# Supplementary Information

## Distinctive $MoS_2$-MoP nanosheets structure anchored on N-doped porous carbon support as a catalyst to enhance electrochemical hydrogen production

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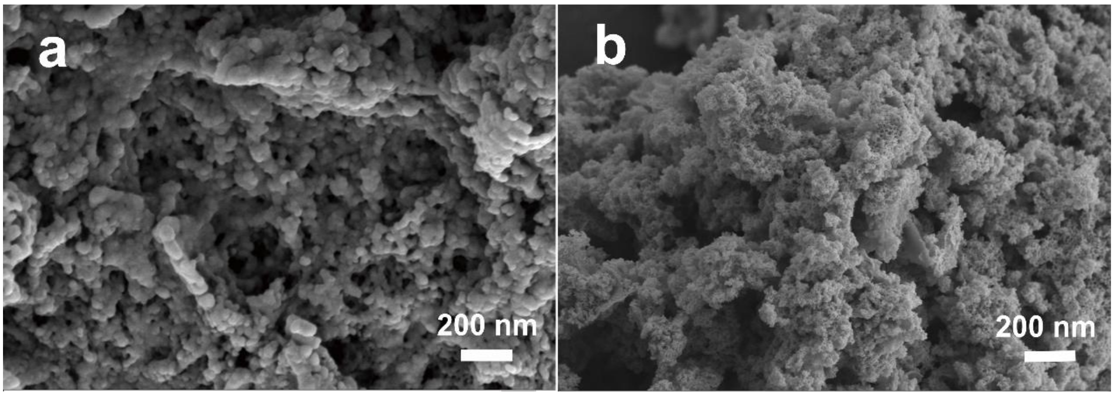


**Fig. S1** SEM images of MoP/NC (a) and $MoS_2$/NC (b).

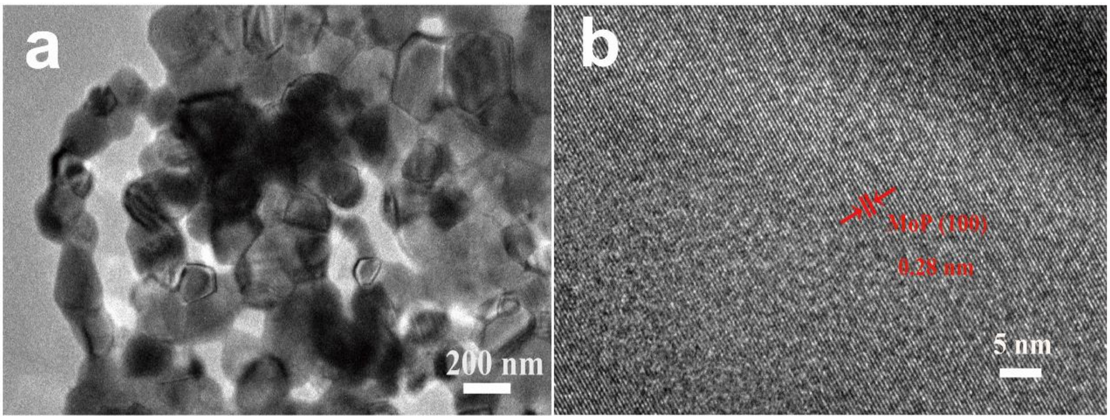


**Fig. S2** TEM images (a) and HR-TEM images (b) of MoP/NC.

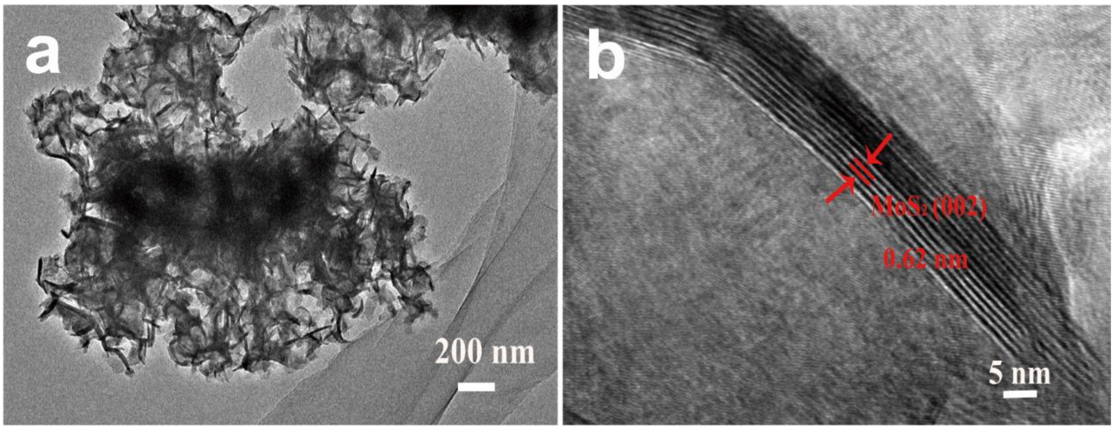


**Fig. S3** TEM images (a) and HR-TEM images (b) of $MoS_2$/NC.

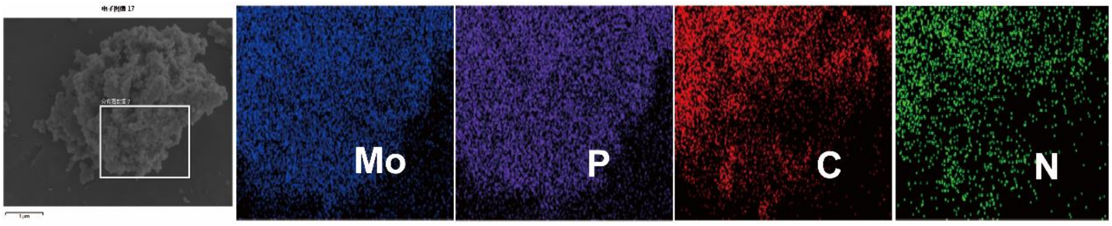


**Fig. S4** EDX elemental mapping of Mo, P, C and N for MoP/NC.

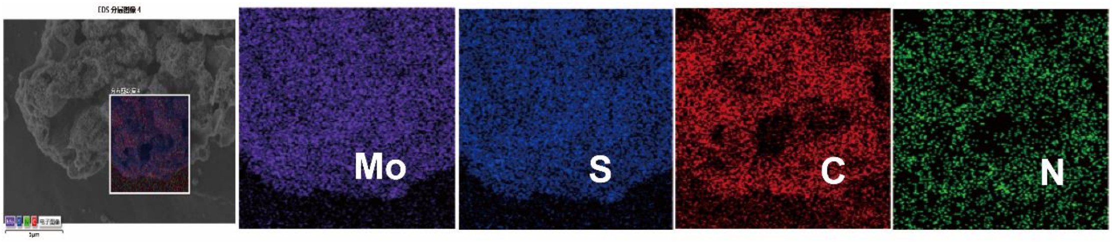


**Fig. S5** EDX elemental mapping of Mo, S, C and N for $MoS_2$/NC.

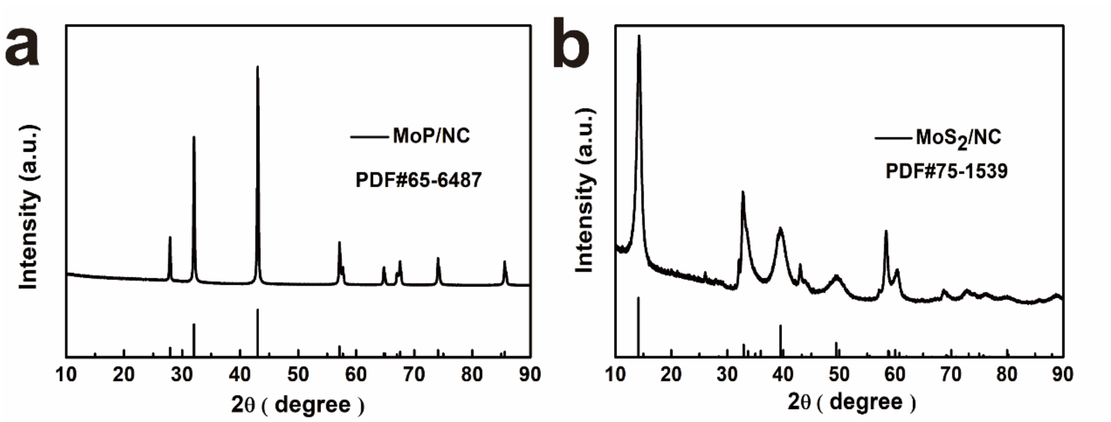


**Fig. S6** XRD patterns of MoP/NC (a) and $MoS_2$/NC (b).

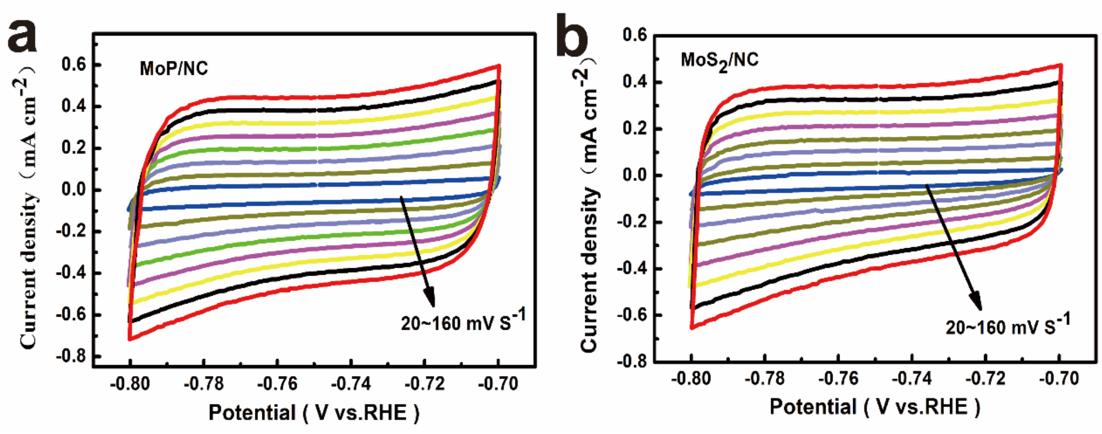


**Fig. S7** CV curves of MoP/NC and $MoS_2$/NC in the non-faradaic capacitance current range at different scan rates in 1 M KOH.

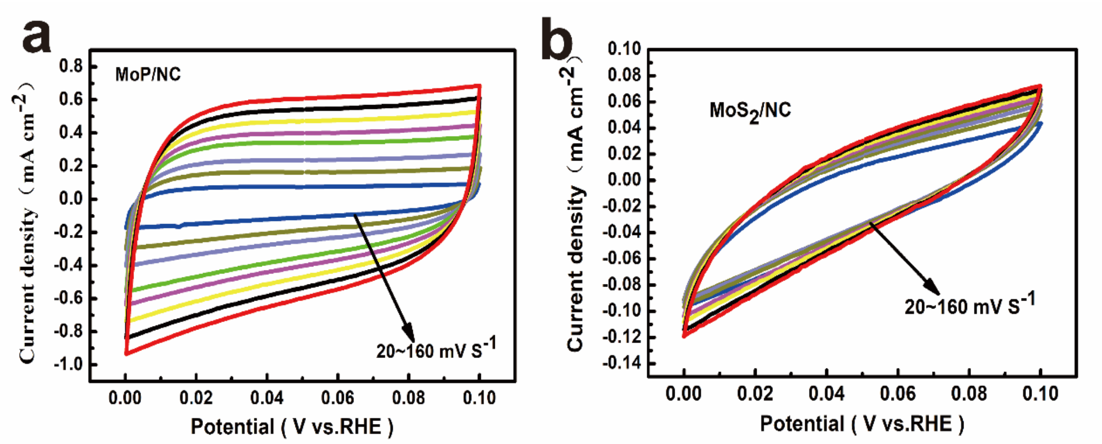


**Fig. S8** CV curves of MoP/NC /NC $MoS_2$ and in the non-faradaic capacitance current range at different scan rates in 0.5 M $H_2SO_4$.

**Table S1** Summary of various MoP and $MoS_2$ based catalysts for HER in 1 M KOH

| Catalyst | $\eta_{10}$ (mV) | Tafel slope (mV $dec^{-1}$) | Reference |
|---|---|---|---|
| $MoS_2$-MoP/NC | 83 | 59.38 | This work |
| MoP/$Mo_2C$@C | 75 | 58 | [1] |
| MnP-MoPNPs/N,P-Gr | 74.2 | 57.7 | [2] |
| MoP/NPG | 126 | 56 | [3] |
| MoP@NC | 149 | 61.7 | [4] |
| Ar-MoP/CC | 100 | 55 | [5] |
| Mn-MoP | 198 | 50 | [6] |
| Fe-$MoS_2$/$CoMo_2S_4$ | 122 | 90 | [7] |
| CoP/CN@$MoS_2$ | 149 | 88 | [8] |
| Co-Ex-$MoS_2$ | 89 | 53 | [9] |
| $MoS_2$-$Ni_3B_4$@NF | 102 | 93 | [10] |

**Table S2** HER parameters of various as-prepared catalysts in 1 M KOH.

| Catalyst | $\eta_{10}$ (mV) | Tafel slope (mV $dec^{-1}$) | $C_{dl}$ (mF $cm^{-2}$) | Rct (Ω) |
|---|---|---|---|---|
| $MoS_2$-MoP/NC | 83 | 59.38 | 17.12 | 17.62 |
| MoP/NC | 279 | 87.43 | 3.01 | 92.34 |
| $MoS_2$/NC | 216 | 71.73 | 2.62 | 75.68 |

**Table S3** Summary of various MoP and $MoS_2$ based catalysts for HER in 0.5 M $H_2SO_4$

| Catalyst | $\eta_{10}$ (mV) | Tafel slope (mV $dec^{-1}$) | Reference |
|---|---|---|---|
| $MoS_2$-MoP/NC | 103 | 59.20 | This work |
| MoP/$Mo_2C$@C | 89 | 45 | [1] |
| MoP/NPG | 148 | 49 | [3] |
| MoP/NG | 94 | 50.1 | [11] |
| MoP@C@rGO | 130 | 79 | [12] |
| MoP@NC-MF | 125 | 53 | [13] |
| MoP/NCNT-NGR | 100 | 44 | [14] |
| $Mo_3P$/MoP | 156 | 59 | [15] |
| $MoS_2$\|P/CNT | 117 | 52.2 | [16] |
| N-$MoS_2$/CN | 114 | 46.8 | [17] |
| $Ag_2S$/$MoS_2$/RGO | 190 | 56 | [18] |

**Table S4** HER parameters of various as-prepared catalysts in 0.5 M $H_2SO_4$.

| Catalyst | $\eta_{10}$ (mV) | Tafel slope (mV dec$^{-1}$) | $C_{dl}$ (mF cm$^{-2}$) | Rct (Ω) |
|---|---|---|---|---|
| $MoS_2$-MoP/NC | 103 | 59.20 | 15.67 | 18.77 |
| MoP/NC | 228 | 98.31 | 3.65 | 85.82 |
| $MoS_2$/NC | 290 | 145.31 | 0.103 | 100.03 |

## Reference


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