

## **Weakened Lattice-Strain Effect in MoO<sub>x</sub>@NPC-Supported Ruthenium Dots toward High-Efficiency Hydrogen Generation**

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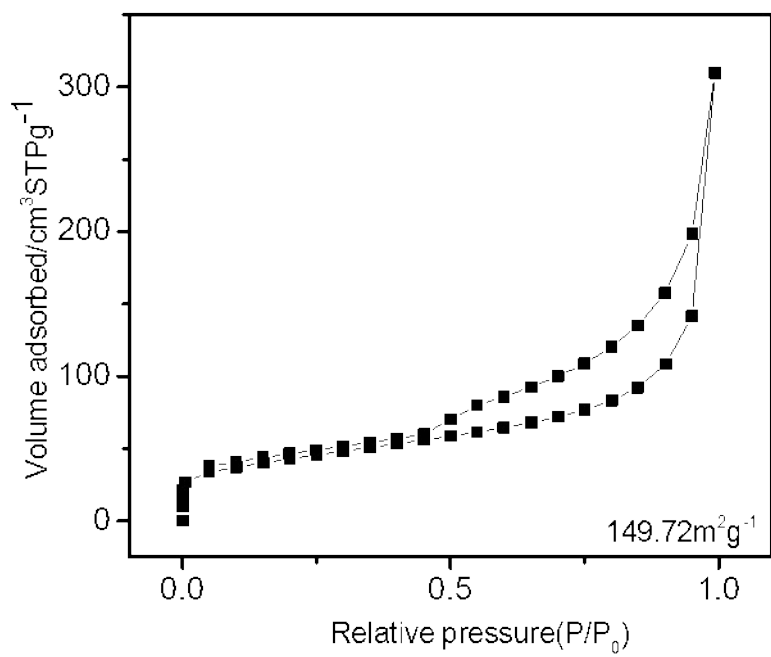
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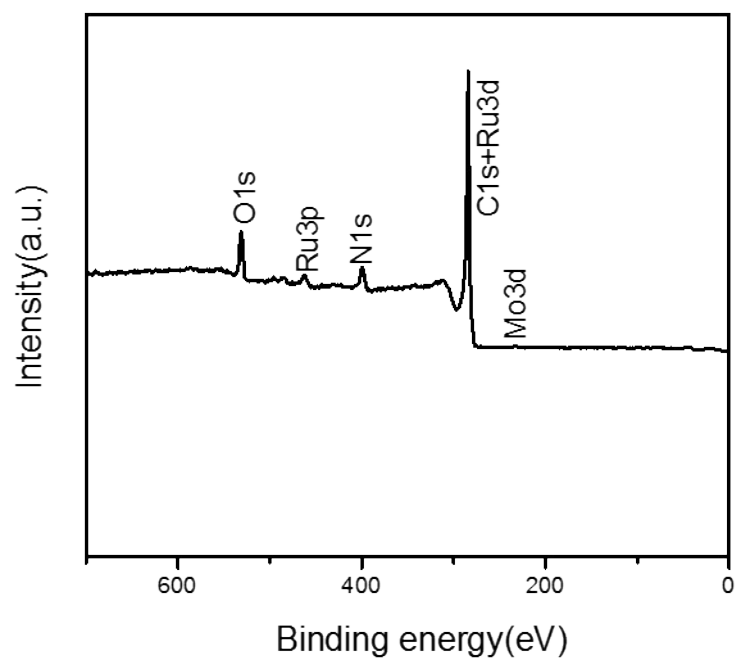
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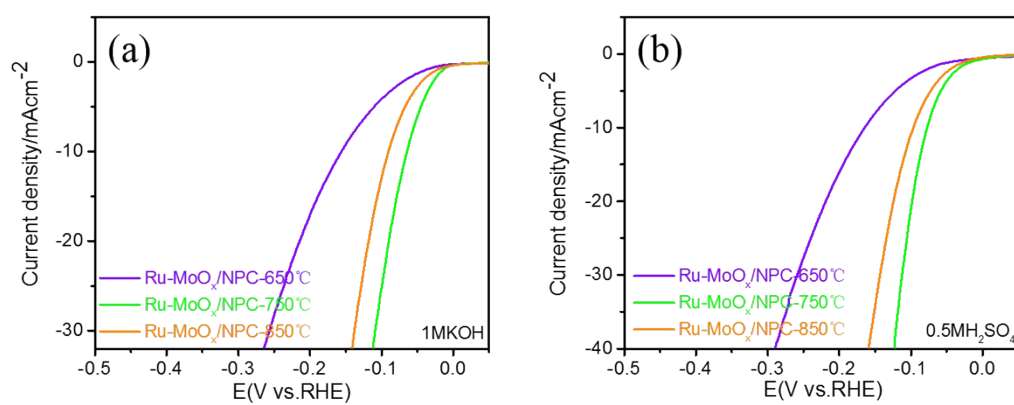
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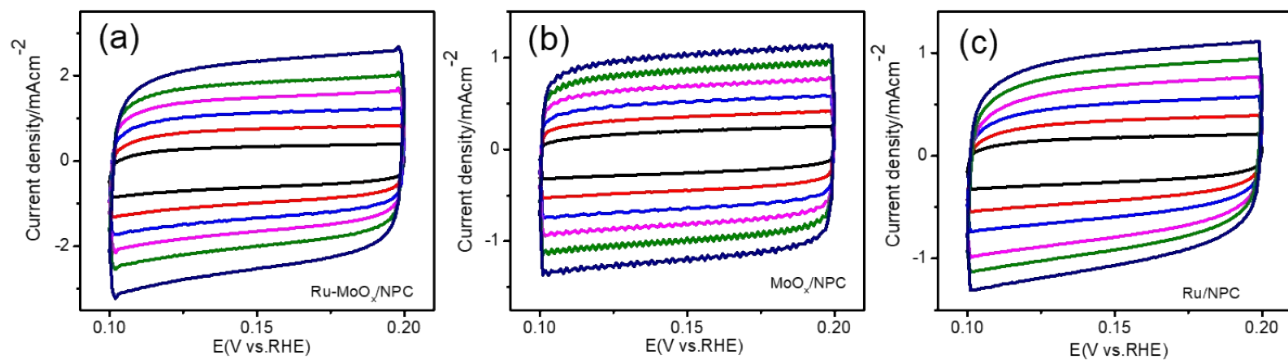
**Fig. S1** N<sub>2</sub> adsorption-desorption isotherm plots for Ru-MoO<sub>x</sub>/NPC.



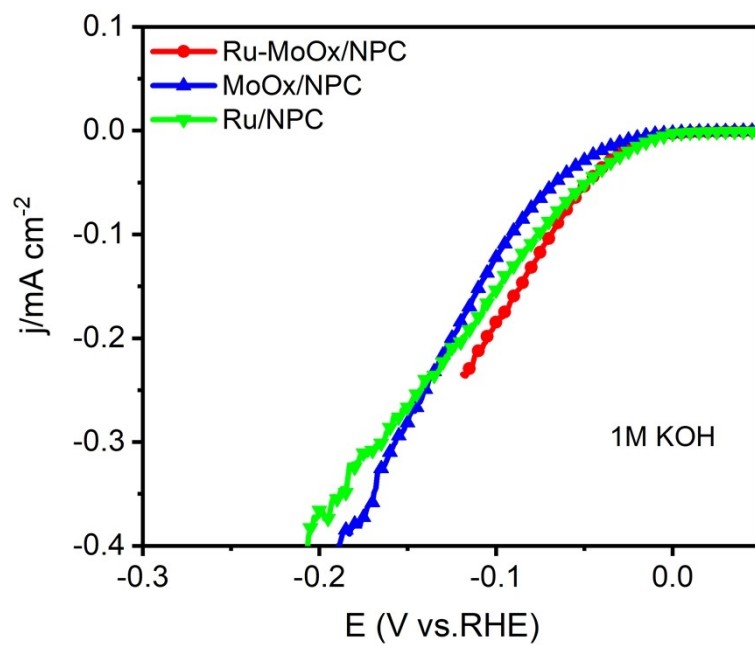
**Fig. S2** High-resolution XPS spectra of survey for Ru-MoO<sub>x</sub>/NPC.



**Fig. S3** Polarization curves of Ru-MoO<sub>x</sub>/NPC-650°C, Ru-MoO<sub>x</sub>/NPC-750°C, Ru-MoO<sub>x</sub>/NPC-850°C in 1 M KOH(a) and 0.5 M H<sub>2</sub>SO<sub>4</sub> (b).



**Fig. S4** Cyclic voltammograms curves of Ru-MoO<sub>x</sub>/NPC (a), MoO<sub>x</sub>/NPC (b) and Ru/NPC (c) at different sweeping rates from 20 mV s<sup>-1</sup> to 100 mV s<sup>-1</sup> at a potential ranging from 0.1 V to 0.2 V in 1 M KOH.



**Fig. S5** LSV curves normalized by ECSA for Ru-MoO<sub>x</sub>/NPC, MoO<sub>x</sub>/NPC and Ru/NPC in 1M KOH.

**Table S1** HER activity of Ru-MoO<sub>x</sub>/NPC and the catalyst reported in literature in 1 M KOH

<b>Electrocatalyst</b>	<b>Overpotential (mV) @10mAcm<sup>-2</sup></b>	<b>Tafel Slope (mVdec<sup>-1</sup>)</b>	<b>Ref</b>
<b>Ru-MoO<sub>x</sub>/NPC</b>	<b>37</b>	<b>37.1</b>	<b>This work</b>
Mo <sub>2</sub> C/N-PC	100	94.5	1
Ru-NiFe-P	44	80	2
Ru/C	53	36.2	3
NiO/Ru@Ni	39	75	4
Ru/RuO <sub>2</sub>	137	112	5
Ni@Ni <sub>2</sub> P-Ru	31	41	6
Ru@CN	32	53	7
Pd <sub>3</sub> Ru	42	/	8
SA-Ru-MoS <sub>2</sub>	76	21	9
Ru/Ni <sub>2</sub> P	132	124	10

**Table S2** HER activity of Ru-MoO<sub>x</sub>/NPC and the catalyst reported in literature in 0.5 M H<sub>2</sub>SO<sub>4</sub>

Electrocatalyst	Overpotential (mV) @10mAcm <sup>-2</sup>	Tafel Slope (mVdec <sup>-1</sup> )	Ref
<b>Ru-MoO<sub>x</sub>/NPC</b>	<b>27</b>	<b>43</b>	<b>This work</b>
Ru-Ru <sub>2</sub> P@NPC	42	39.75	11
Ni@Ni <sub>2</sub> P-Ru	51	35	6
Ru@CN	126	/	7
Pd@Ru	37	30	12
Ru/Ni <sub>2</sub> P	89	62	10
rGO-MoO <sub>3-x</sub> -MoRu	60	40	13
3D-NiCoP	80	37	14
FLNPC@MoP - N C/MoP - C/CC	74	50	15
CoPS	48	56	16
Ni <sub>0.89</sub> Co <sub>0.11</sub> Se <sub>2</sub> MNSN/NF	52	39	17

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