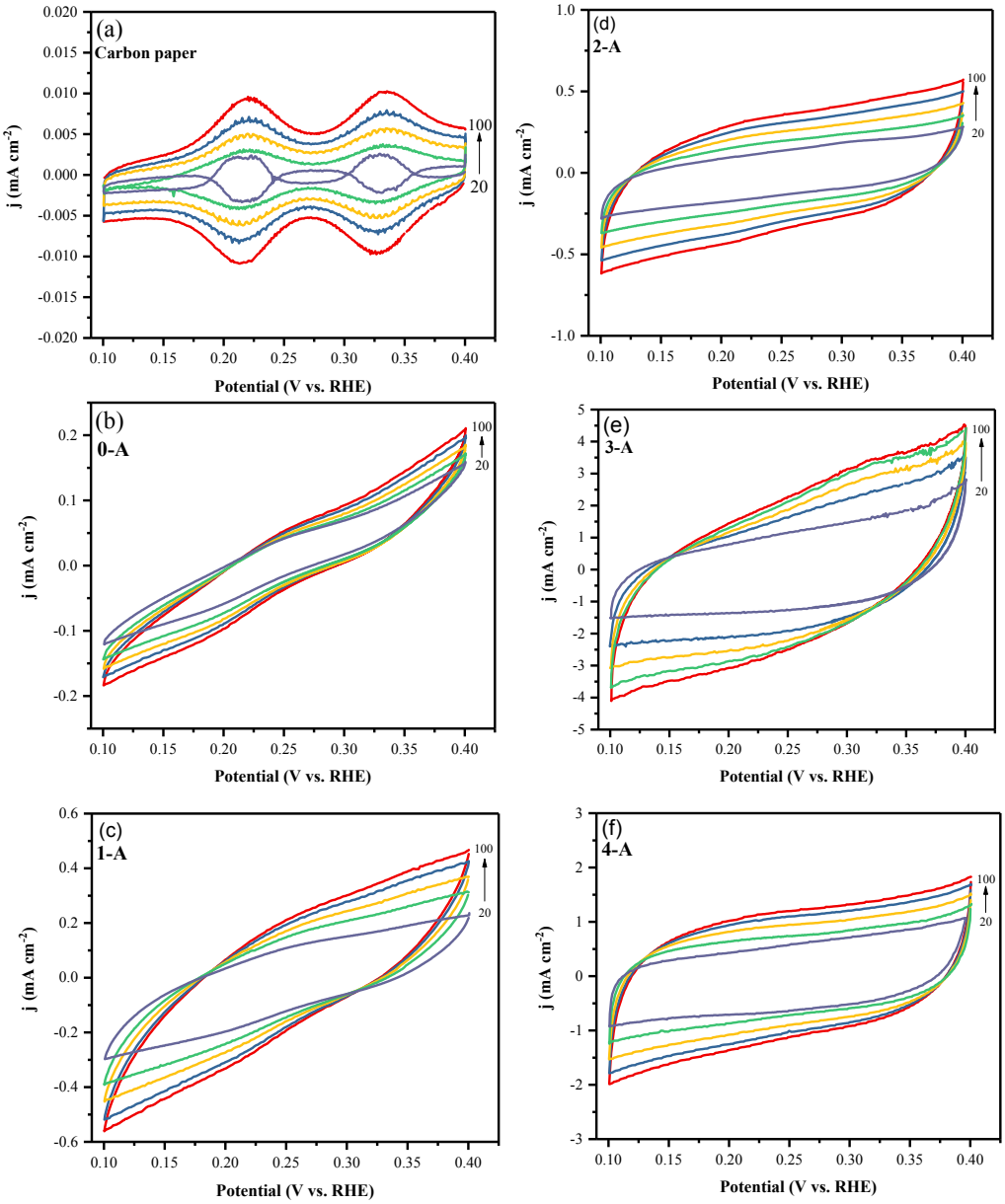


Figure S8. Cyclic voltammogram of (a) carbon fiber paper (CFP), (b) AMS-0, (c) AMS-1, (d) AMS-2, (e) AMS-3, and (f) AMS-4.

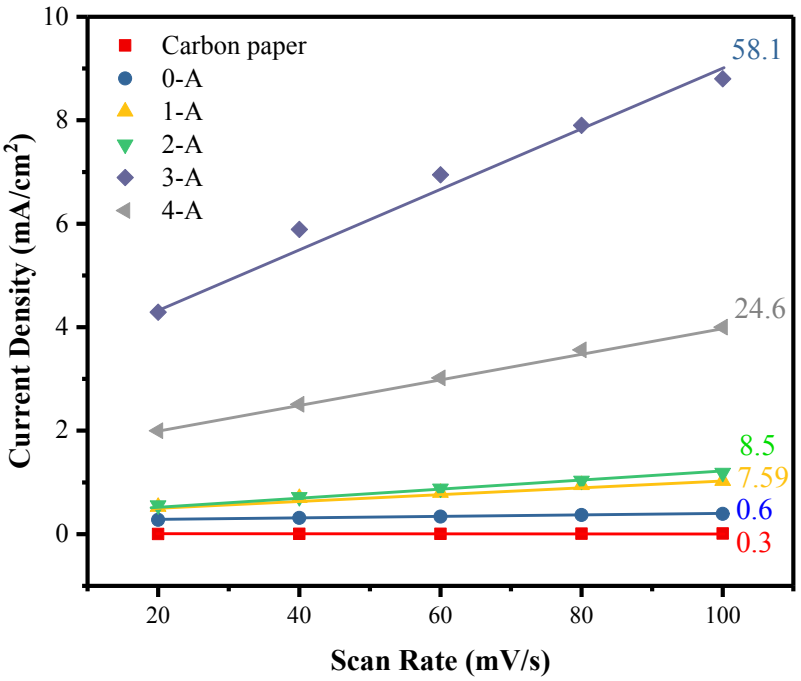


Figure S9. The scan rate-current density slopes of AMS-*x* electrodes for their double layer capacitive measurements in acid solution.

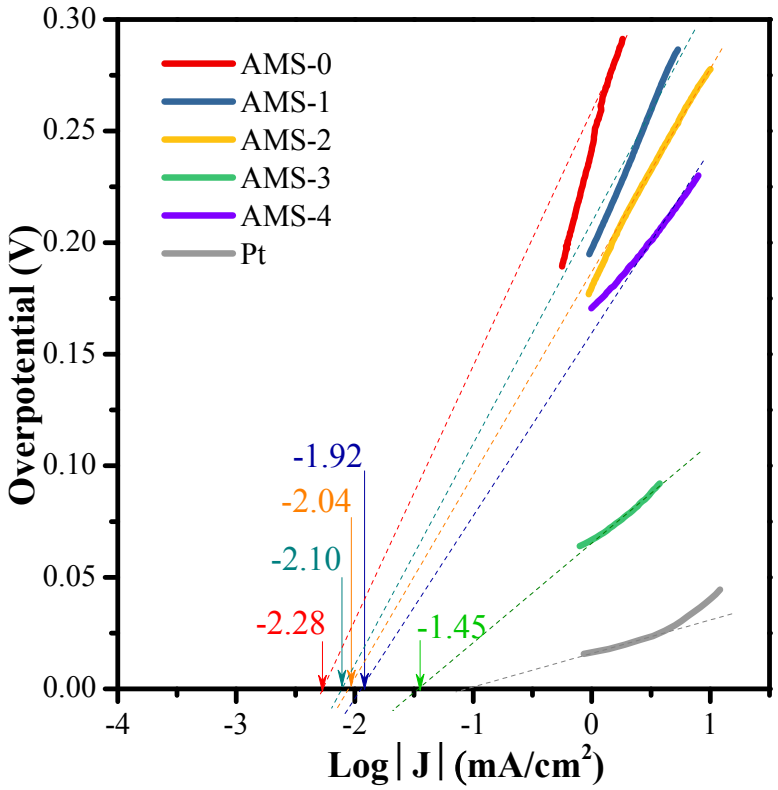


Figure S10. Overpotential versus log current density to determine exchange current density.

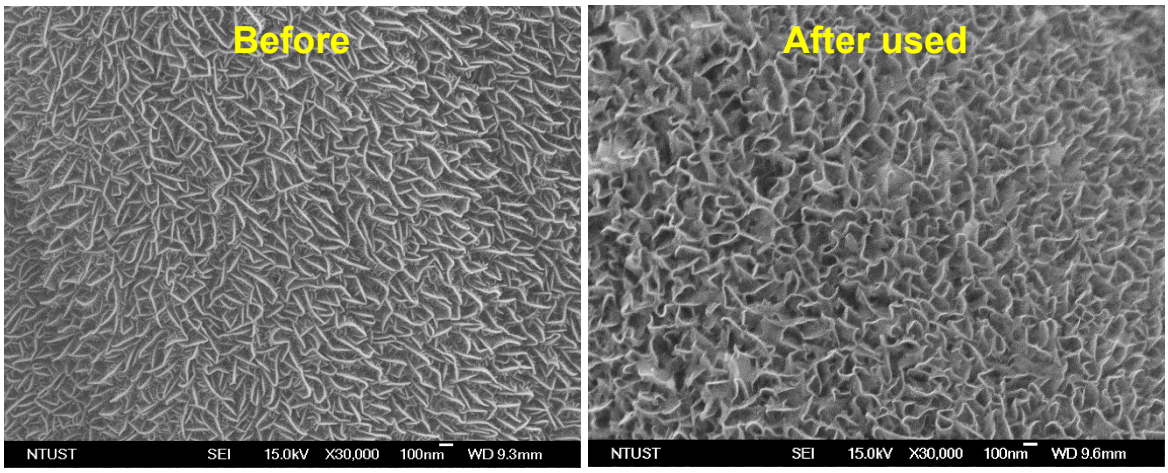


Figure S11. SEM images before and after HER test

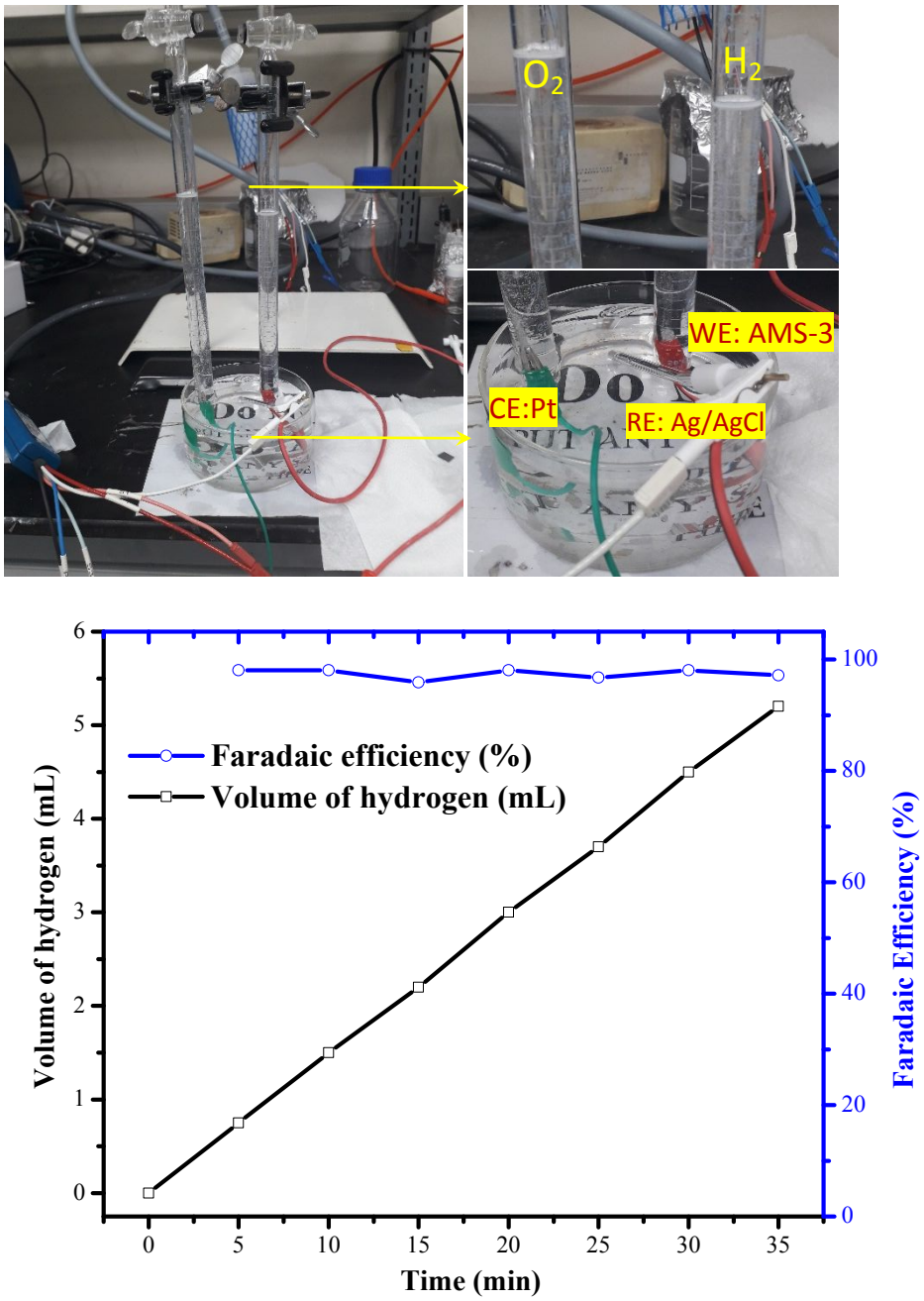


Figure S12. Experiment set-up of hydrogen measurement (top) and volume of hydrogen gas versus time and corresponding faradaic efficiency (bottom).