Supporting Information

Frogspawn inspired twin Mo_2C/Ni composite with conductive fibrous network as robust bifunctional catalyst for advanced anion exchange membrane electrolyzers

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Scherrer equation

The average particle size of the grains was calculated according to the **Equation S1**.

$$D = \frac{k\lambda}{\beta \cos\theta} \quad (1)$$

In equation S1, k is the scherrer constant (0.9), λ is the X-ray wavelength (0.15406 nm), β is the half width of the diffraction peak, θ is the diffraction angle.

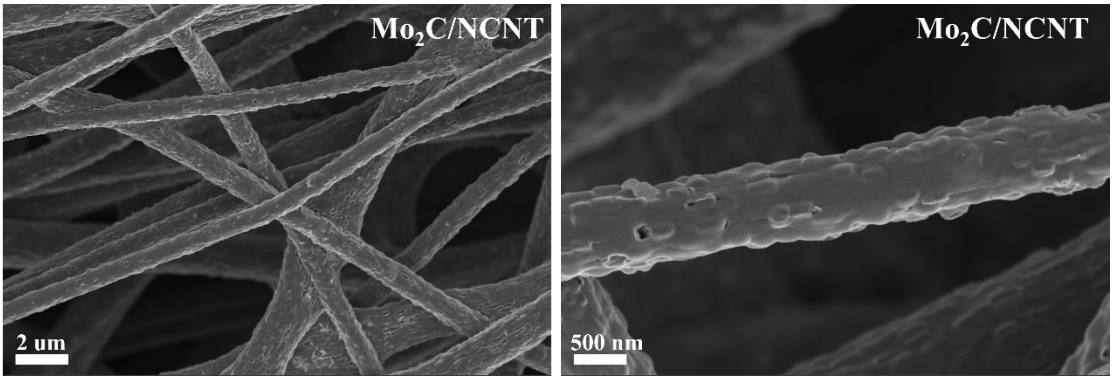

Figure S1. SEM image of the Mo_2C/NCNTs.

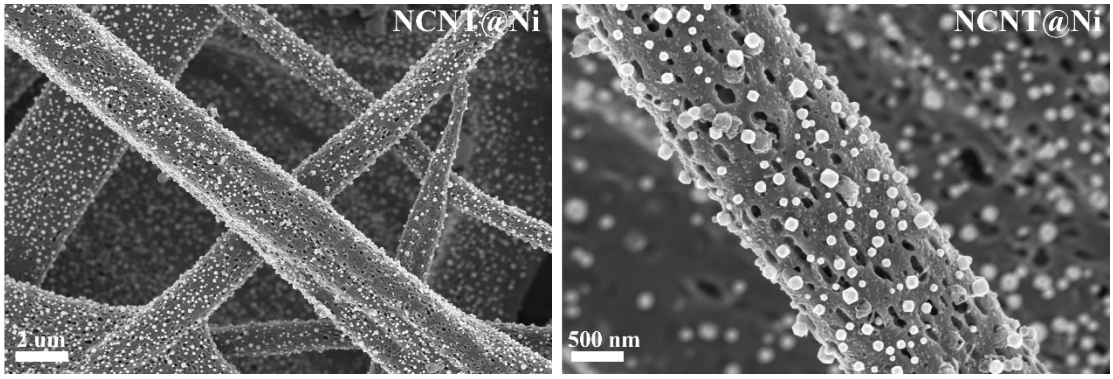

Figure S2. SEM image of the NCNTs@Ni.

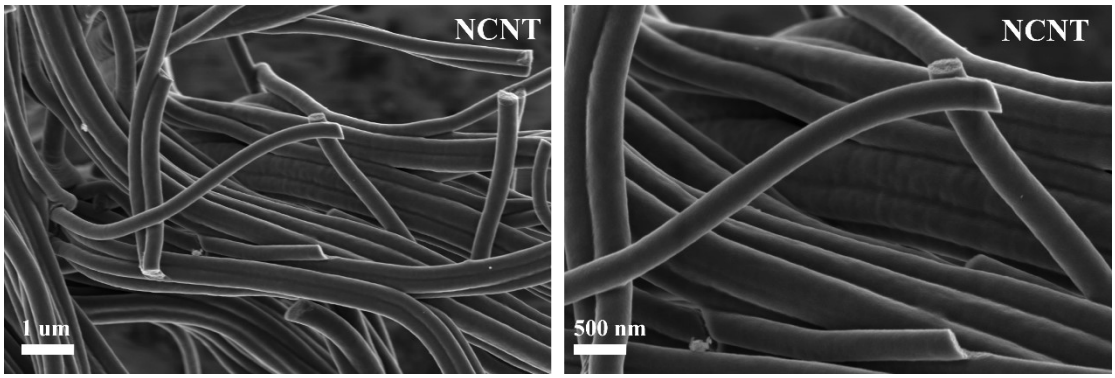

Figure S3. SEM image of the NCNTs.

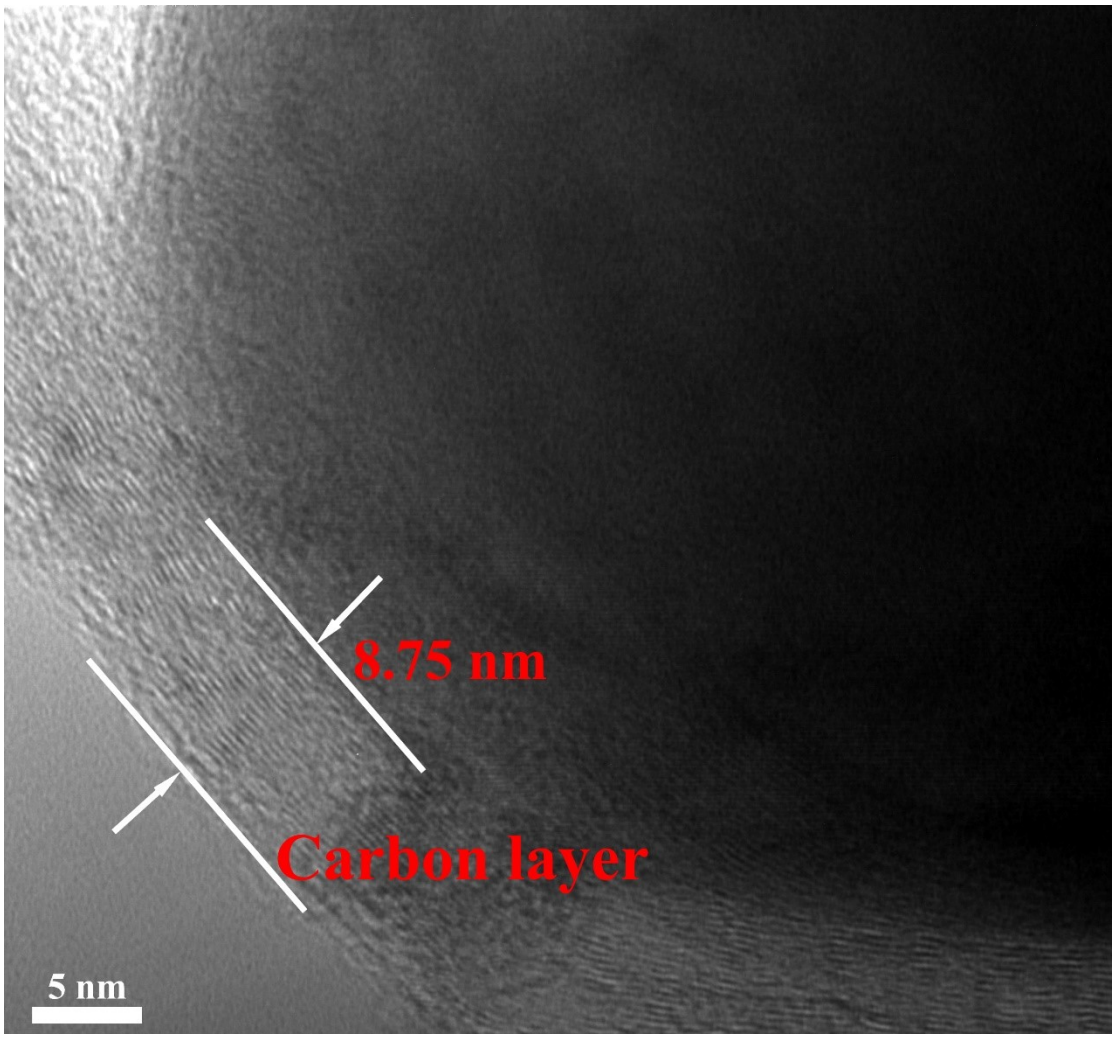

Figure S4. HAADF-STEM image of the Mo_2C/NCNTs@Ni.

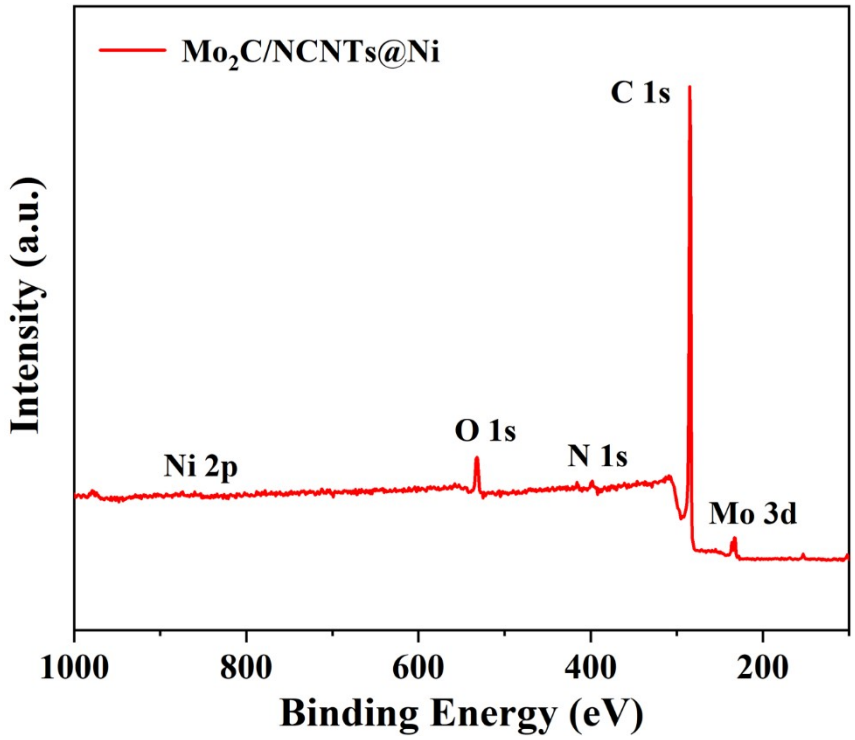

Figure S5. XPS full scan of the Mo_2C/NCNTs@Ni.

Table S1. Calculated R_{ct} values of the samples based on equivalent circuit models.

sample	R_{ct} (Ω)
Mo_2C/NCNTs@Ni	5.31
Mo_2C/NCNTs	8.20
NCNTs@Ni	6.98

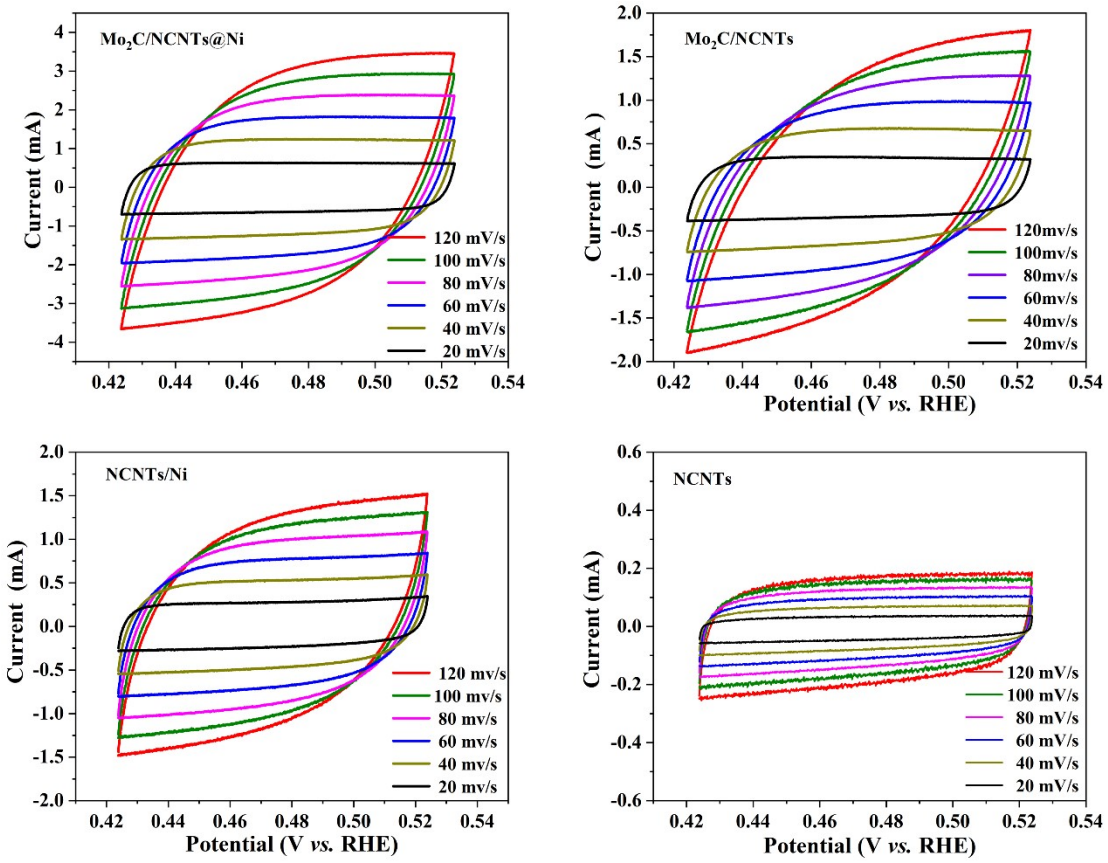

Figure S6. Cyclic voltammograms at different scan rates. (a) Mo_2C/NCNTs@Ni. (b) Mo_2C/NCNTs. (c) NCNTs@Ni. (d) NCNTs.

Table S2. Calculated R_{ct} values of the samples based on equivalent circuit models.

sample	R_{ct} (Ω)
Mo_2C/NCNTs@Ni	4.73
Mo_2C/NCNTs	6.49
NCNTs@Ni	6.43

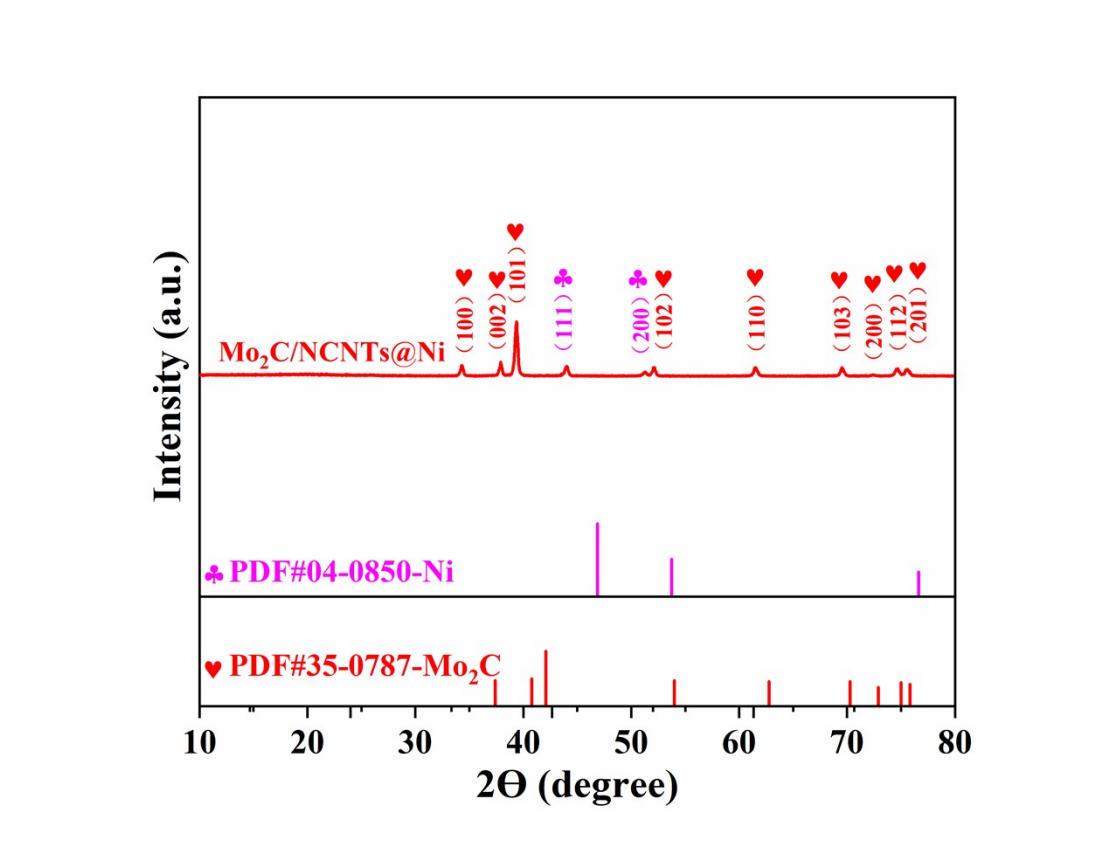

Figure S7. XRD patterns of the Mo_2C/NCNTs@Ni after the HER durability test.

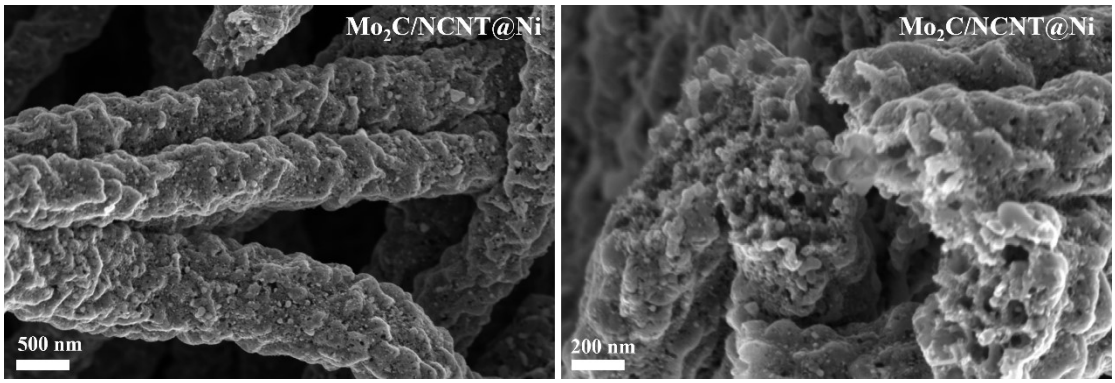

Figure S8. SEM image of the Mo_2C/NCNTs@Ni after the HER durability test.

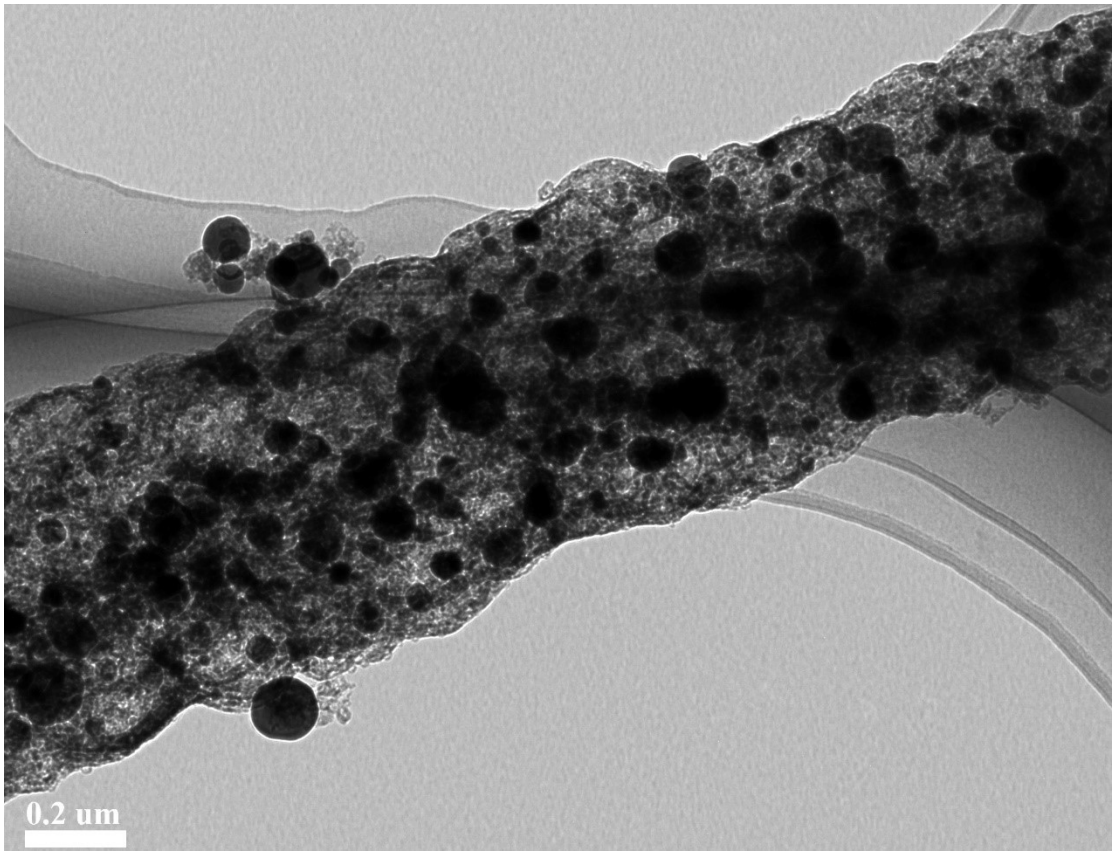

Figure S9. SEM image of the Mo_2C/NCNTs@Ni after the HER durability test.

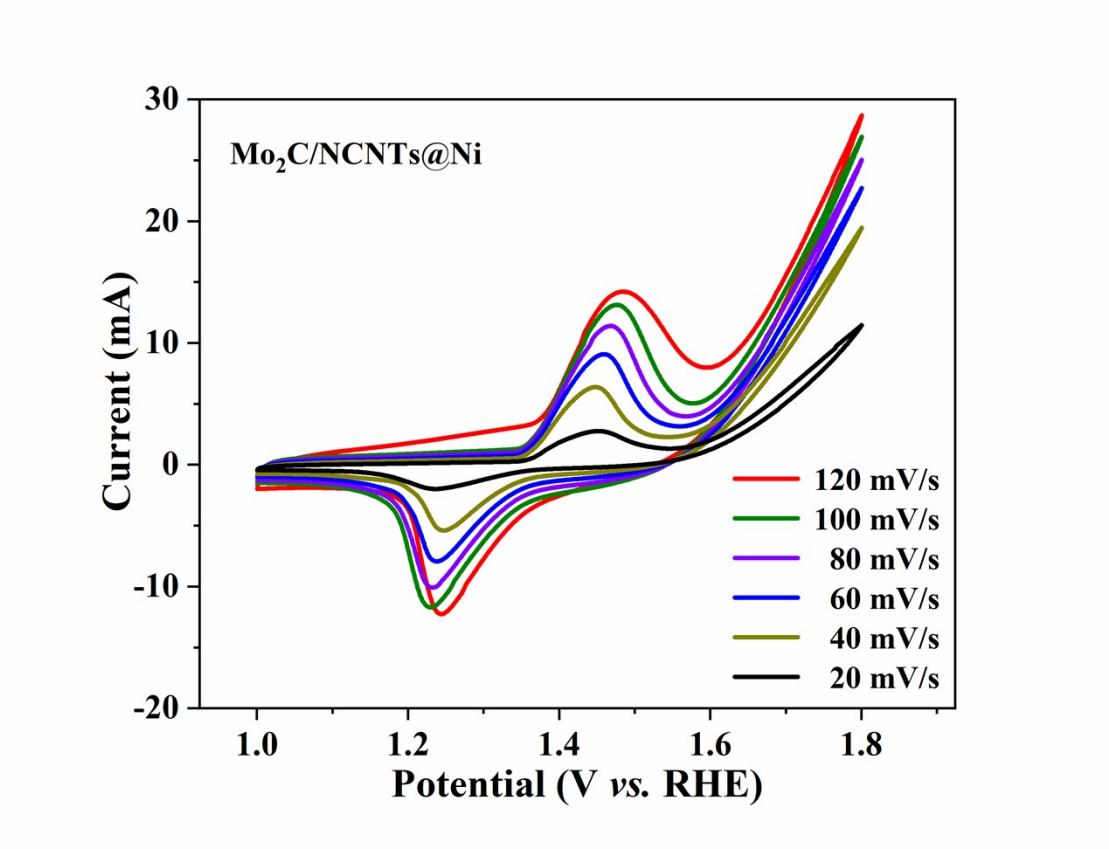

Figure S10. CVs for Mo_2C/NCNTs@Ni in the faradic capacitance current range at scan rates from 20 to 120 mV s^{-1}.

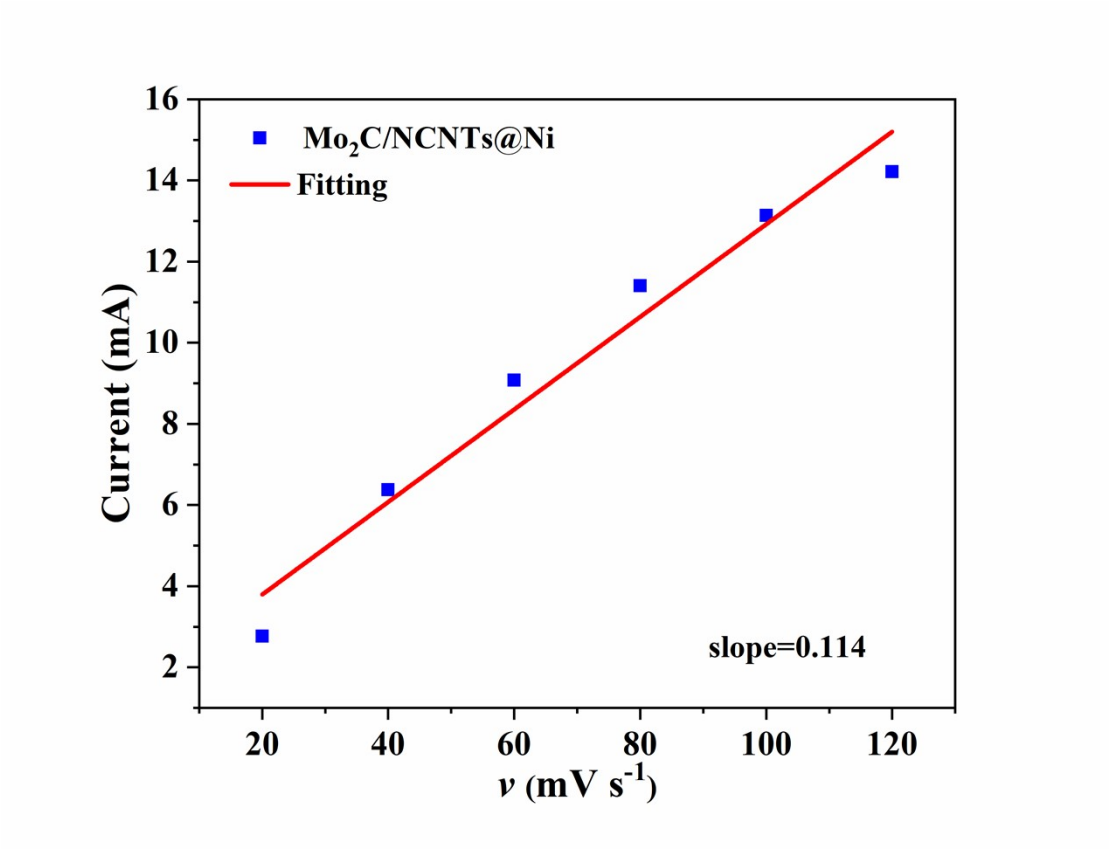

Figure S11. The corresponding plot of oxidation peak current versus the scan rate from CV test.

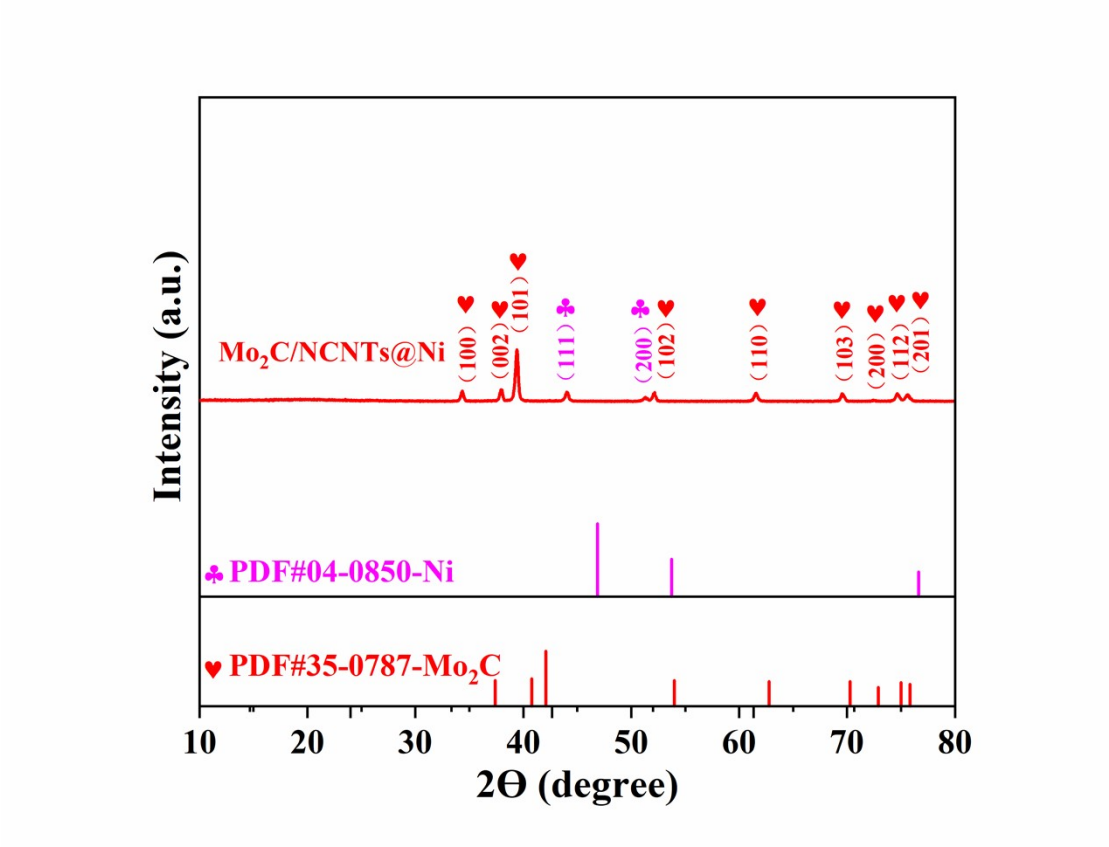

Figure S12. XRD patterns of the Mo_2C/NCNTs@Ni after the OER durability test.

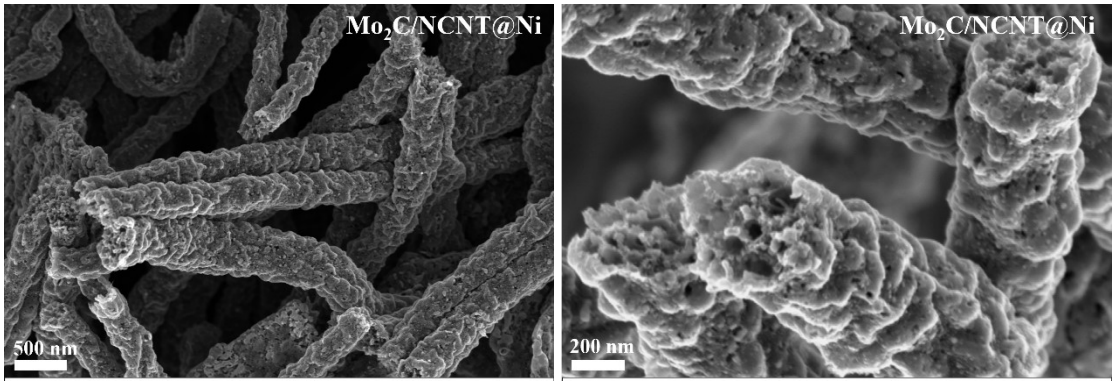

Figure S13. SEM image of the Mo_2C/NCNTs@Ni after the OER durability test.

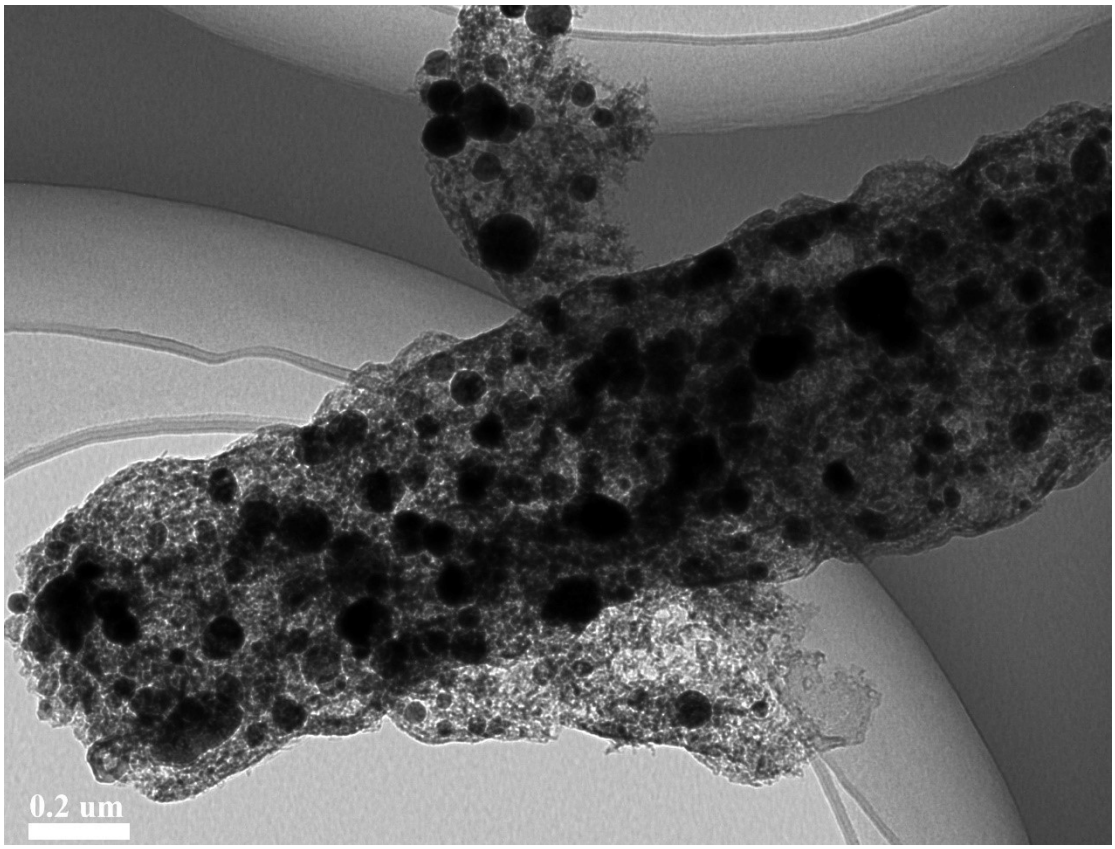

Figure S14. SEM image of the Mo_2C/NCNTs@Ni after the OER durability test.

Table S3. Activity comparison of AEM water electrolysis.

Catalyst	Temperature	Activity	Ref.
Mo_2C/NCNTs@Ni|| Mo_2C/NCNTs@Ni	room temperature	82.5 mA cm^{-2} at 1.99 V	This work
Co-Mo_2C@NC||Co-Mo_2C@NC	room temperature	10 mA cm^{-2} at 1.83 V	[1]
Nickel nanopowders ||$Li_{0.21}Co_{2.79}O_4$	45°C	300 mA cm^{-2} at 2.05 V	[2]
Ni/CP||Ni/CP	50°C	150 mA cm^{-2} at 1.9 V	[3]
Co_3O_4eCuO||Ni	40°C	92.11 mA cm^{-2} at 2 V	[4]
$CuCoO_x$||Ni/(CeO_2-La_2O_3)/C	60°C	74 mA cm^{-2} at 2 V	[5]
$Cu_{0.7}Co_{2.3}O_4$||Pt	25 °C	73.33 mA cm^{-2} at 2 V	[6]
CuxMg$_{0.9-x}$$Co_{2.1}O_4$||Pt	40°C	66.67 mA cm^{-2} at 2 V	[7]
SG-LSFN-0.5||Pt/C	room temperature	100 mA cm^{-2} at 1.89 V	[8]

References:

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