Electronic Supplementary Material (ESI) for ChemComm.

Supporting information

Ni doped Mo_2C/NCF composite for efficient electrocatalytic hydrogen evolution

Jie Yang[1], Tariq Bashir[1], Yanping Lin[2], Lijun Gao[1]*

1. College of Energy, Soochow Institute for Energy and Materials Innovations, Soochow University, Suzhou 215006, China
2. School of Physics and Energy, Xuzhou University of Technology, Xuzhou 221018, China

* Corresponding author: gaolijun@suda.edu.cn (L. Gao)

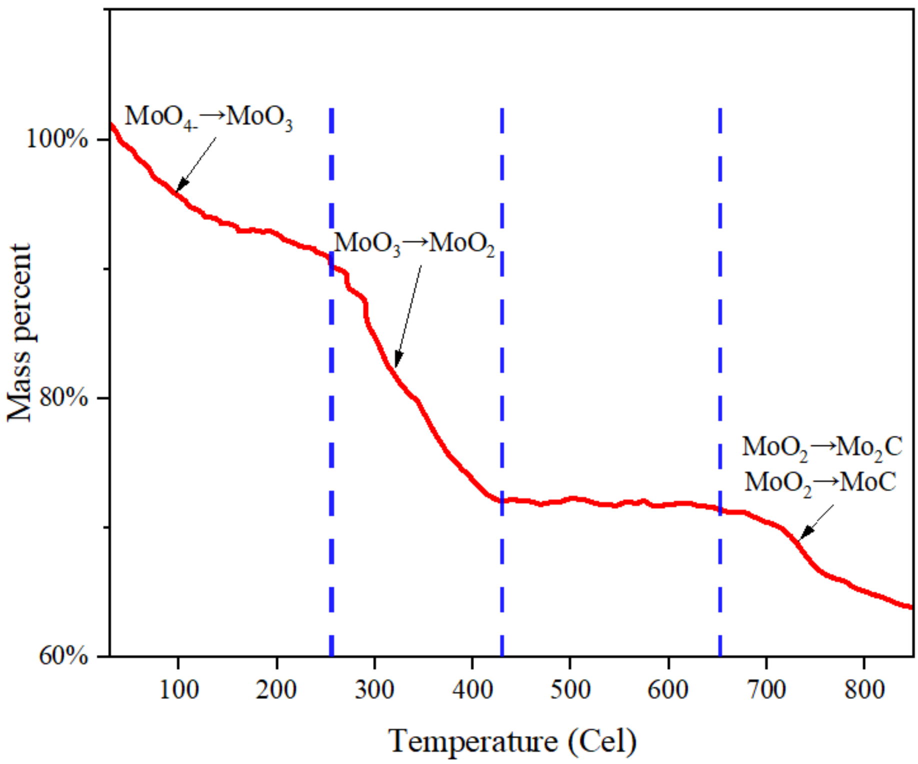


Fig. S1 Thermo-gravimetric profile of dopamine-chelating ammonium molybdate.

a b

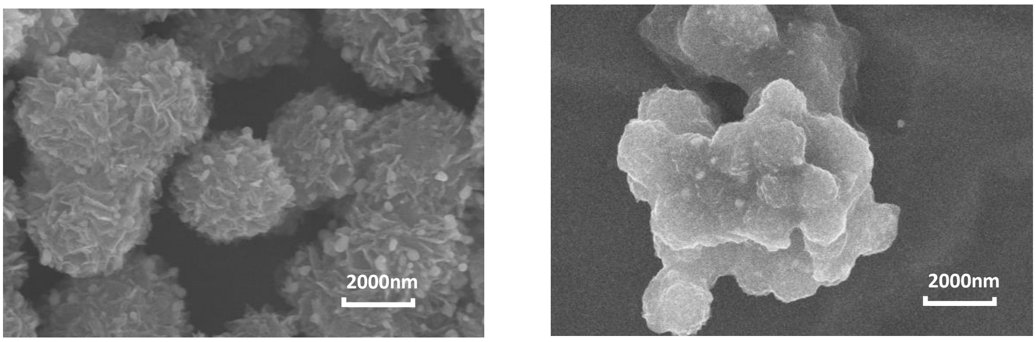
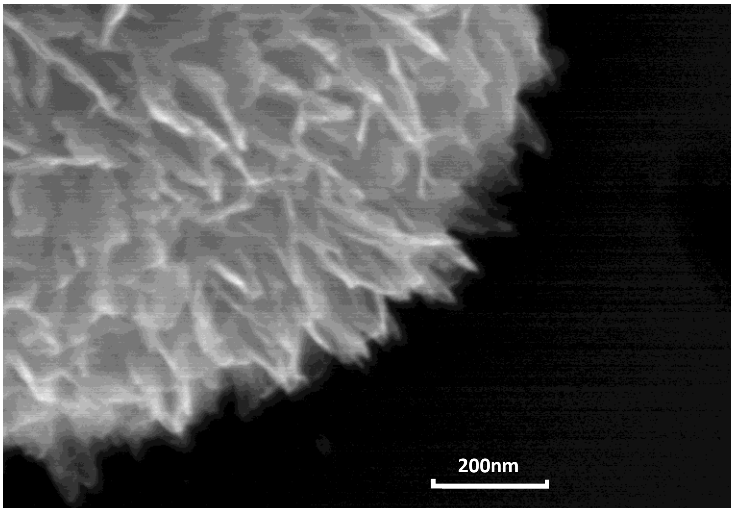
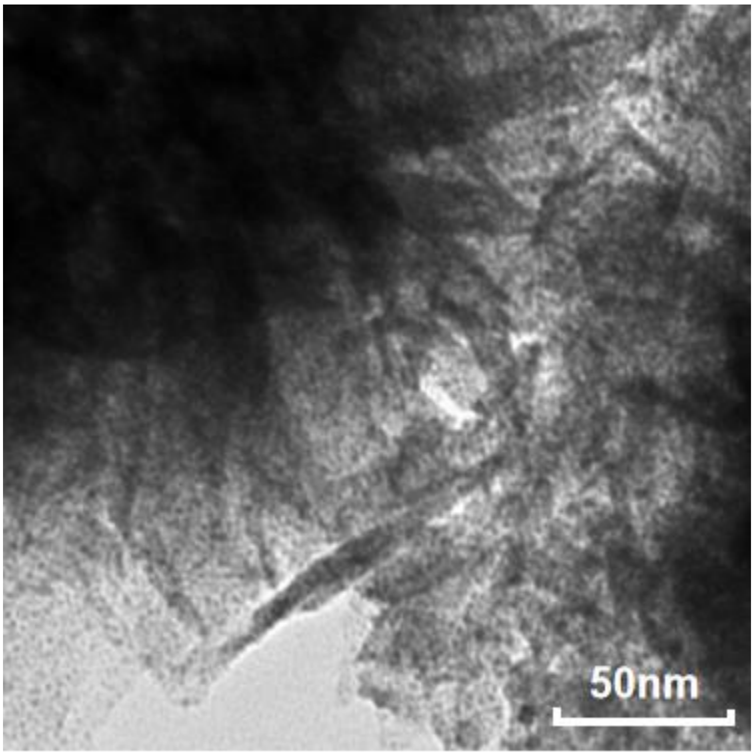


Fig. S2 SEM images of the molybdenum carbide material at (a) 700℃ and (b) 800℃

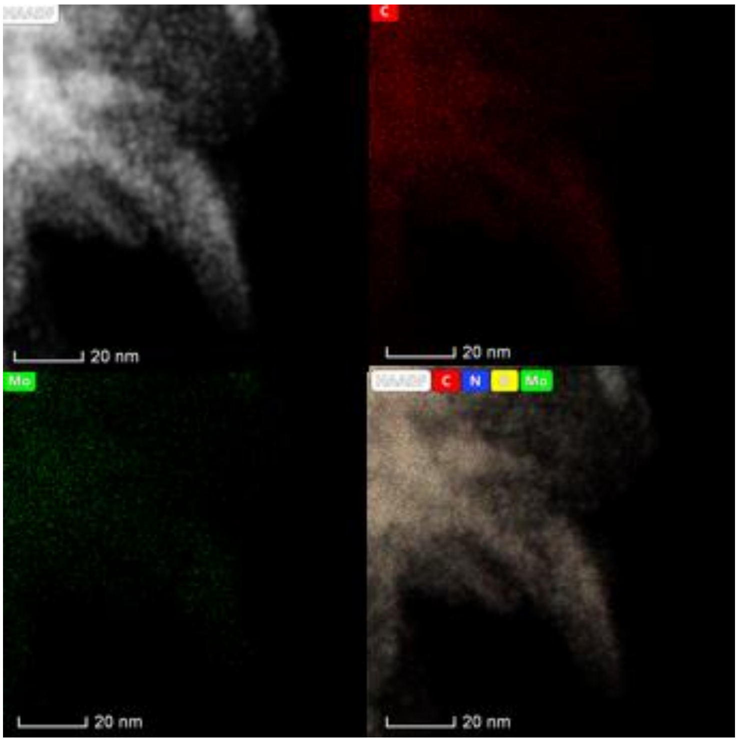
a



b



c



d

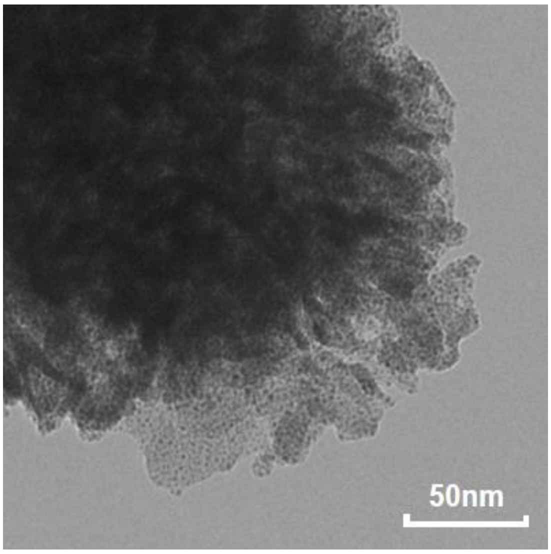
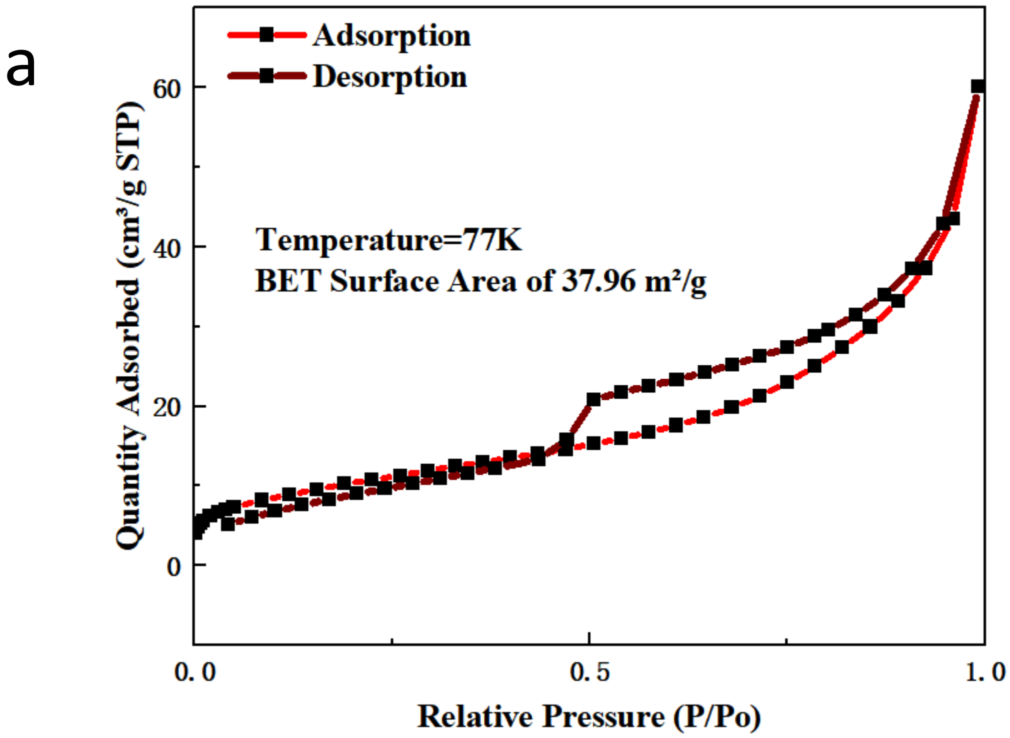


Fig. S3. Structural characterizations of molybdenum carbide, (a) SEM image of NCF, (b) TEM image, and (c) EDS elemental mapping of Mo_2C/NCF. (d) TEM image of Ni-Mo_2C/NCF.



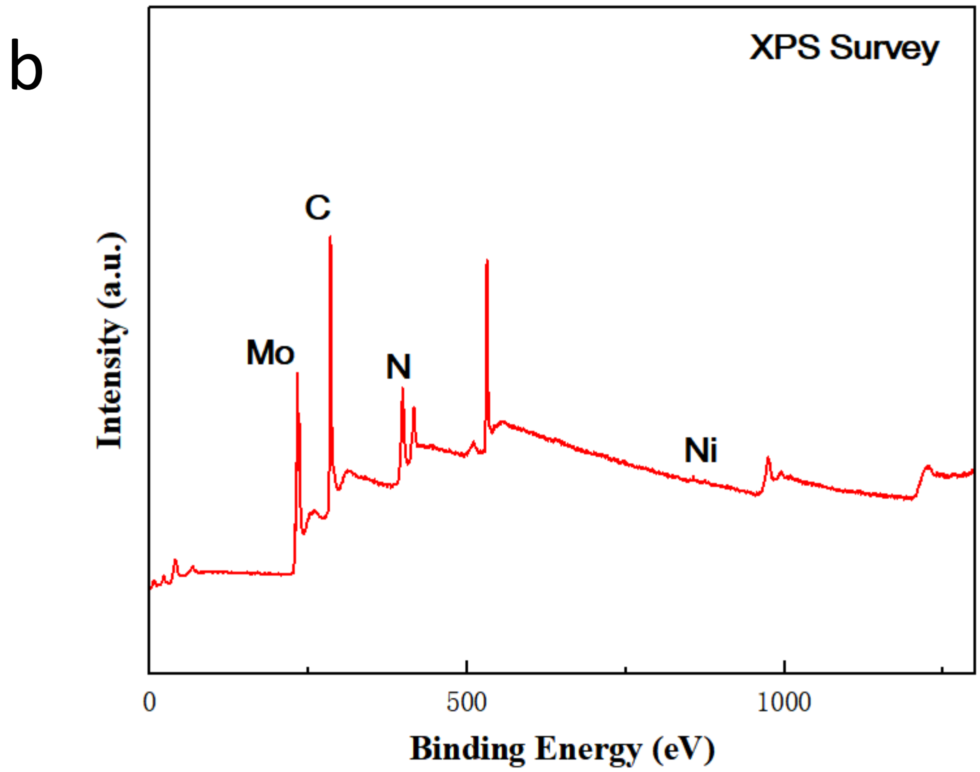


Fig. S4. (a) Nitrogen adsorption-desorption isotherm of Ni-Mo_2C/NCF at 77 K, (b) XPS survey spectrum of Mo_2C/NCF showing the presence of Mo, N, C and Ni elements.

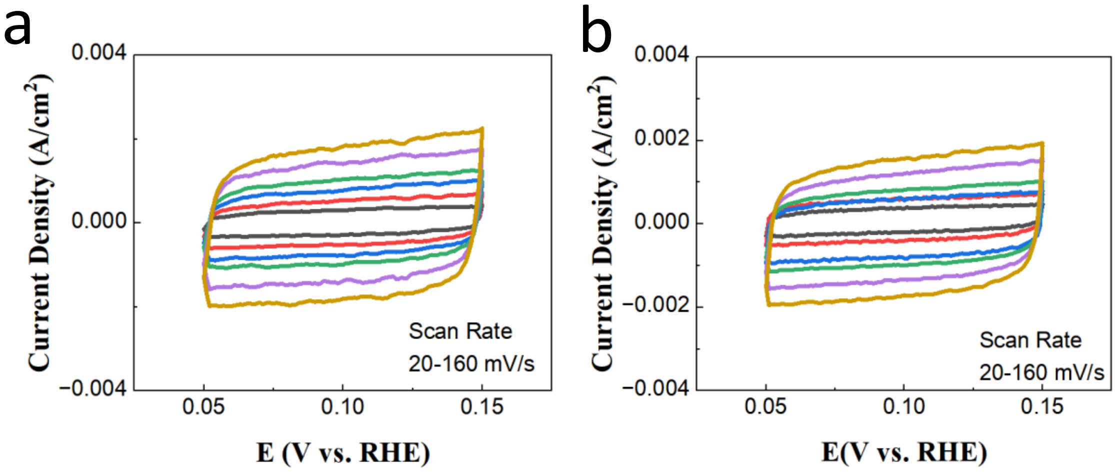


Fig. S5. CV curves of (a) Ni-Mo_2C/NCF and (b) Mo_2C/NCF under different scan rates from 20 to 160 mV/s in 1.0 M KOH.

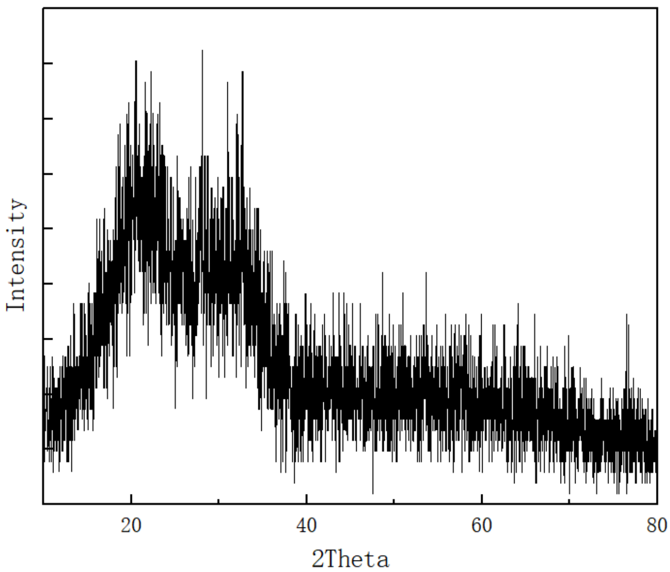


Fig. S6. XRD of Mo-chelated polydopamine .

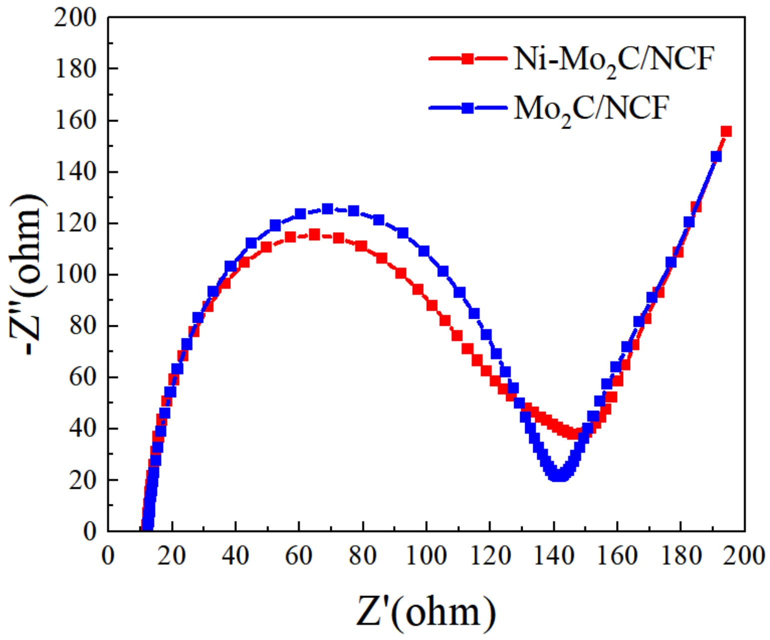


Fig. S7. Nyquist plots of Ni-Mo_2C/NCF and Mo_2C/NCF in 1.0M KOH at open circuit potential.

Conversion method of E_{RHE}

Based on the Nernst equation we can derive：

$$E_{RHE} = E_{test} + 0.059\times pH + E_R,$$

where E_{test} is the original voltage applied during the test, E_R is the standard electrode potential of the reference electrode, the value of pH is about 13.6 in 1M KOH solution. In this work, the reference electrode was Hg/HgO, E_R=0.098V

$$E_{RHE} = E_{test} + 0.059\times 13.6 + 0.098$$

$$= E_{test} + 0.9004$$

Calculation of ECSA

Based on the linear fitting of **Fig. 3d** insert, we can derive specific capacitance of Ni-Mo_2C/NCF as follows:

$$C = \frac{k}{2m} = \frac{21.6mF/cm^2}{2\times 0.28mg/cm^2} = 38.6\ F/g,$$

where C is the specific capacitance of Ni-Mo_2C/NCF, k is the fitting slope, m is the catalyst areal loading.

Then, we can calculate its ECSA of Ni-Mo_2C/NCF by assuming a standard value of 30 μF/cm^2 (it is commonly used for many oxide surfaces) :

$$ECSA = \frac{C}{30\ \mu F/cm} = 128.6\ m^2/g$$