

Supplementary data

**In-situ synthesis of molybdenum carbide/N-doped carbon hybrids as an efficient
hydrogen-evolution electrocatalyst**

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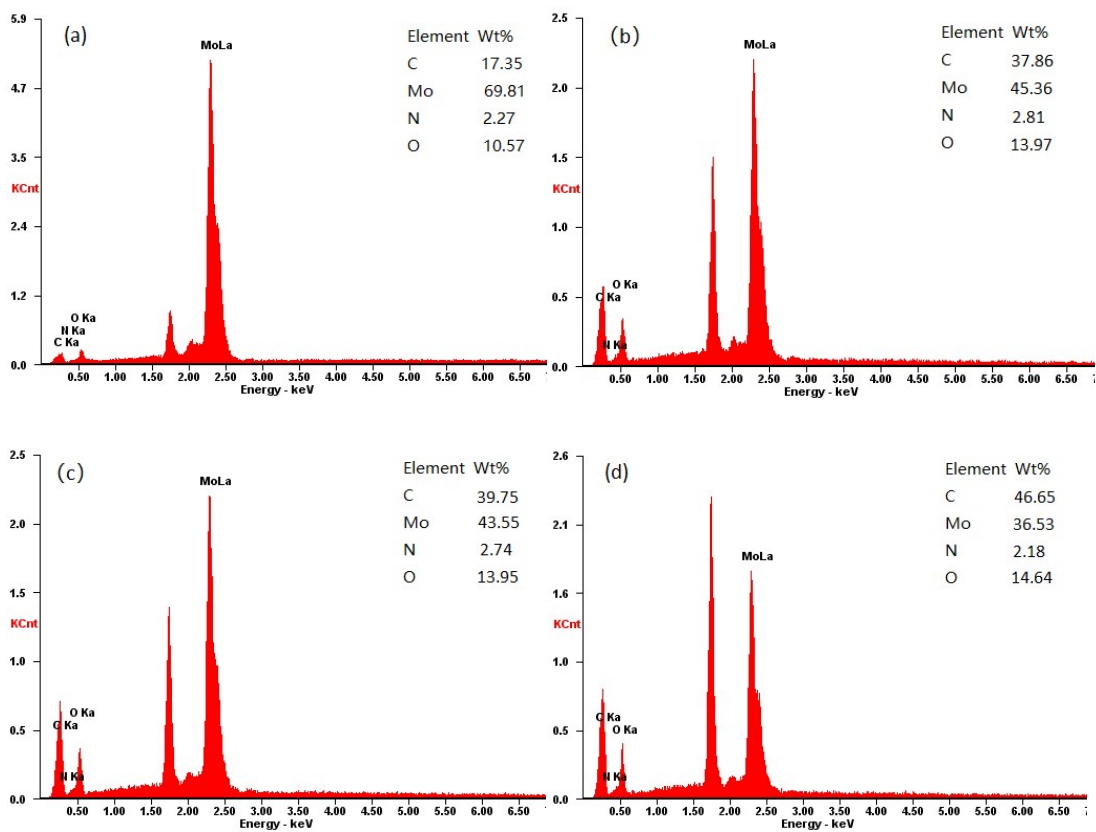


Fig. S1 EDX spectra of $\text{Mo}_2\text{C}@NC$ nanomaterials. (a) $\text{Mo}_2\text{C}@NC-80$, (b) $\text{Mo}_2\text{C}@NC-160$, (c) $\text{Mo}_2\text{C}@NC-240$, (d) $\text{Mo}_2\text{C}@NC-320$. The peaks at 1.74 and 2.01 keV were attributed to Si and P, as the $\text{Mo}_2\text{C}@NC$ nanomaterials were measured on phosphorus-doped N-Type silicon plates.

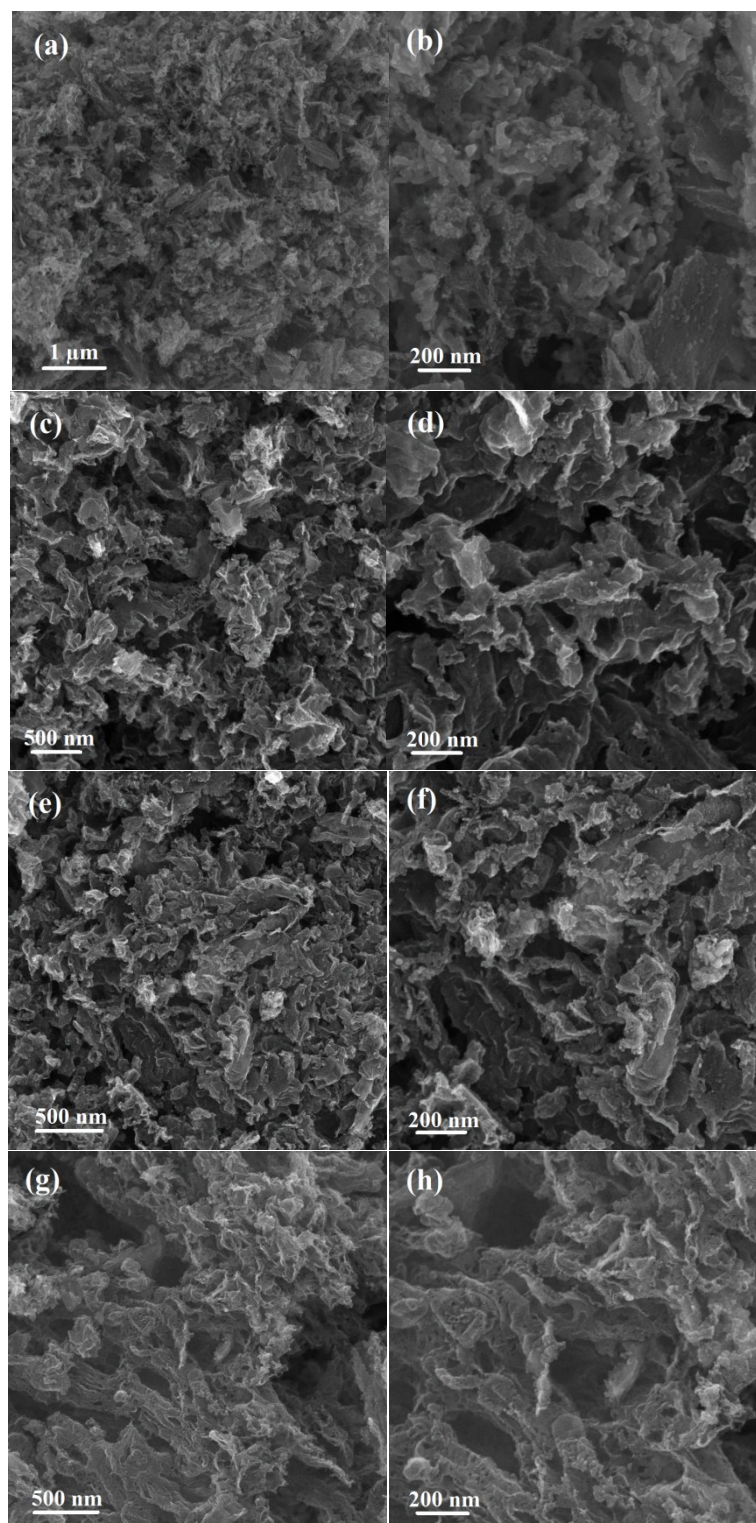


Fig. S2 SEM images of Mo₂C@NC nanomaterials. a and b: Mo₂C@NC-80, c and d: Mo₂C@NC-160, e and f: Mo₂C@NC-240, g and h: Mo₂C@NC-320.

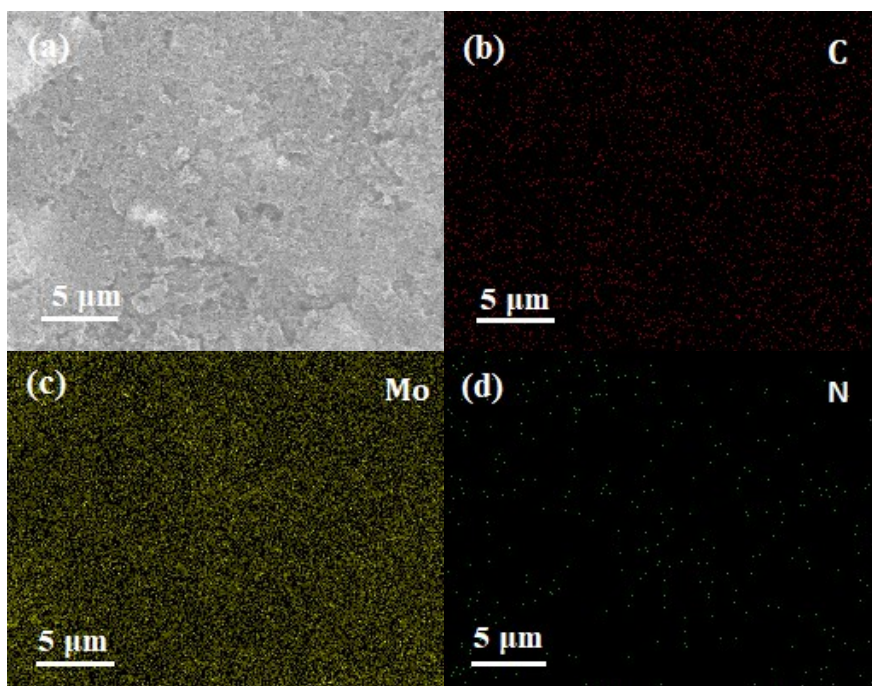


Fig. S3 SEM image and corresponding C, Mo and N elemental mapping of Mo₂C@NC-160.

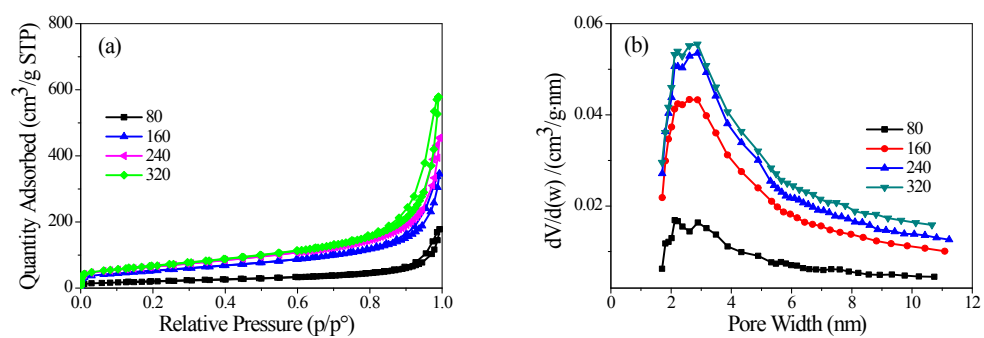


Fig. S4 (a) N₂ adsorption-desorption isothermal curves and (b) pore distribution of Mo₂C@NC nanomaterials.

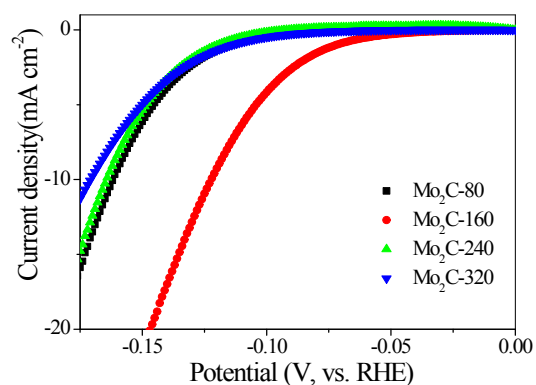


Fig. S5 Polarization curves of different Mo₂C@NC electrocatalysts without IR corrections. The HER activity of Mo₂C without IR correction also followed the order: Mo₂C@NC-160 > Mo₂C@NC-80 > Mo₂C@NC-240 > Mo₂C@NC-320. And it needed overpotentials of 106, 140, 144 and 163 mV to reach a current density of 10 mA cm² for Mo₂C@NC-160, Mo₂C@NC-80, Mo₂C@NC-240 and Mo₂C@NC-320, respectively.

Table S1 Summary of information for Mo₂C@NC electrocatalysts.

Samples	Free Carbon content (%)	BET Surface Area (m ² /g)	η_{10} (mA cm ²)	Tafel slope [mV/decade]	j_0 [10 ⁻² mAcm ²]	TOF [10 ⁻³ s ⁻¹]	R _{ct} [Ω]
Mo ₂ C@NC-80	3.7	70.8	124	45	0.814	0.806	45.4
Mo ₂ C@NC-160	28.1	186.7	90	50	7.65	11.7	28.5
Mo ₂ C@NC-240	35.9	230.9	128	55	2.42	1.16	71.6
Mo ₂ C@NC-320	41.3	240.2	147	63	2.74	0.555	90.1

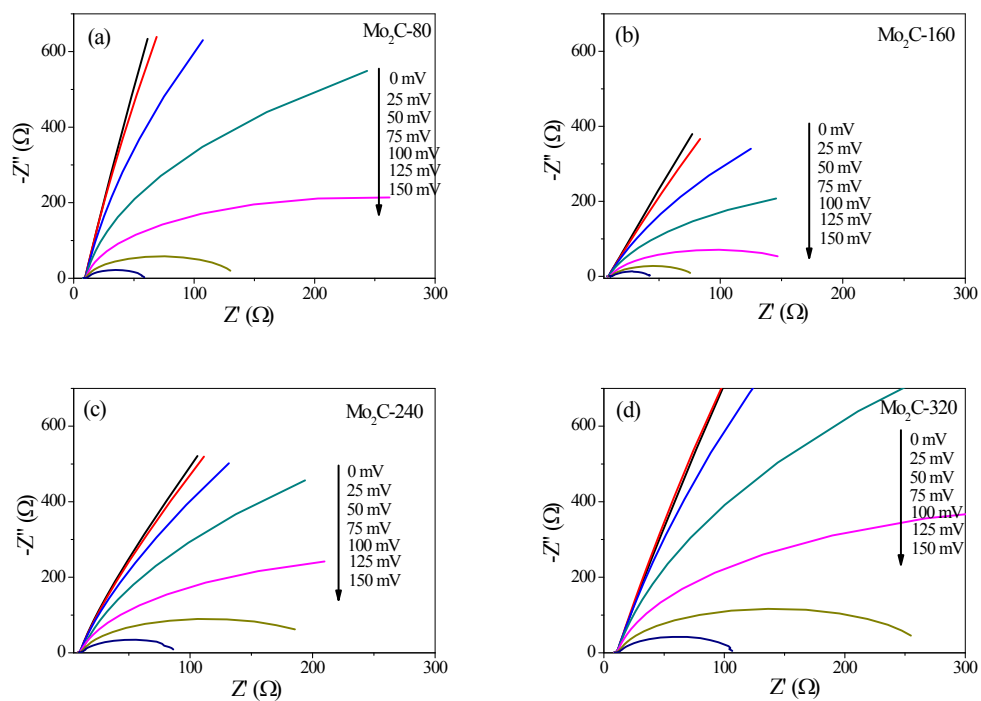


Fig. S6 Electrochemical impedance spectroscopy (EIS) Nyquist plots of different Mo₂C@NC electrocatalysts.

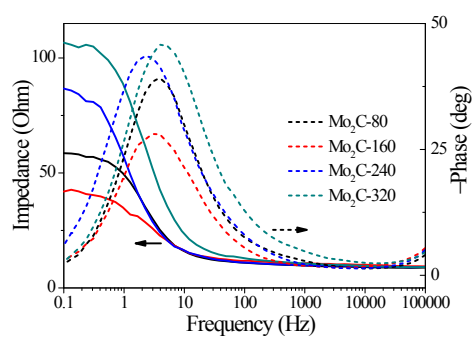


Fig. S7 Comparison of bode plots for different Mo₂C@NC electrocatalysts at $\eta = 150$ mV.

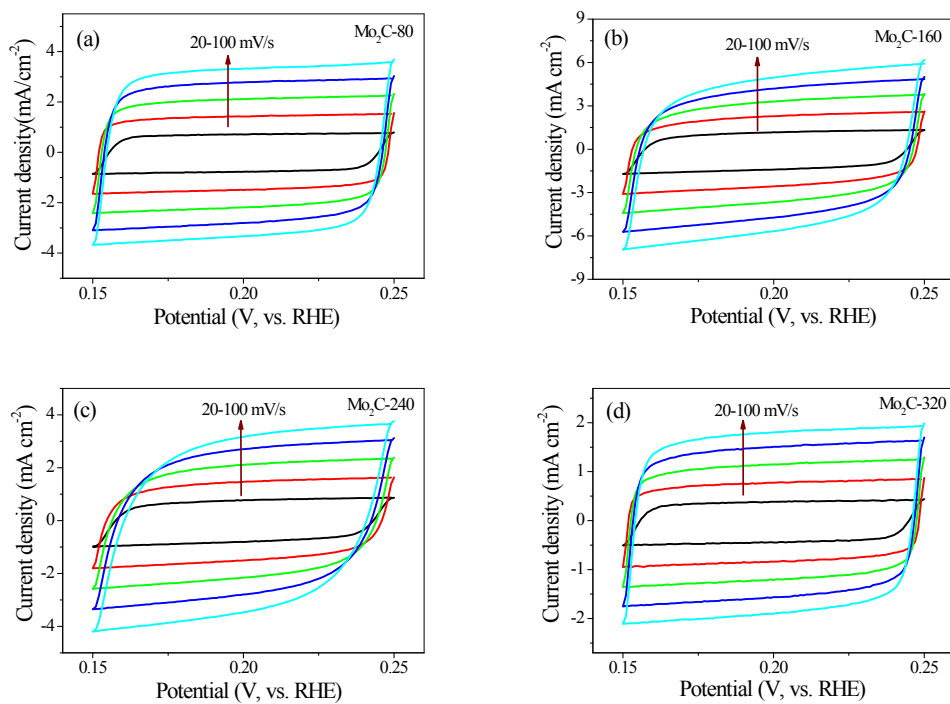


Fig. S8 CVs performed at various scan rates of different $\text{Mo}_2\text{C}@NC$ electrocatalysts.

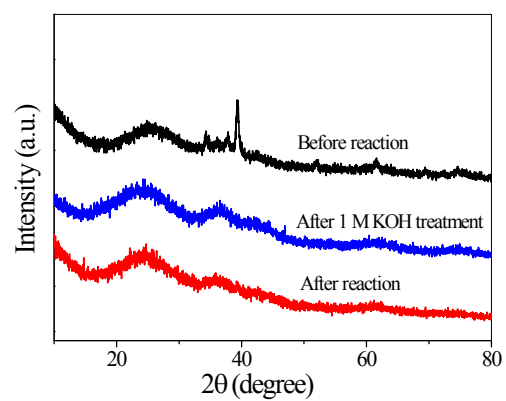


Fig. S9 XRD patterns of Mo₂C@NC-160 in different conditions.