

# Supplementary Materials: Prickly Pear-Like Three-Dimensional Porous MoS<sub>2</sub>: Synthesis, Characterization and Advanced Hydrogen Evolution Reaction

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Table S1. HER activities of synthesized MoS<sub>2</sub> catalysts.

Materials	Onset Potential (mV)	Tafel Slope (mV)	Surface Area (m <sup>2</sup> ·g <sup>-1</sup> )
ZT-MoS <sub>2</sub> -H	-160	90.3	405.3 ± 4.6
ZT-MoS <sub>2</sub>	-110	63	462.1 ± 5.2
ZT-MoS <sub>2</sub> -T	-185	135.5	389.4 ± 7.1

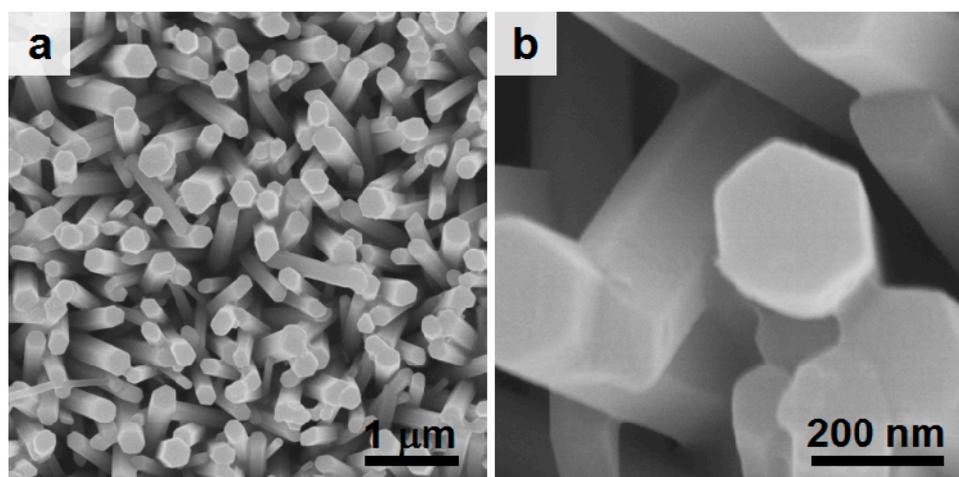


Figure S1: (a) SEM image and (b) corresponding magnified SEM image of ZnO NRs.

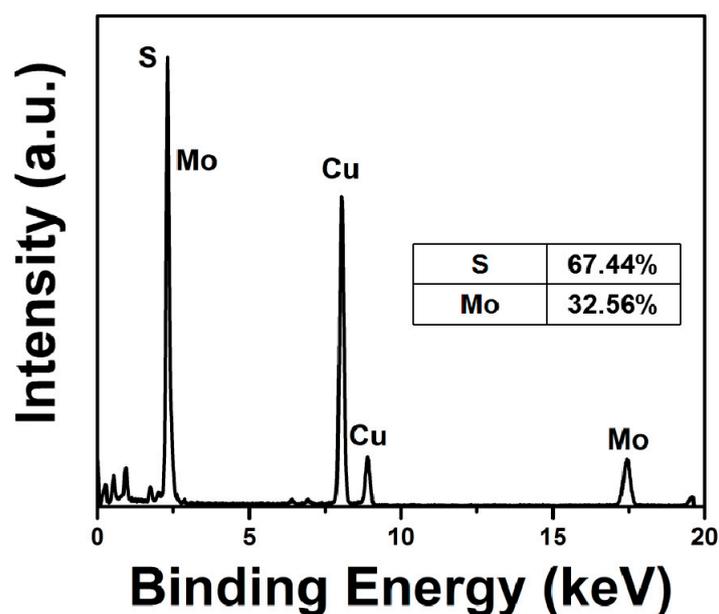
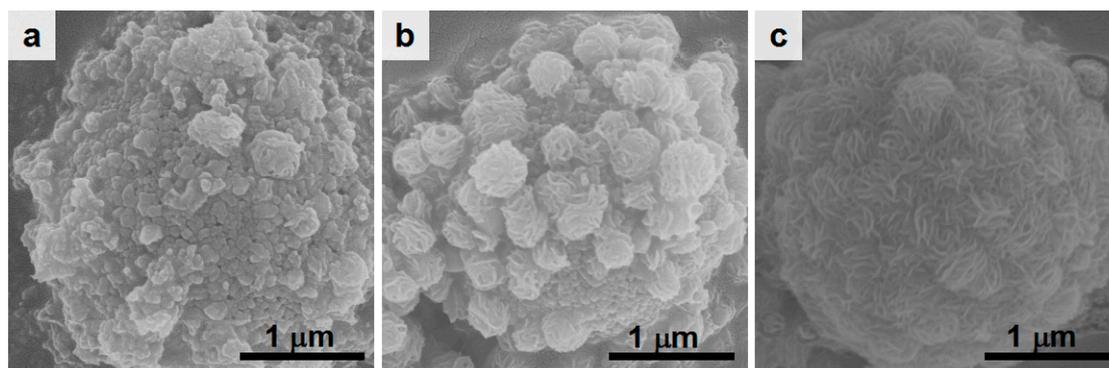
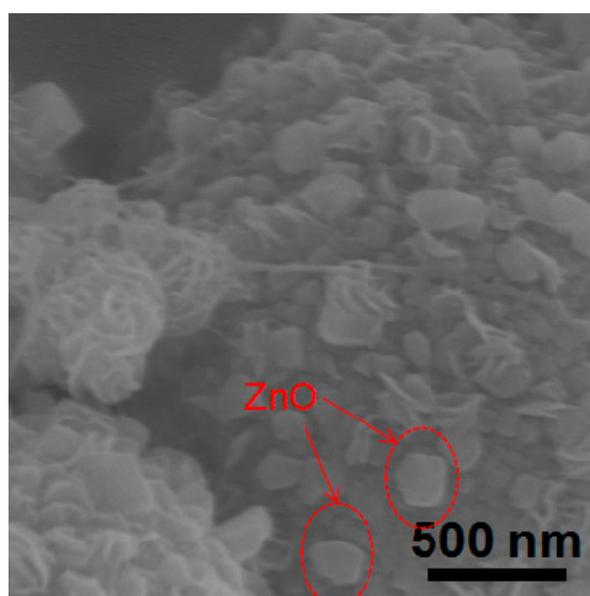


Figure S2. Energy Dispersive X-ray Spectrometer (EDS) spectrum of ZT-MoS<sub>2</sub>.



**Figure S3.** SEM image of different ZT-MoS<sub>2</sub>: (a) ZT-MoS<sub>2</sub>-H, (b) ZT-MoS<sub>2</sub> and (c) ZT-MoS<sub>2</sub>-T.



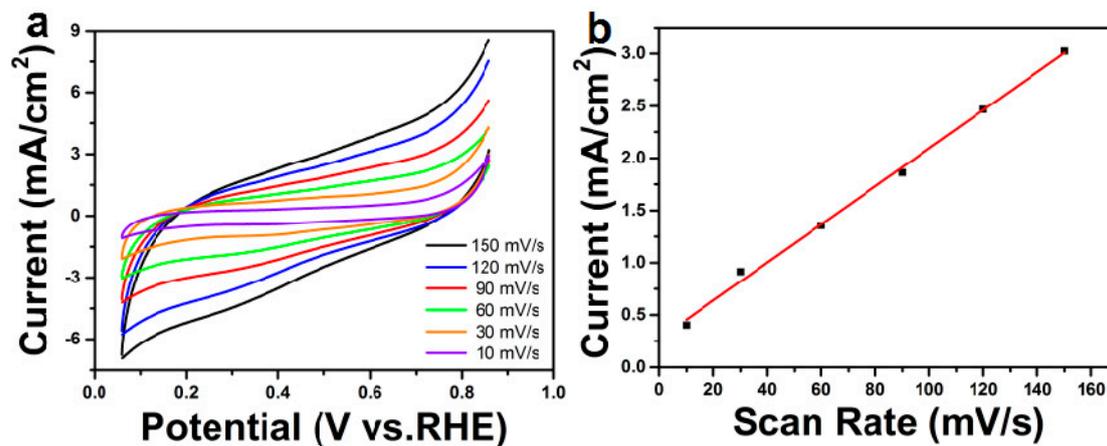
**Figure S4.** SEM image of MoS<sub>2</sub> before HCl etching.

To obtain more information of the intrinsic catalytic activity, the turnover frequency (TOF) for the active sites of ZT-MoS<sub>2</sub> catalysts was further calculated using the roughness factor method according to the following equation.

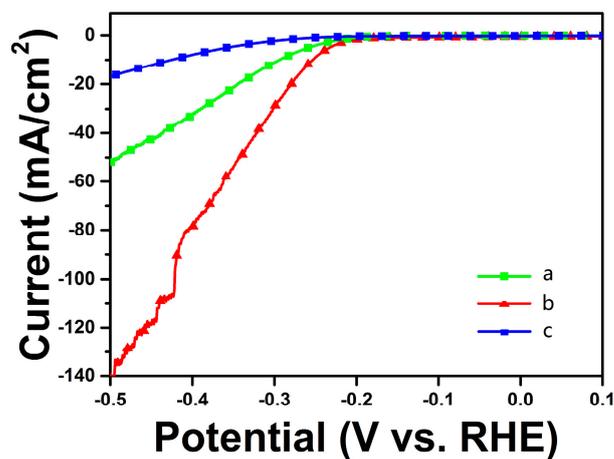
$$D_c = D_s \times \frac{C_{dlc}}{C_{dls}} \quad (1)$$

$$TOF(s^{-1}) = \frac{j / (2 \times q)}{D_c} \quad (2)$$

where  $D_c$  and  $D_s$  was the density of active sites for catalyst (Sites/cm<sup>2</sup>) and standard sample (Sites/cm<sup>2</sup>), the  $C_{dlc}$  and  $C_{dls}$  was the double layer capacitor ( $C_{dl}$ ) for catalysts calculated and for standard MoS<sub>2</sub> (60 μF/cm) by the CV experiment at different scan rates (Figure S5), the  $j$  (A/cm<sup>2</sup>) was the current density of LSV at -500 mV and  $q$  was the elementary charge ( $1.6 \times 10^{-19}$  C). The active sites of ZT-MoS<sub>2</sub> was  $3.53 \times 10^{17}$  sites/cm<sup>2</sup>, which was 1.3 times higher than the MoS<sub>2</sub> ( $2.75 \times 10^{17}$  sites/cm<sup>2</sup>). The ZT-MoS<sub>2</sub> presented a superior TOF of  $1.25 \text{ s}^{-1}$  to P-MoS<sub>2</sub> ( $0.69 \text{ s}^{-1}$ ), further indicating advanced HER catalytic activity of ZT-MoS<sub>2</sub>.



**Figure S5.** Electrochemical measurement for determining TOF: (a) a cyclic voltammetry (CV) curve of ZT-MoS<sub>2</sub> at different scan rates. (b) Current density of CV experiment at overpotential 500 mV vs RHE as a function of scan rates.



**Figure S6.** Polarization curves of different ZT-MoS<sub>2</sub>: (a) ZT-MoS<sub>2</sub>-H, (b) ZT-MoS<sub>2</sub> and (c) ZT-MoS<sub>2</sub>-T.