

Electronic Supplementary Information (ESI) for:

Defect-decorated NiMoS flower-like nanostructure with self-assembled nanosheets as high-performance hydrodesulfurization catalysts

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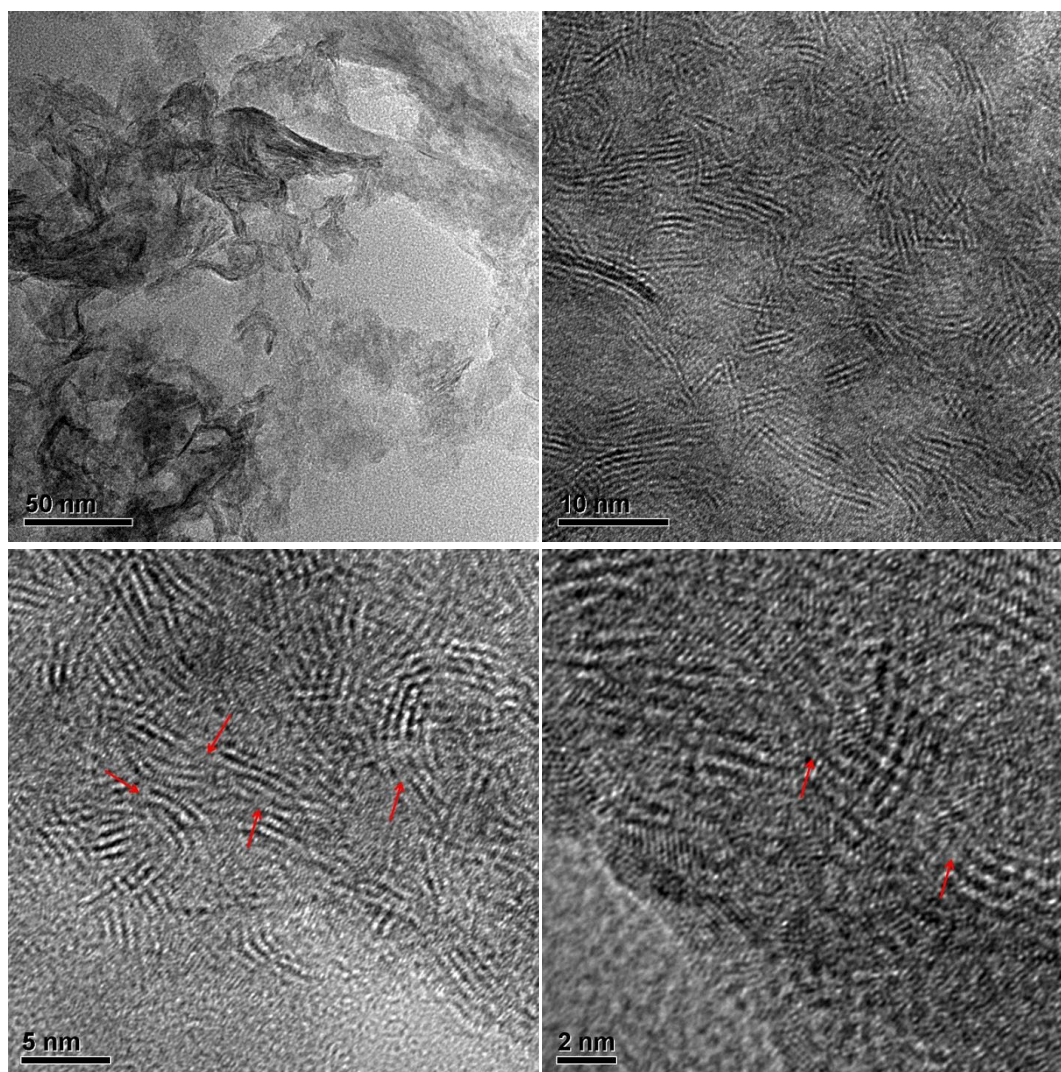


Fig. S1 TEM images of the H₂ treated NiMoS-NSs sample with different magnification (Red arrows reflect the defect sites).

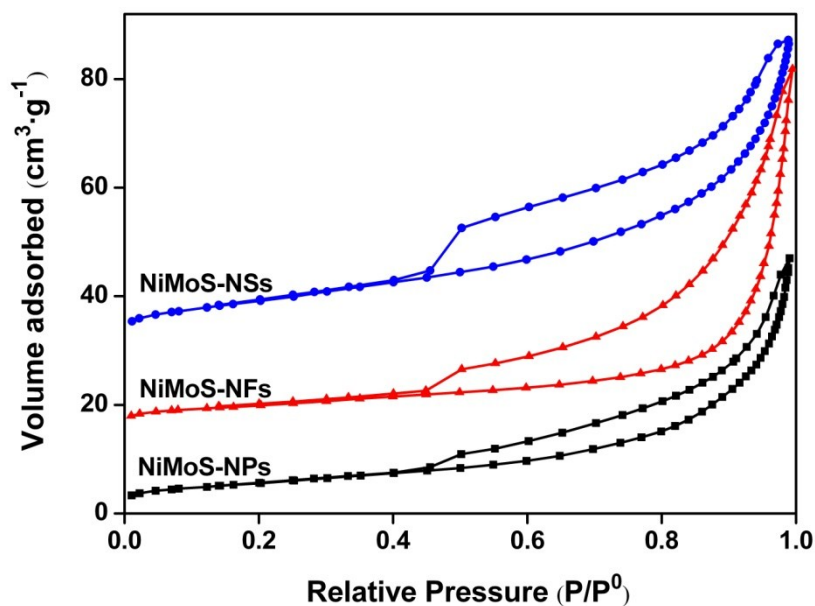


Fig. S2 Nitrogen adsorption-desorption isotherms of the NiMoS samples.

Table S1 XPS parameters of the different contributions of Mo 3d and Ni 2p.

Sample	Mo ^{IV}		Mo ^V		Mo ^{VI}	
	BE (eV)	%atom.	BE (eV)	%atom.	BE (eV)	%atom.
NiMoS-NPs	229.0	83.5	231.1	7.9	232.9	8.6
NiMoS-NFs	229.0	87.6	230.7	6.4	232.9	6.0
NiMoS-NSs	229.0	90.5	231.0	4.0	233.0	5.5

Sample	NiMoS		NiS _x		Ni (II)	
	BE (eV)	%atom.	BE (eV)	BE (eV)	%atom.	BE (eV)
NiMoS-NPs	853.4	57.8	852.9	22.2	855.9	20.0
NiMoS-NFs	853.6	62.2	852.9	20.0	855.8	17.8
NiMoS-NSs	853.5	64.5	852.9	18.1	855.8	17.4

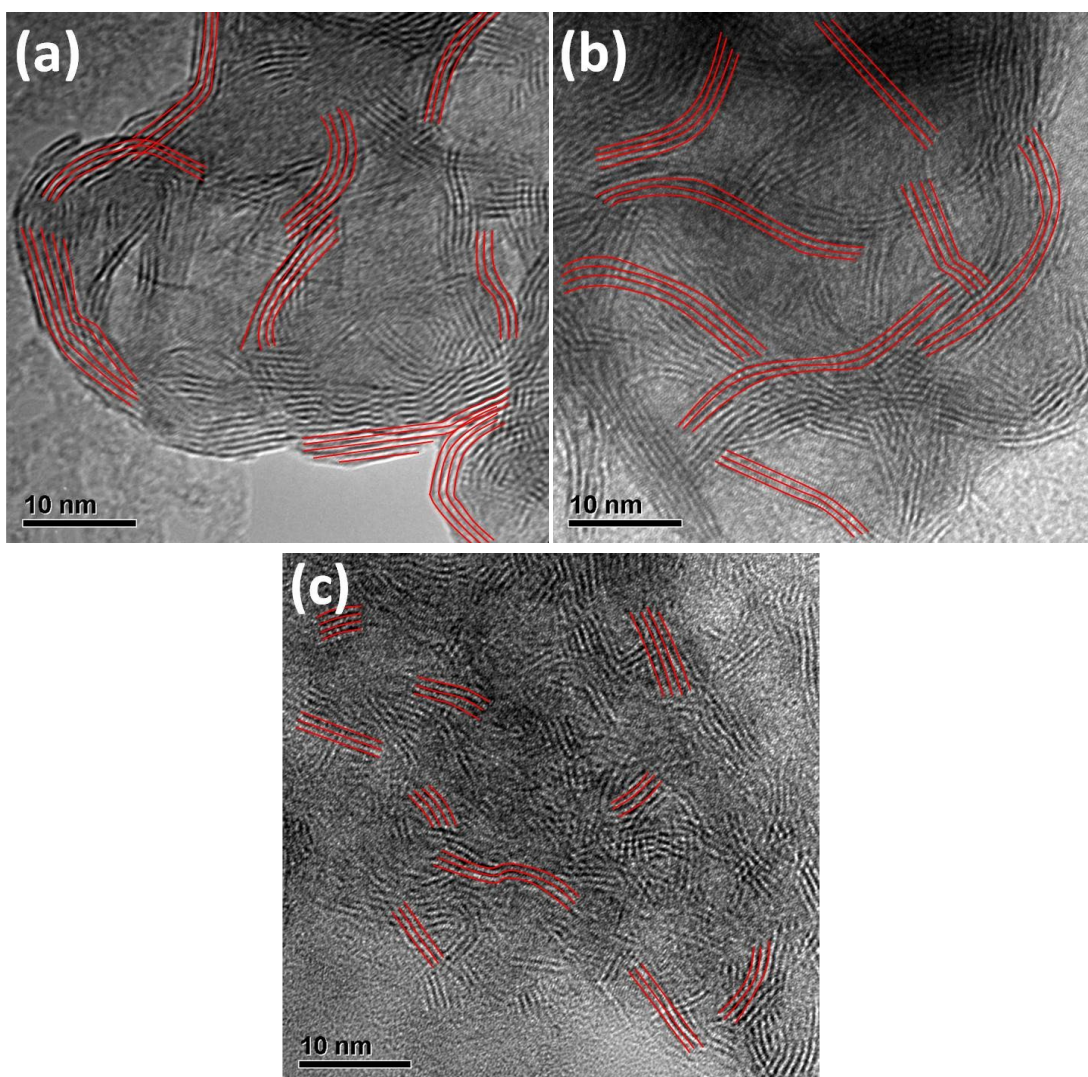


Fig. S3 Schematic diagram of the statistical slabs lengths obtained by TEM images: (a) NiMoS-NPs; (b) NiMoS-NFs; (c) NiMoS-NSs. The MoS₂ fringes were marked as red line, and a piece of software called 'SigmaScan Pro 4' was used to measure the lengths of the marked red line, finally, the measured lengths of the red line were normalized scale bar (10 nm) to obtain actual MoS₂ slabs lengths. Otherwise, the stacking layer numbers were obtained via counting the layer number of the MoS₂ cluster (one by one).

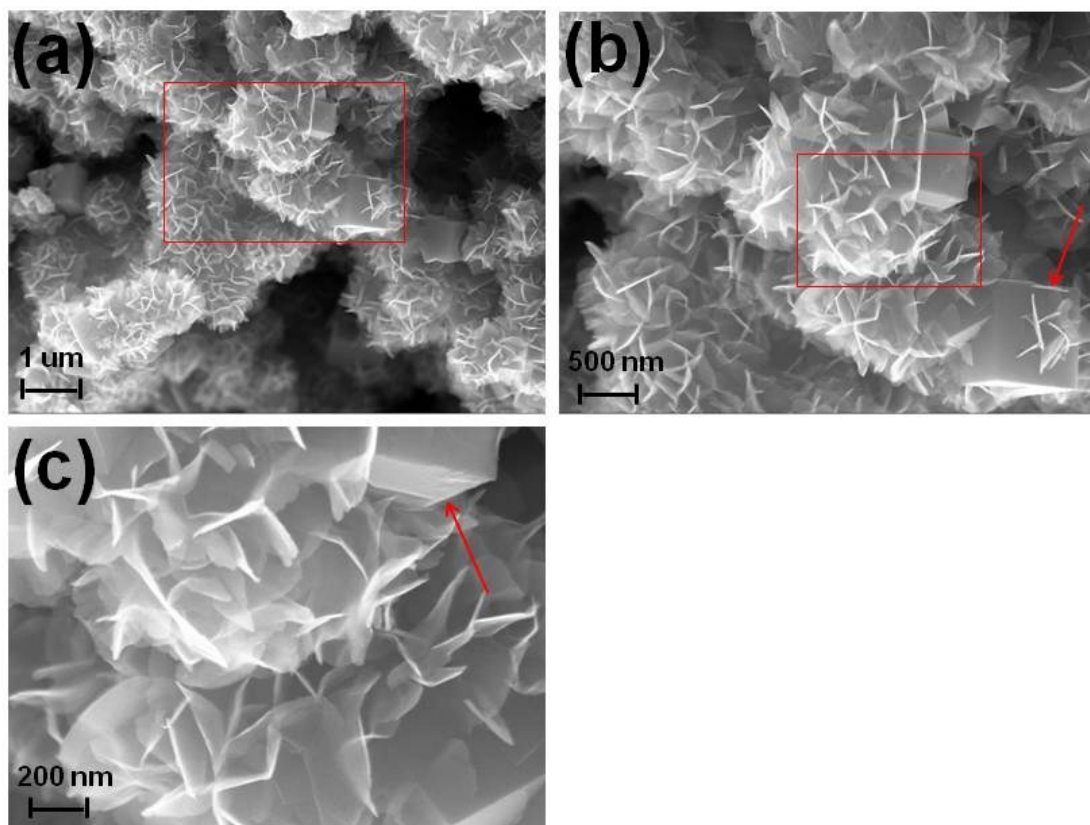


Fig. S4 FESEM images of NiMoS-Nanosheets(NSs) sample: (a) low magnification image, (b) enlarged view of the red rectangle in image 'a', (c) enlarged view of the red rectangle in image 'b' (Red arrows reflect the Ni_3S_2 crystals).

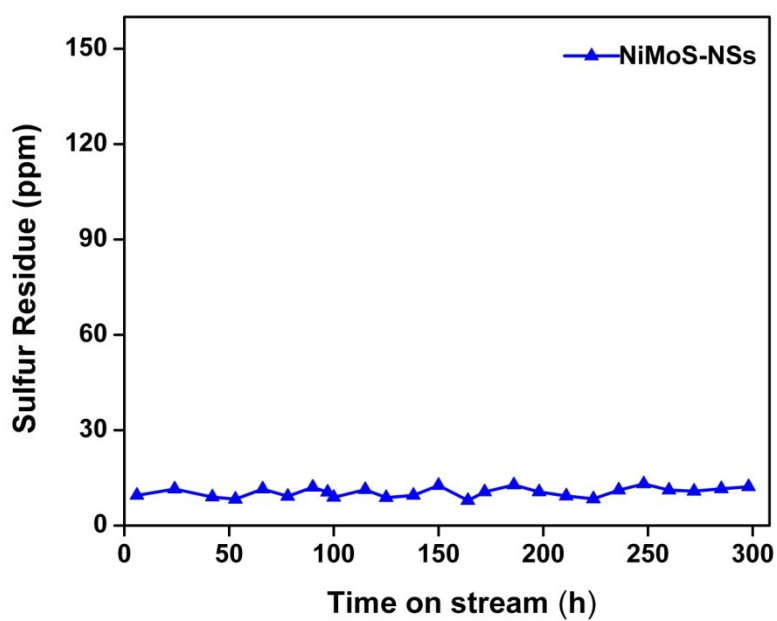


Fig. S5 Sulfur residue in the product with time on stream over the NiMoS-NSs catalyst under reaction conditions of $\text{H}_2/\text{oil} = 600$, $\text{LHSV} = 4 \text{ h}^{-1}$ and H_2 pressure of 3.0 MPa at 350 °C.

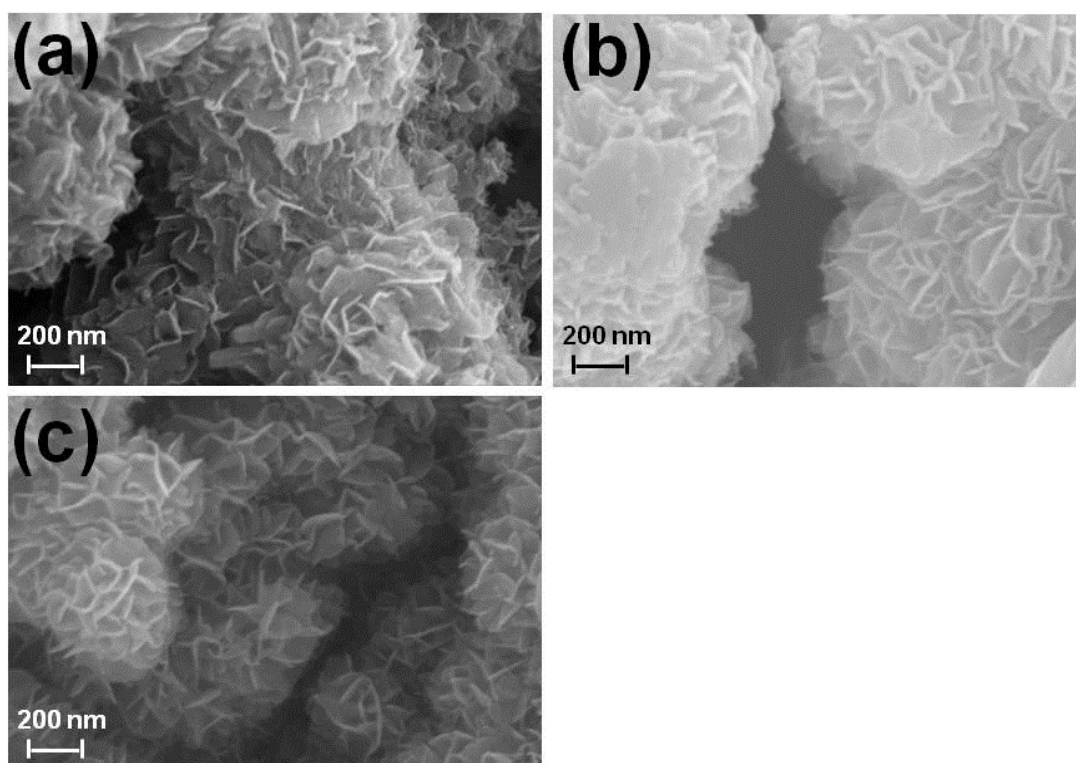


Fig. S6 FESEM images of NiMoS-NSs sample with various hydrazine hydrate (HHA) addition: (a) HHA/Mo=8, (b) HHA/Mo=14, (c) HHA/Mo=22.

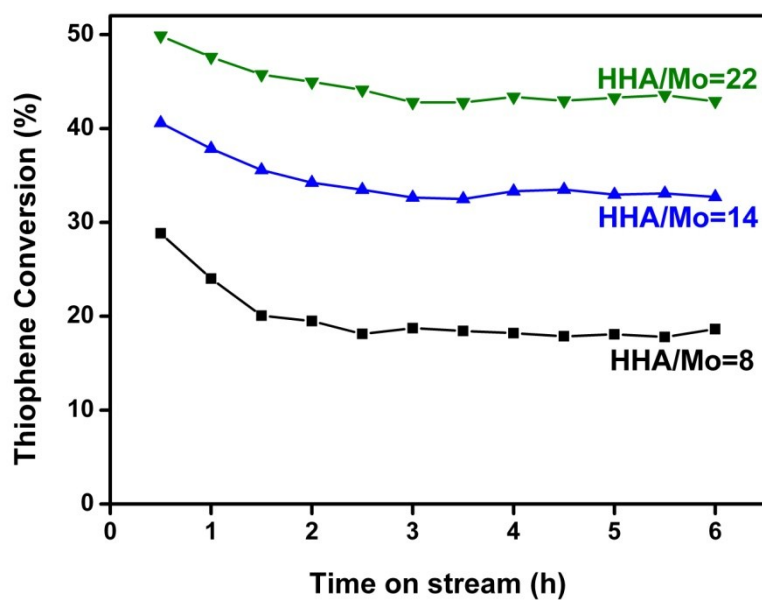


Fig. S7 Thiophene HDS results of NiMoS-NSs catalysts with various hydrazine hydrate (HHA) addition under reaction conditions of H_2 /thiophene=7, $F/m=2.8 \times 10^{-5} \text{ mol} \cdot \text{g}^{-1} \cdot \text{s}^{-1}$ and temperature of 250 °C at atmosphere.