Supplementary Information

Three-Dimensional Porous $MoNi_4$ Networks Constructed by Nanosheets as Bifunctional Electrocatalysts for Overall Water Splitting

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Table S1. HER, OER and overall water splitting activities of the porous $MoNi_4$ networks and reported catalysts.

Catalyst (mass loading)	**Electrolyte**	**HER Potential vs. RHE (V) @ 10 mA cm^{-2}**	**OER Potential vs. RHE (V) @ 10 mA cm^{-2}**	**Overall Water Splitting Potential (V) @ 10 mA cm^{-2}**	**Overall Water Splitting Onset Potential (V)**
porous $MoNi_4$ networks ($\sim$1.09 mg/cm^2)	1 M KOH	-0.028	1.51	1.58	1.45[this work]
$NiCo_2O_4$ hollow microcuboids[1] ($\sim$1 mg/cm^2)	1 M KOH	-0.110	1.52	1.65	
NiSe nanowire film/Ni foam[2] (2.8 mg/cm^2)	1 M KOH	-0.096		1.63	~1.5
Ni_5P_4 Films/Ni foil[3] ($\sim$3.5 mg/cm^2)	1 M KOH	-0.15	1.56	<1.7	~1.53
Ni_2P nanoparticles[4] (0.14 mg/cm^2)	1 M KOH		1.52	1.63	~1.5
Co-P films/Cu foil[5] (2.71 mg/cm^2)	1 M KOH	-0.094	1.575	1.64	1.57
Porous Cobalt-Based Thin Film[6] ($\sim$0.1 mg/cm^2)	1 M KOH	-0.38	1.53		
	0.5 M H_2SO_4	-0.15			
Ni_3S_2 Nanosheet Arrays /Ni foam[7] ($\sim$1.6 mg/cm^2)	1 M KOH	~-0.22	~1.49	~1.76(@ ~13 mA cm^{-2})	
	neutral media	~-0.17			

$NiFeO_x$/CFP after two lithium galvanostatic cycles[8] (~1.6 mg/cm^2)	1M KOH	-0.088	1.46	1.55	~1.5
				1.51 (increasing the mass loading)	

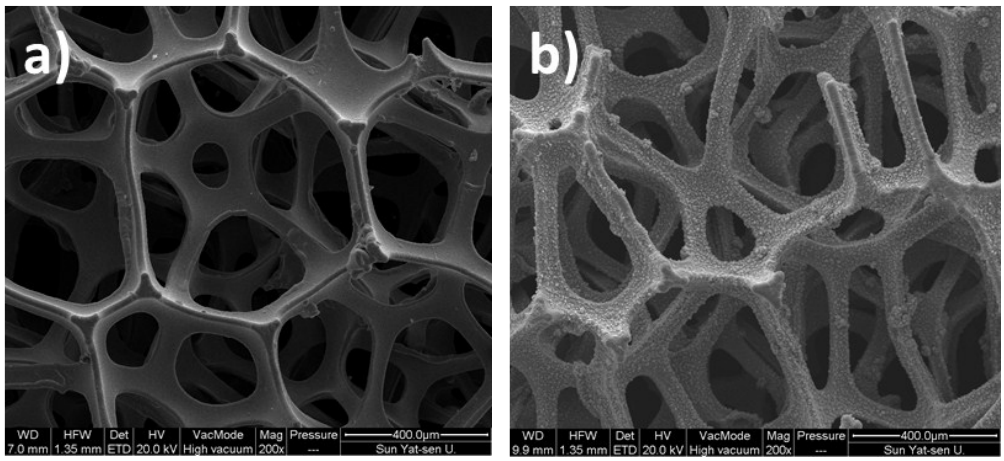

Figure S1. SEM images of (a) nickel foam, (b) porous $MoNi_4$ networks annealed at 450°C at low magnification.

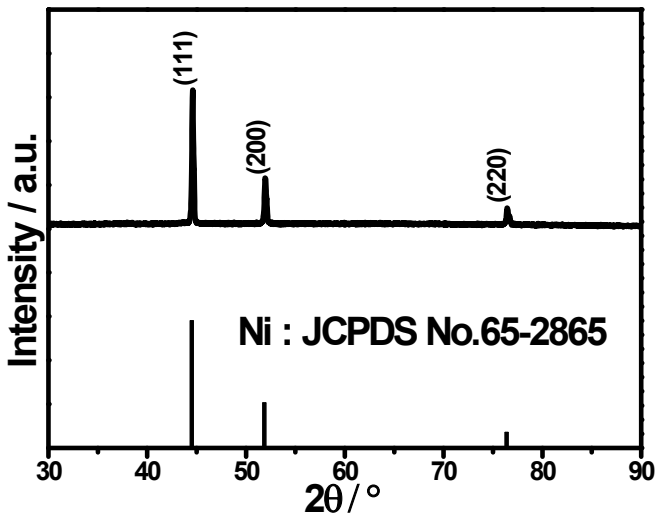

Figure S2. XRD patterns of nickel foam.

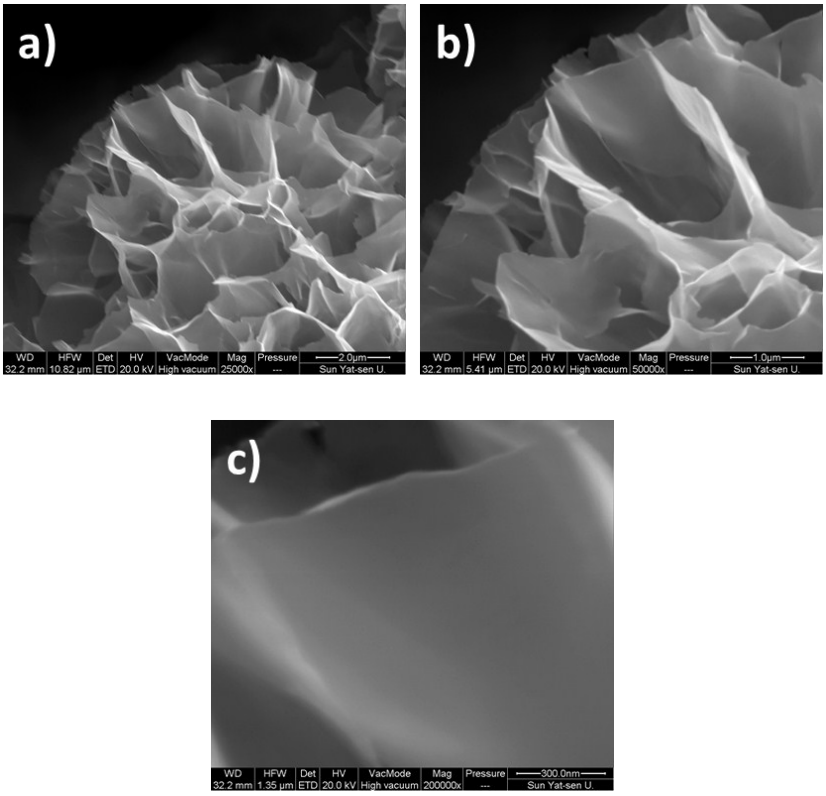

Figure S3. SEM images of Mo-Ni based precursors at different magnifications.

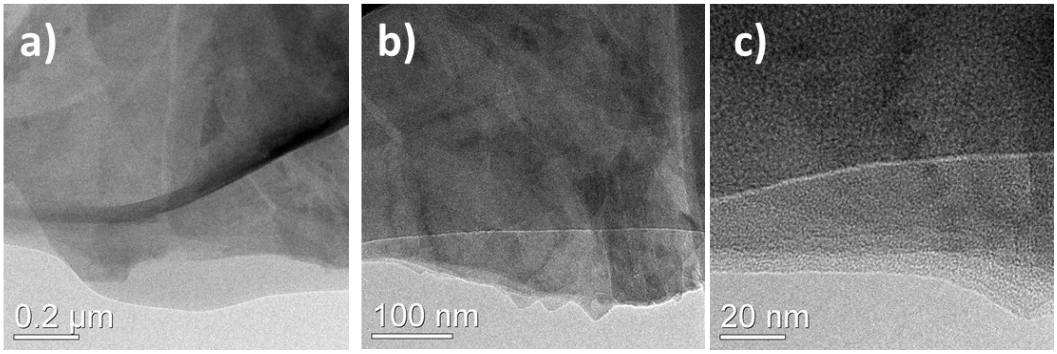

Figure S4. TEM images of Mo-Ni based precursors at different magnifications.

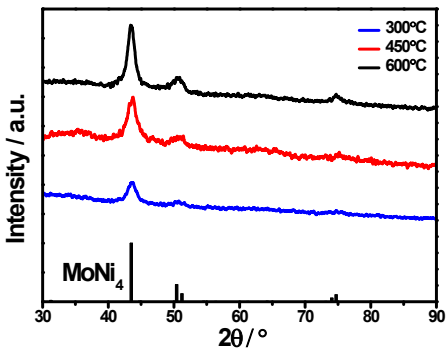

Figure S5. XRD patterns of the porous $MoNi_4$ networks annealed at 300°C, 450°C and 600°C.

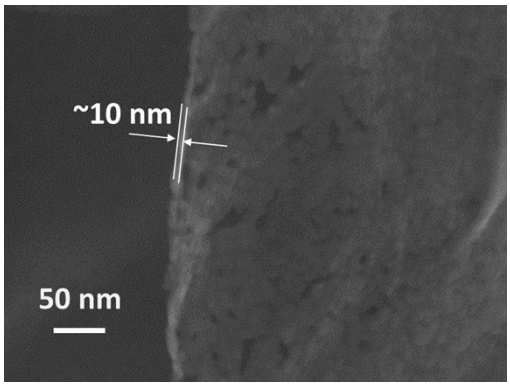

Figure S6. Higher resolution SEM image of the porous $MoNi_4$ networks annealed at 450°C.

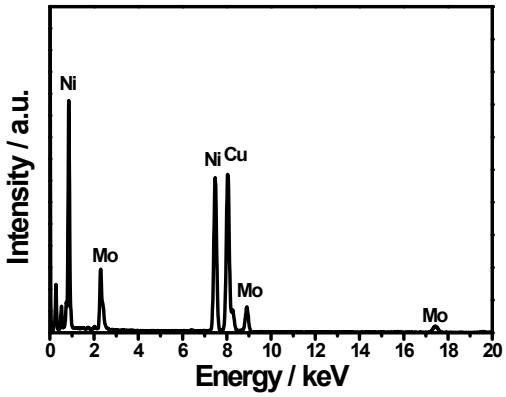

Figure S7. The corresponding energy dispersive X-ray (EDX) spectrum of porous $MoNi_4$ networks annealed at 450°C.

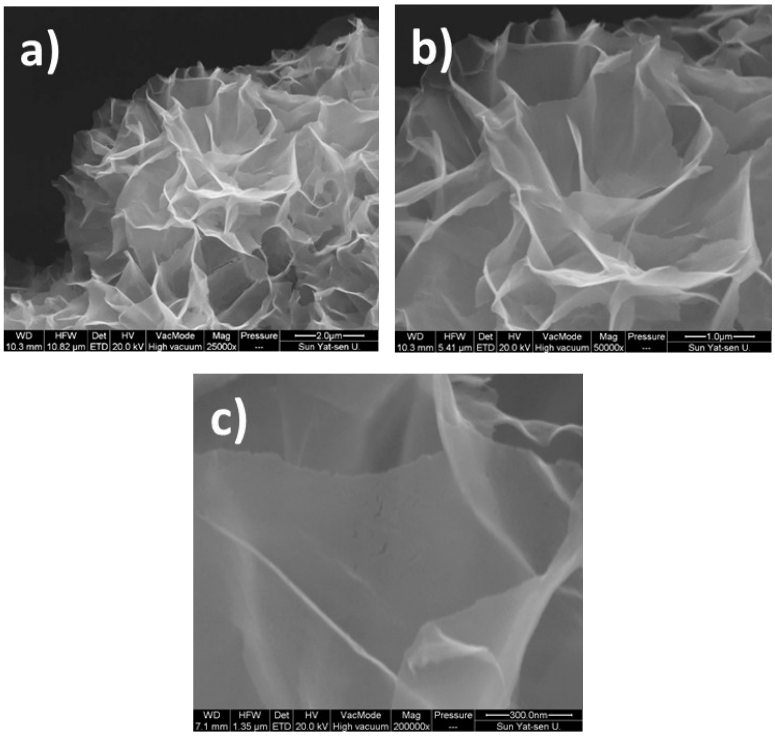

Figure S8. SEM images of porous $MoNi_4$ networks annealed at 300°C at different magnifications.

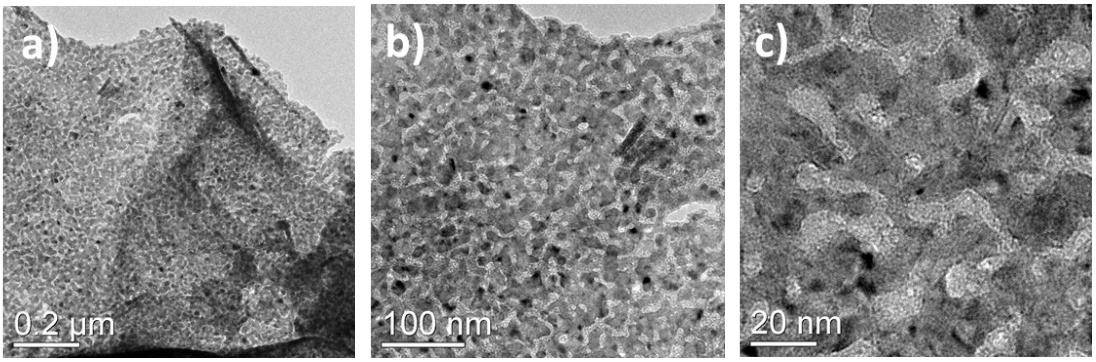

Figure S9. TEM images of porous $MoNi_4$ networks annealed at 300°C at different magnifications.

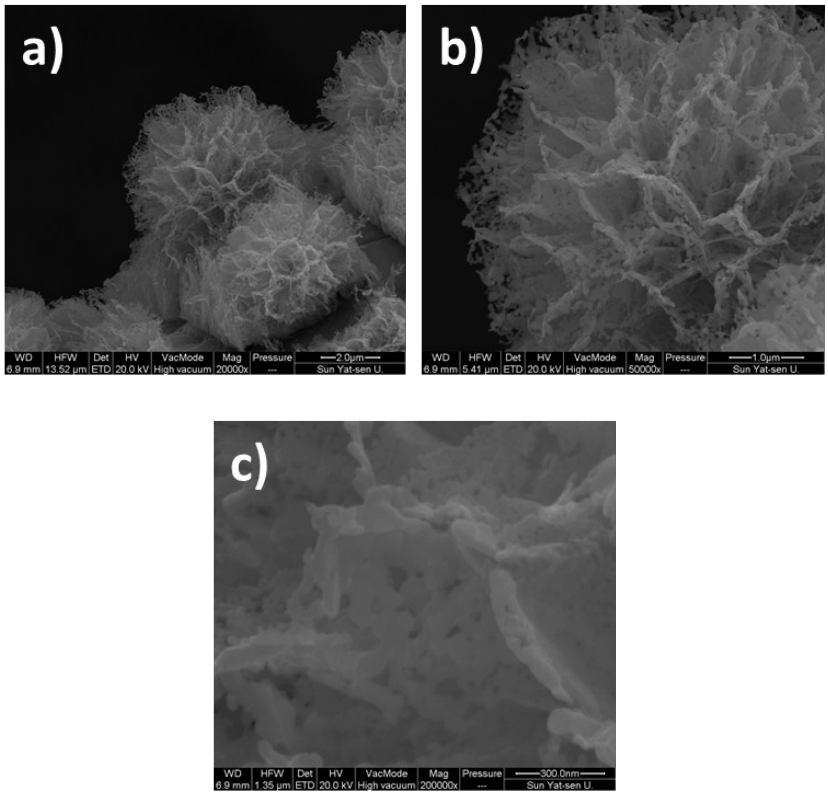

Figure S10. SEM images of porous $MoNi_4$ networks annealed at 600°C at different magnifications.

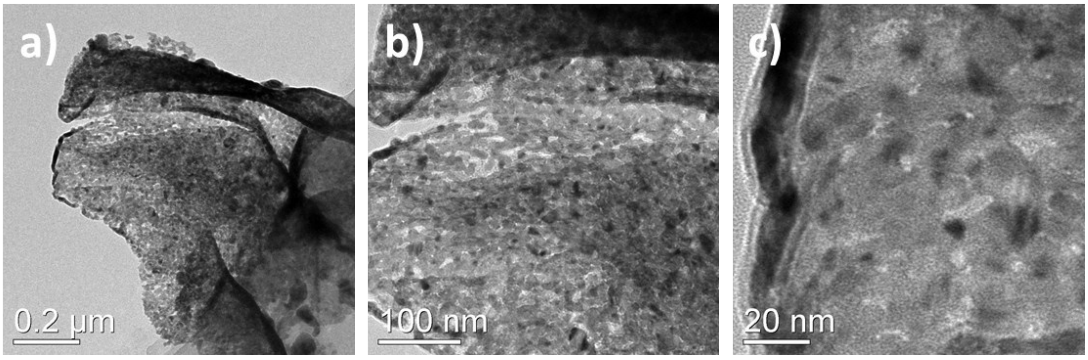

Figure S11. TEM images of porous $MoNi_4$ networks annealed at 600°C at different magnifications.

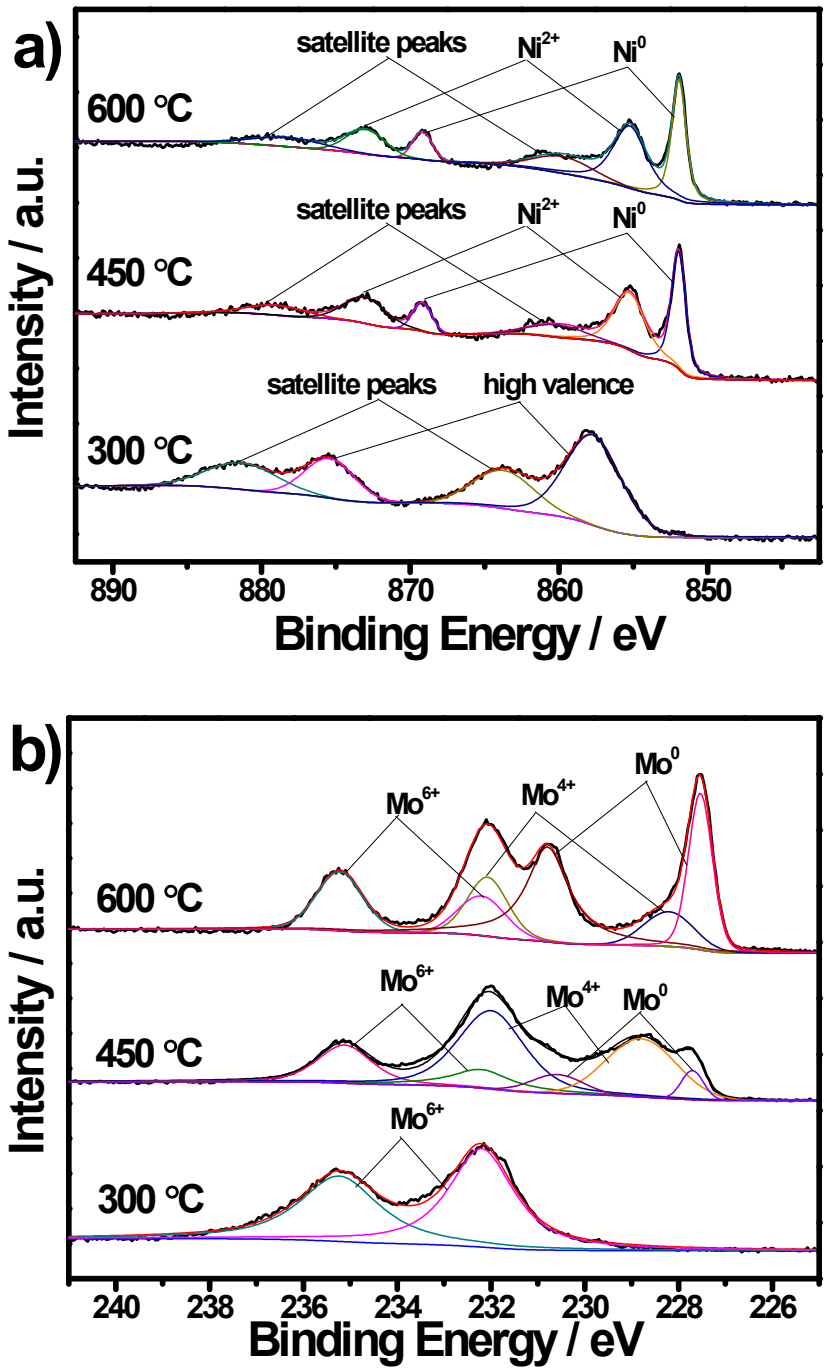

Figure S12. XPS spectra of the $MoNi_4$ networks annealed at different temperature. (a) Ni 2p peaks. (b) Mo 3d peaks.

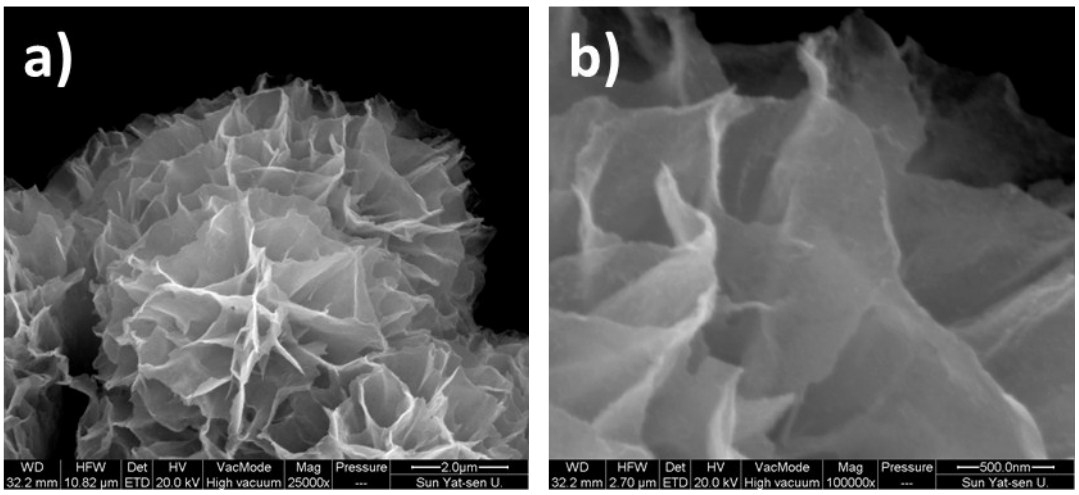

Figure S13. SEM images of porous $MoNi_4$ networks annealed at 450°C after the HER stability test.

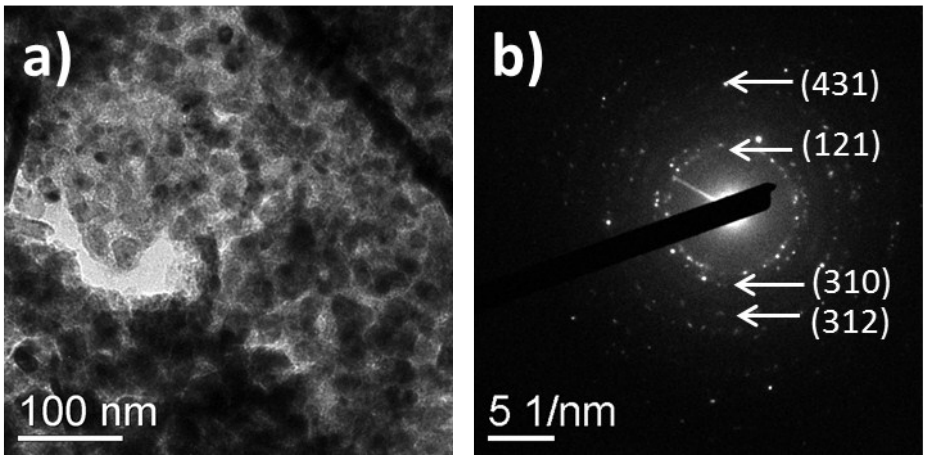

Figure S14. (a) TEM images and (b) the corresponding selected-area electron diffraction (SAED) pattern of porous $MoNi_4$ networks annealed at 450°C after the HER stability test.

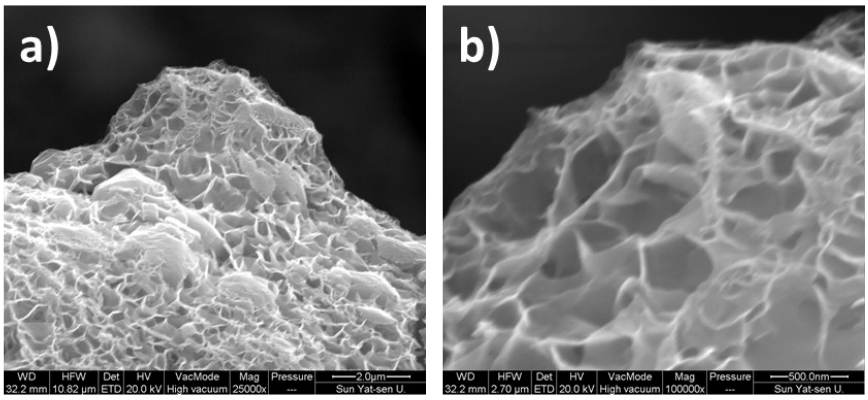

Figure S15. SEM images of porous $MoNi_4$ networks annealed at 450°C after the OER stability test.

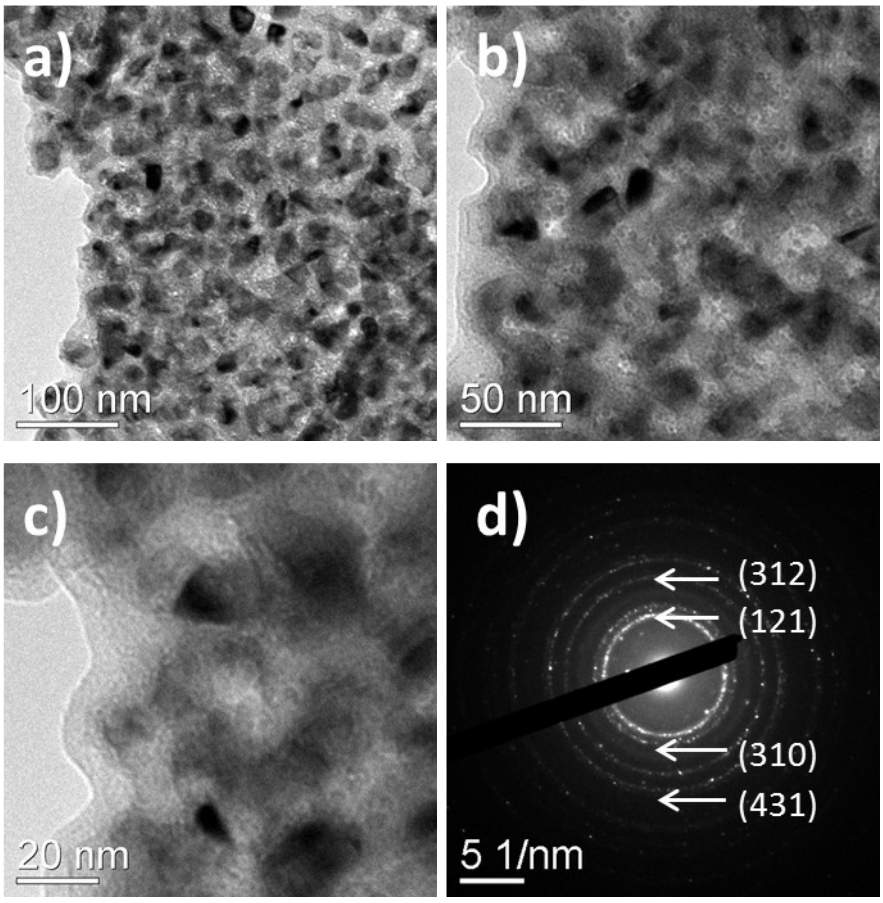

Figure S16. (a-c) TEM images and (d) the corresponding selected-area electron diffraction (SAED) pattern of the porous $MoNi_4$ networks annealed at 450°C after the OER stability test.

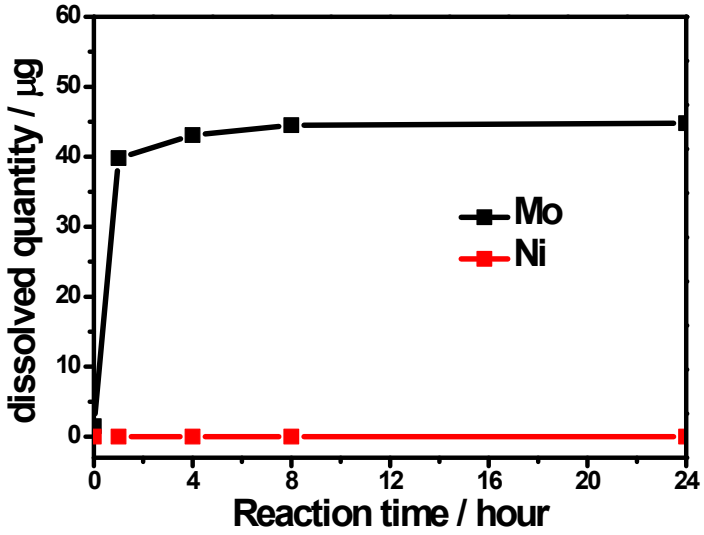

Figure S17. Dissolved quantity - time curves of Mo and Ni during OER.

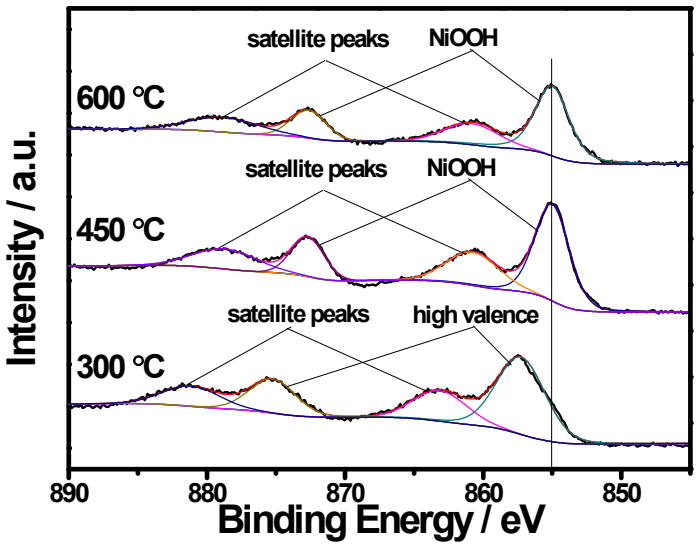

Figure S18. XPS spectra (Ni 2p peaks) of the $MoNi_4$ networks annealed at different temperature after OER.

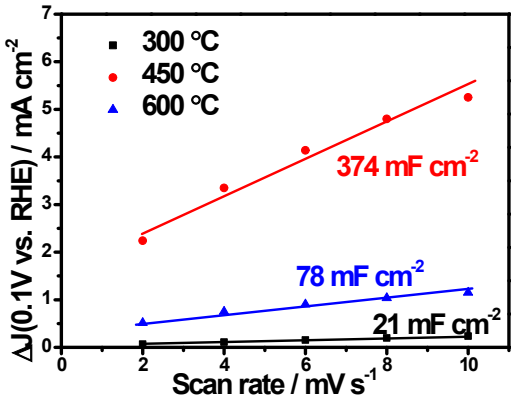

Figure S19. Electrochemically surface area measurements. The corresponding j_{geo} vs scan rates plots of the porous $MoNi_4$ networks annealed at 450°C.

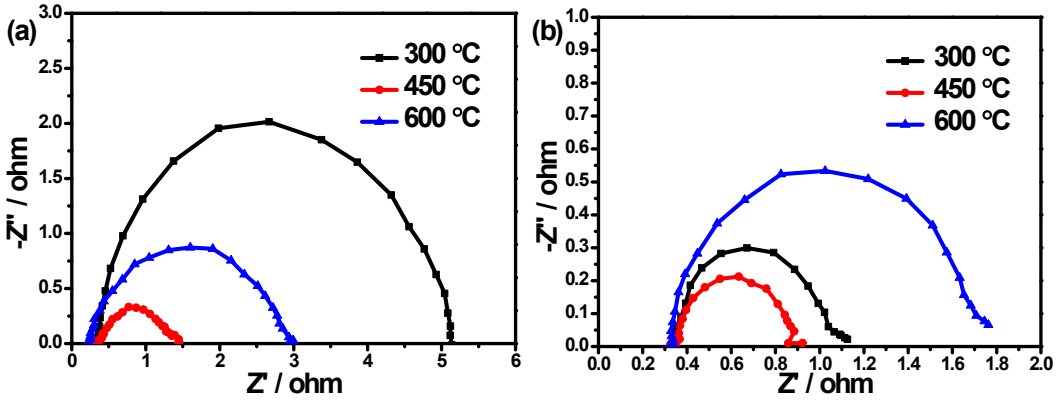

Figure S20. The Nyquist plots of the porous $MoNi_4$ networks annealed at 450°C at (a) -100 mV vs. RHE and (b) 1.6 V vs. RHE. All of the potentials and voltages are without iR corrected.

References

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