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Electronic Supplementary Information (ESI)

Metallic 1T-VS_2 nanosheets featuring V^{2+} self-doping and mesopores towards efficient hydrogen evolution reaction

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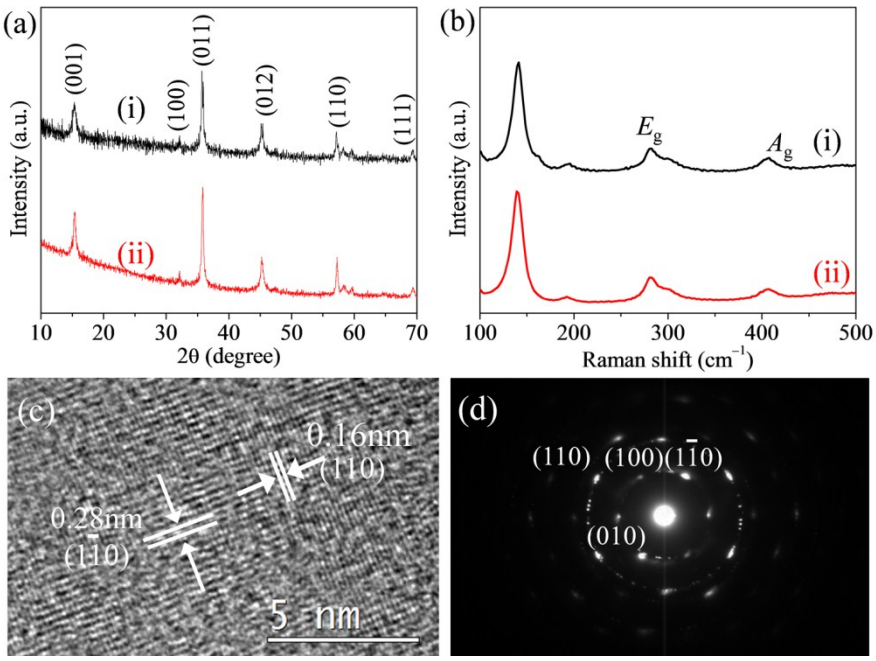

Fig. S1 (a,b) XRD patterns (a) and Raman spectra (b) of the V^{2+}-doped VS_2 mesoporous nanosheets before (i) and after (ii) annealing at 350 °C in N_2 atmosphere, showing outstanding thermal stability. (c,d) HRTEM image (c) and SAED pattern (d) of the annealed VS_2 nanosheets.

Fig. S2 SEM image of the $VS_2 \cdot NH_3$ precursor.

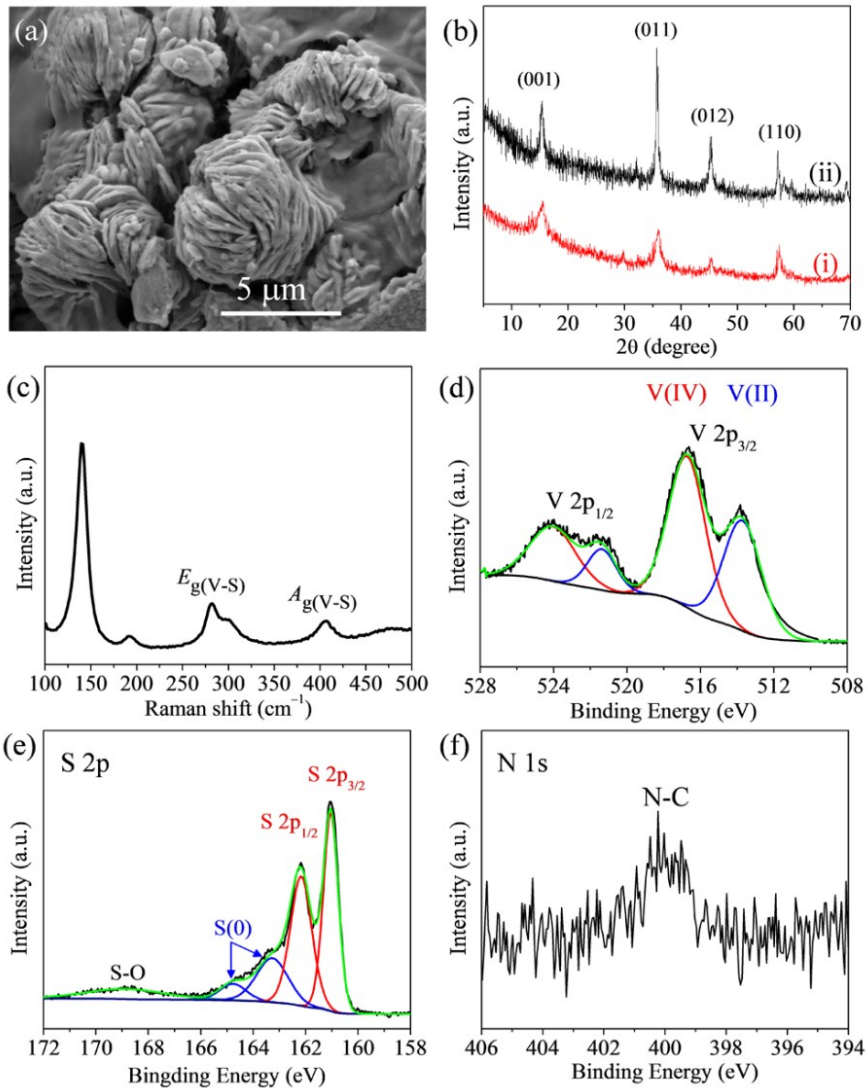

Fig. S3 (a) SEM image of the V^{2+}-doped VS_2 electrocatalyst after stability measurement. Surface of the V^{2+}-doped VS_2 electrocatalyst was slightly contaminated with the binder (Nafion). (b) XRD patterns of the V^{2+}-doped VS_2 electrocatalyst: (i) after and (ii) before stability measurement, indicating the electrocatalyst after stability measurement shows decreased crystallinity. (c) Raman spectrum of the V^{2+}-doped VS_2 electrocatalyst after stability measurement, indicating the well-reserved 1T nature. (d-f) XPS spectra of the V^{2+}-doped VS_2 electrocatalyst after stability measurement, revealing good stability of the surface.

Table S1. Recent advance of HER performance of various VS_2-based catalysts.

Morphology	η (mV) at -10 mA cm^{-2}	Tafel slope (mV dec^{-1})	Stability test (hours)	Counter electrode	Ref.
V^{2+}-doped VS_2 mesoporous nanosheets	59	38	70	Graphite rod	Our work
	43	38		Pt wire	
Array of VS_2 nanoplates on carbon cloth	42	36	12	Graphite rod	*Chem. Mater.*, **2016**, 28, 5587-5591.
VS_2/MWCNTs	123	40	10	Carbon rod	*Int. J. Hydrogen Energy,* **2018**, 43, 22949-22954.
VS_2 nanoflowers	400	170	/		
C/$V_{1.11}S_2$ nanosheets	≈ 50	51	20	Graphite rod	*Electrochimica. Acta.*, **2019**, 300, 208-216.
bulk VS_2	≈ 120	70	/		
VS_2/rGO nanosheets	350	150	/	Graphite rod	*J. Solid State Chem.*, **2015**, 224, 82-87.
VS_2 nanosheets	450	201			
MoS_2 nanodots/VS_2 nanosheets	291	58.1	16	Graphite rod	*ACS Sustainable Chem. Eng.*, **2018**, 6, 15471−15479.
N-doped Ni_3S_2/VS_2 nanosheets	151	107.5	20	Graphite rod	*Electrochimica. Acta.*, **2018**, 269, 55-61.
VSSe nanoplates	180	87	20	Graphite rod	*J. Mater. Chem. A*, **2019**, 7, 15714–15721
CVD grown VS_2 nanosheets	68	34	/	Pt foil	*Adv. Mater.*, **2015**, 27, 5605-5609.
VS_2 nanoflowers	58	34	12	Pt plate	*J. Mater. Chem. A.*, **2017**, 5, 15080-15086.
Interlayer-expanded VS_2 nanosheets	43	36	60	Pt wire	*Small*, **2018**, 170, 3098-3107.
VS_2 nanosheets	41	36	10	Pt wire	*Dalton Trans.*, **2018**, 47, 13792-13799.
VS_4/rGO	210	73	/		
VS_2@MoS_2 nanocomposites	177	54.9	20	Pt wire	*ACS Appl. Mater. Interfaces.*, **2017**, 9, 29942−29949.