Supporting Information

Oxygen Vacancies Confined in Nickel Molybdenum Oxide Porous Nanosheets for Promoted Electrocatalytic Urea Oxidation

Yun Tong[1‡], Pengzuo Chen[1‡], Mengxing Zhang[2], Tianpei Zhou[1], Lidong Zhang[2], Wangsheng Chu[2], Changzheng Wu,*[1] and Yi Xie[1]

1. Hefei National Laboratory for Physical Science at the Microscale, iChEM(Collaborative Innovation Center of Chemistry for Energy Materials), and CAS Key Laboratory of Mechanical Behavior and Design of Materials, University of Science and Technology of China, Hefei, Anhui, 230026, P. R. China.
2. National Synchrotron Radiation Laboratory, University of Science and Technology of China, Hefei, Anhui 230026, P. R. China.

‡ These authors contributed equally.

To whom correspondence should be addressed. E-mail: czwu@ustc.edu.cn

Table of contents

S1. The SEM images of Ni-Mo precursor/NF sample

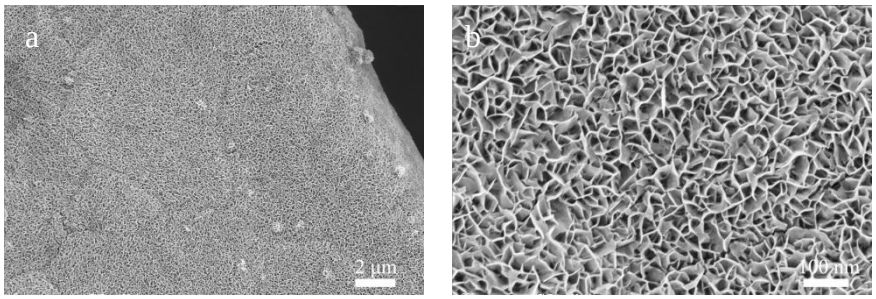


Figure S1 SEM images of Ni-Mo precursor/NF nanosheets at (a) low magnification and (b) high magnification.

S2. The XRD pattern of p-$NiMoO_4$/NF electrode

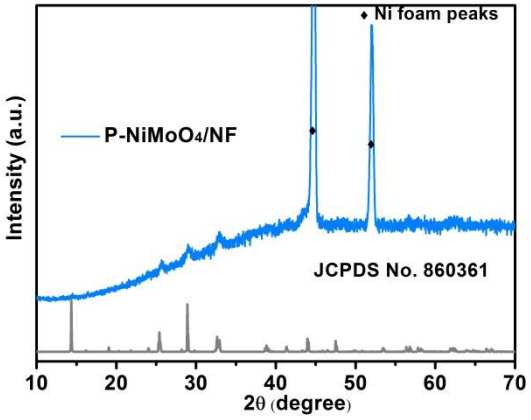


Figure S2 The XRD pattern of as-prepared p-$NiMoO_4$/NF electrode.

S3. The elemental mapping images of r-$NiMoO_4$ nanosheet

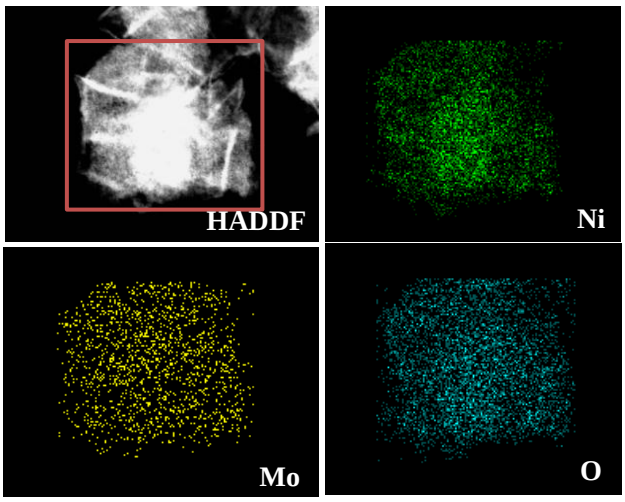


Figure S3 The TEM-EDS mapping images of r-$NiMoO_4$ nanosheet.

S4. The SEM images and TEM images of p-$NiMoO_4$/NF nanosheets

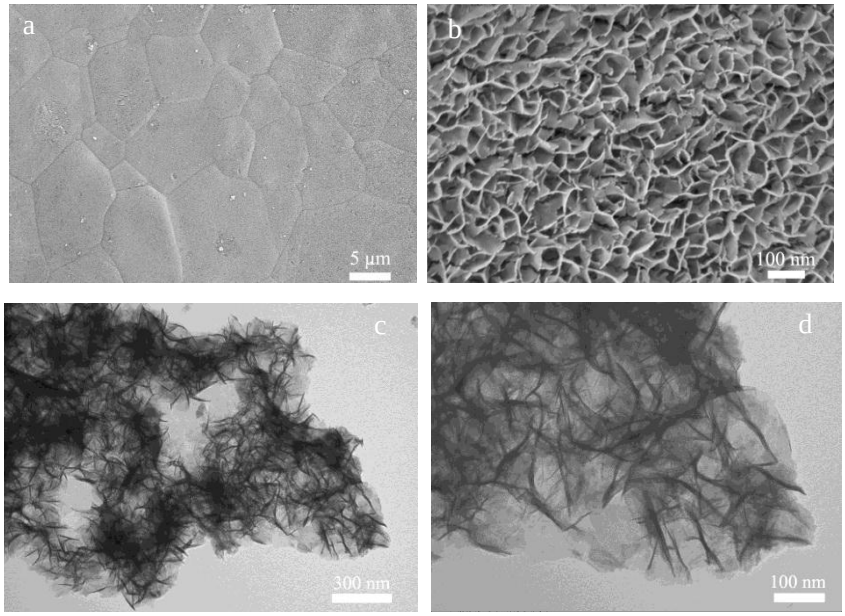


Figure S4 SEM images of p-$NiMoO_4$/NF electrode at (a) low magnification and (b) high magnification. TEM images of p-$NiMoO_4$ nanosheets at (c) low magnification and (d) high magnification.

S5. The EDS spectrum and elemental mapping images of p-$NiMoO_4$/NF electrode

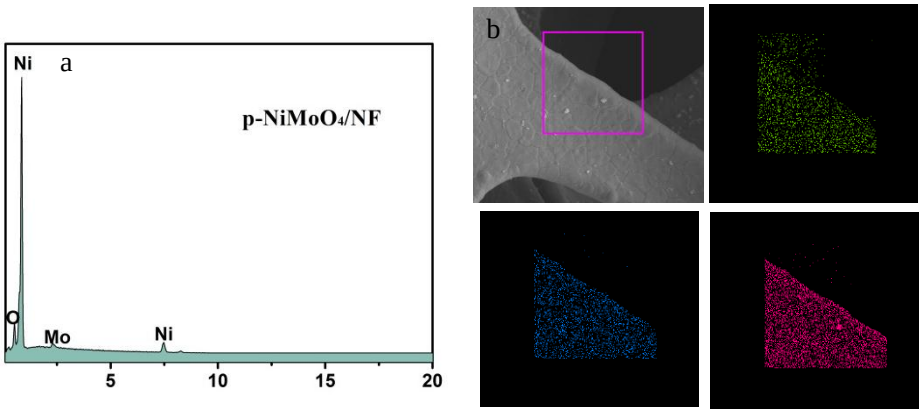


Figure S5 (a) The EDS spectrum and (b) elemental mapping images of p-$NiMoO_4$/NF electrode

S6. The HRTEM image of p-$NiMoO_4$ porous nanosheets

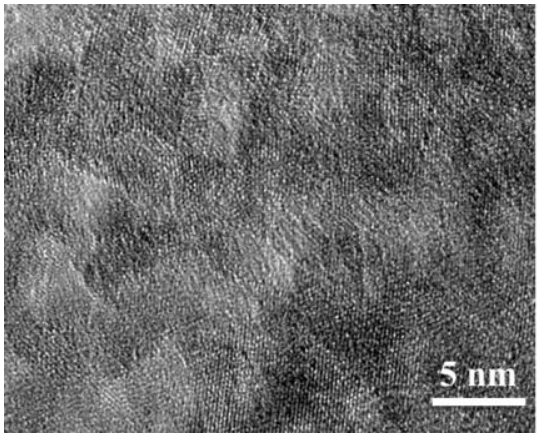
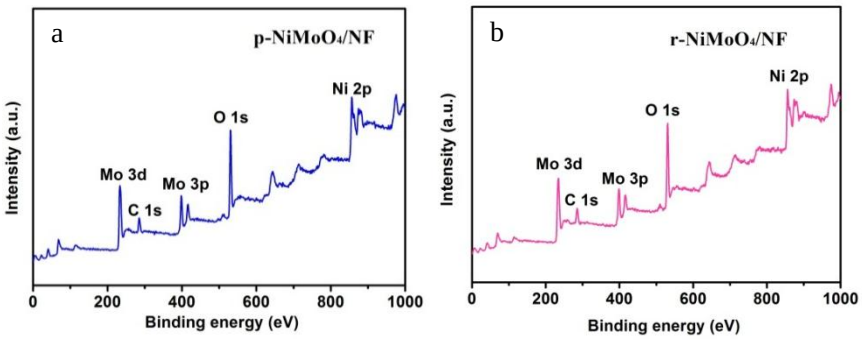


Figure S6 The HRTEM image of p-$NiMoO_4$ porous nanosheets.

S7. The XPS survey of as-prepared p-$NiMoO_4$ and r-$NiMoO_4$ samples



c

Sample	Elements atomic ratio (%)		
	Ni	Mo	O
p-$NiMoO_4$	16.64	15.55	67.81
r-$NiMoO_4$	19.71	18.11	62.18

Figure S7 The XPS survey of as-prepared (a) p-$NiMoO_4$ and (b) r-$NiMoO_4$ samples. (c) The element atomic content of Ni, Mo and O elements in the as-prepared $NiMoO_4$ products.

S8. Comparison between the simulations and experimental data of Mo edges for r-$NiMoO_4$ and p-$NiMoO_4$ samples

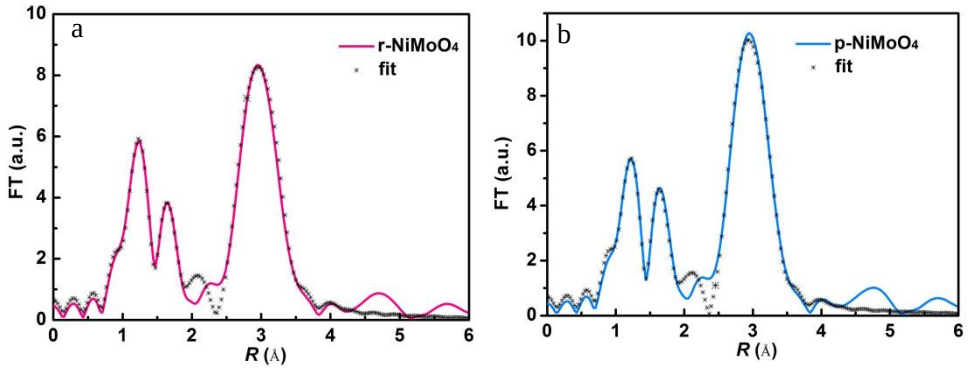


Figure S8 Comparison between the simulations and experimental data of Mo-edges for a) r-$NiMoO_4$ and b) p-$NiMoO_4$ products.

S9. The theoretical multiple-scattering paths of r-$NiMoO_4$ product

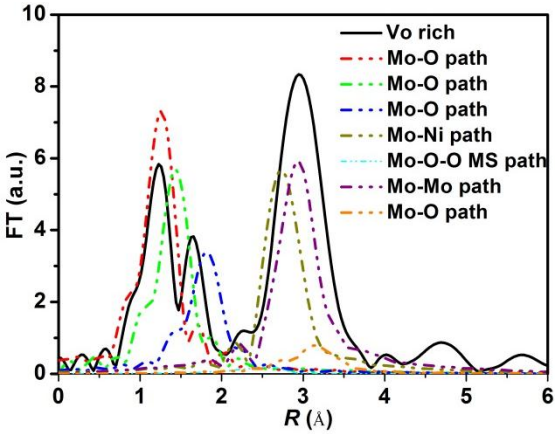


Figure S9 The theoretical simulation of scattering paths for r-$NiMoO_4$ sample.

S10. Cyclic voltammetry (CV) plots of r-$NiMoO_4$/NF with/without KOH electrolyte

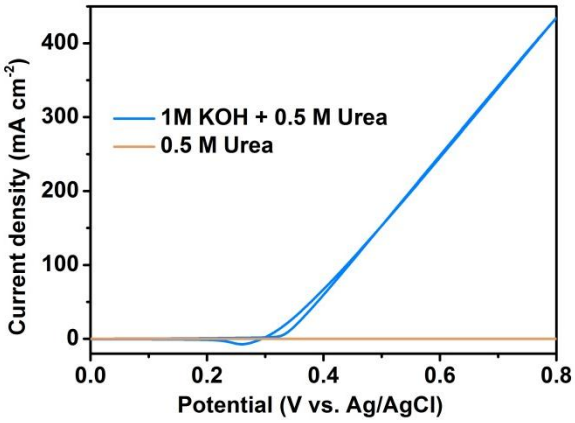


Figure S10 Cyclic voltammetry plots of r-$NiMoO_4$/NF in 0.5 M urea with and without 1 M KOH electrolyte.

S11. Cyclic voltammetry (CV) plots of bare Ni foam with/without urea solution

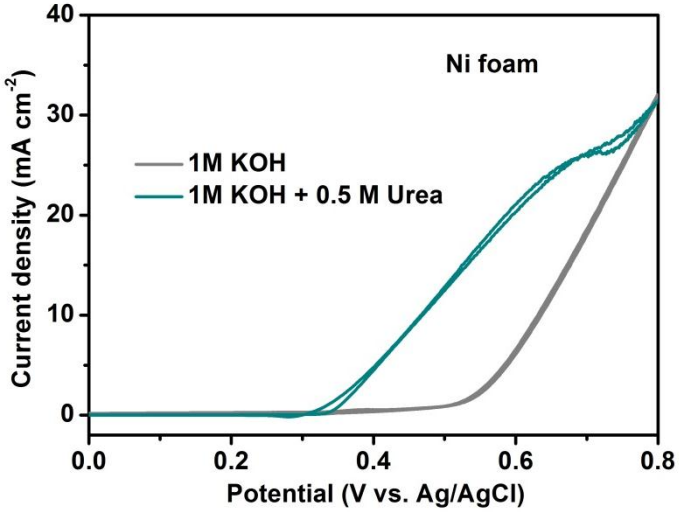


Figure S11 CV curves of Ni foam in 1 M KOH electrolyte with and without 0.5 M urea.

S12. Chronoamperometric response of UOR process for r-$NiMoO_4$/NF

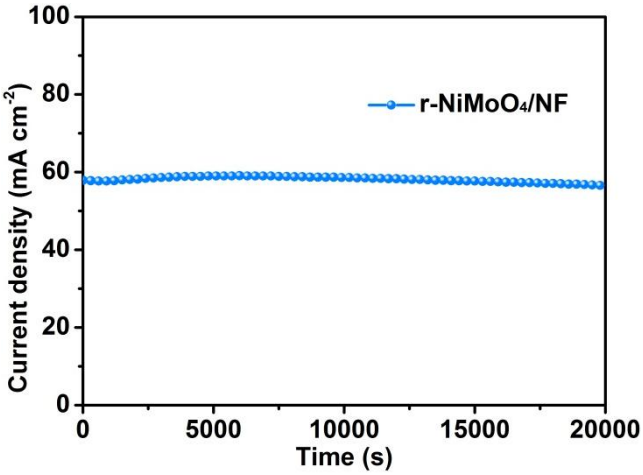


Figure S12 Time dependence of the current density for UOR under a static potential of 400 mV in 1M KOH solution.

S13. Cyclic voltammetry plots of r-$NiMoO_4$/NF at different scan rates

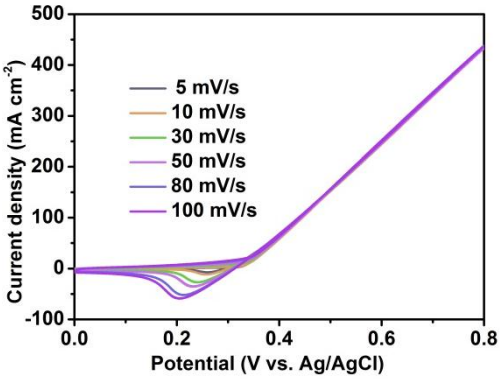


Figure S13 Cyclic voltammetry plots for r-$NiMoO_4$/NF at different scan rates.

S14. CVs at different scan rates from 2 to 10 mV/s for series of $NiMoO_4$ products

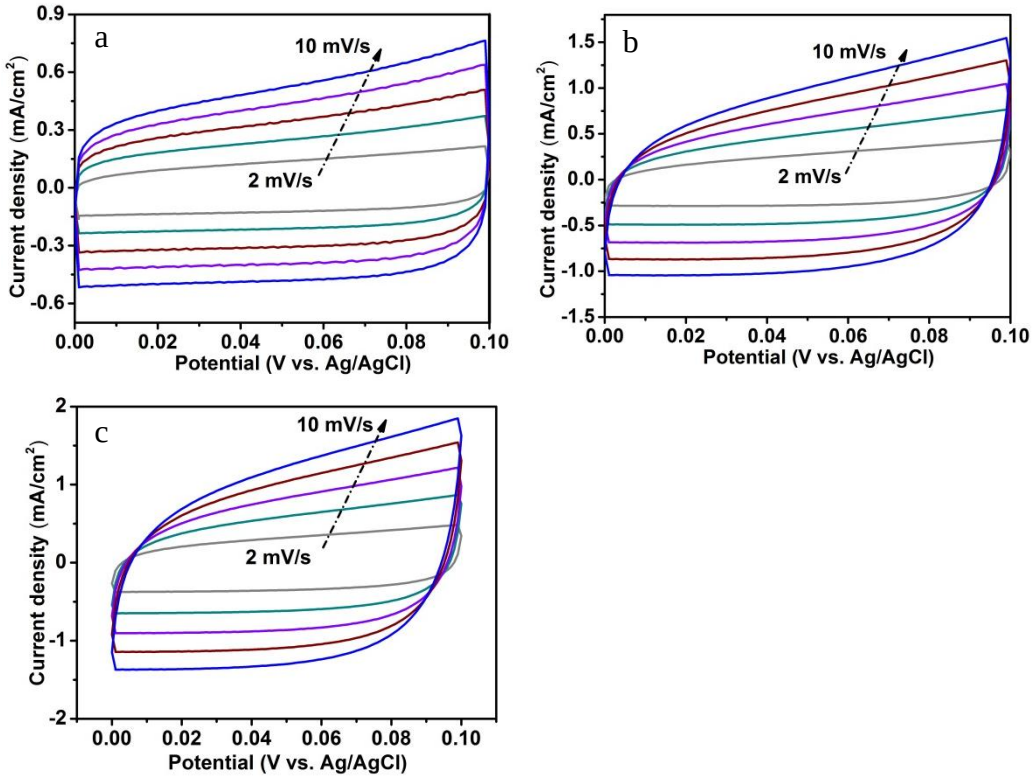


Figure S14 Cyclic voltammograms of (a) Ni-Mo precursor/NF, (b) p-$NiMoO_4$/NF and (c) r-$NiMoO_4$/NF at different scan rates from 2 to 10 mV s^{-1}.

The electrochemical double-layer capacitance (EDLC) of p-$NiMoO_4$ and r-$NiMoO_4$ catalysts were investigated on the basis of CV curves recorded at different scan rates of 2-10 mV s^{-1}. Under this potential region, charge transfer electrode reactions are considered to be negligible and the current is originated solely from electrical double layer charging and discharging. Finally, we calculated the slope from the linear relationship of the current density against the scan rate.