Supporting Information

Construction of efficient bismuth/boron-based flexible electrode in organic media toward neutral hydrogen evolution

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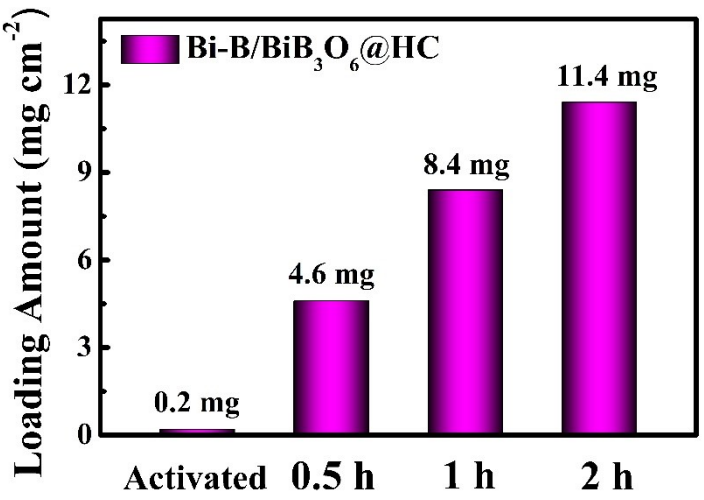


Fig. S1. Loading amount of activated Bi-B/BiB_3O_6 on the HC substrate at different plating time (0.5 h, 1 h and 2 h).

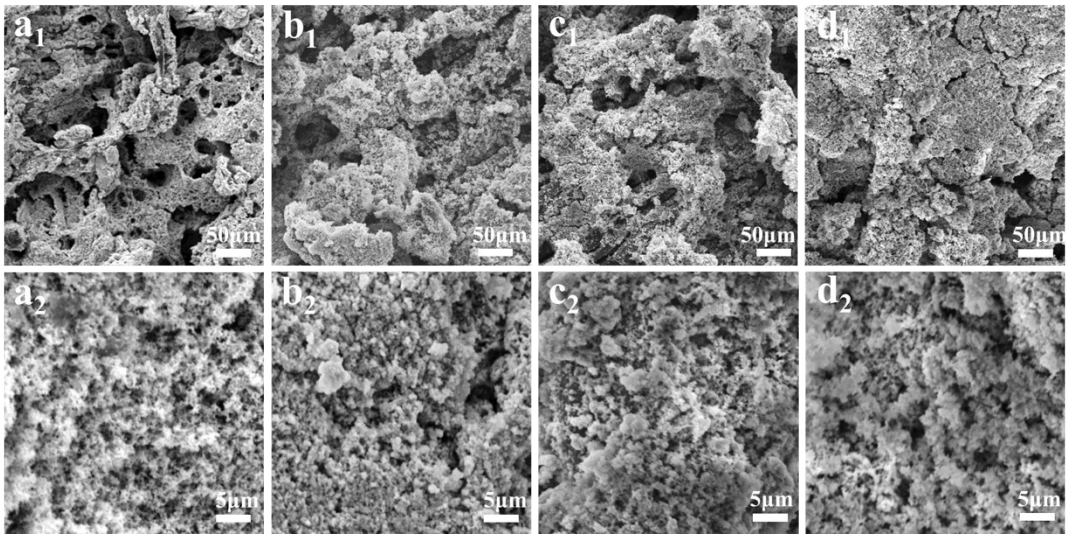


Fig. S2. SEM images of Bi-B/BiB_3O_6@HC electrode during HER process at 25°C. (a_1), (a_2): activated HC; (b_1), (b_2): 0.5 h; (c_1), (c_2): 1 h; (d_1), (d_2): 2 h.

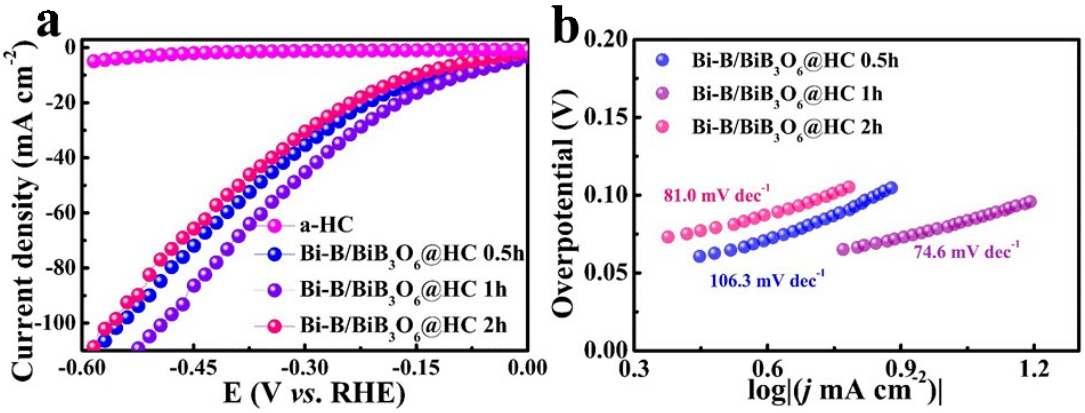


Fig. S3. (a) LSV curves; (b) Tafel slopes of Bi-B/BiB_3O_6@HC electrode at different electroless plating time without *iR*-correction in 1.0 M PBS.

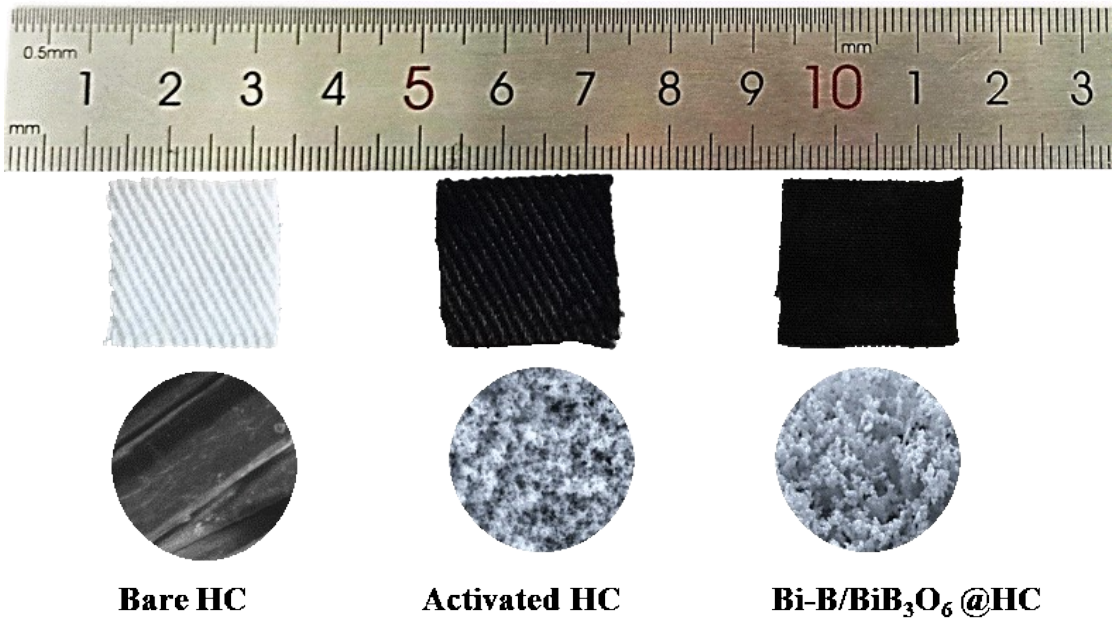


Fig. S4. Photograph and SEM images of bare HC, activated HC and Bi-B/BiB_3O_6@HC electrodes.

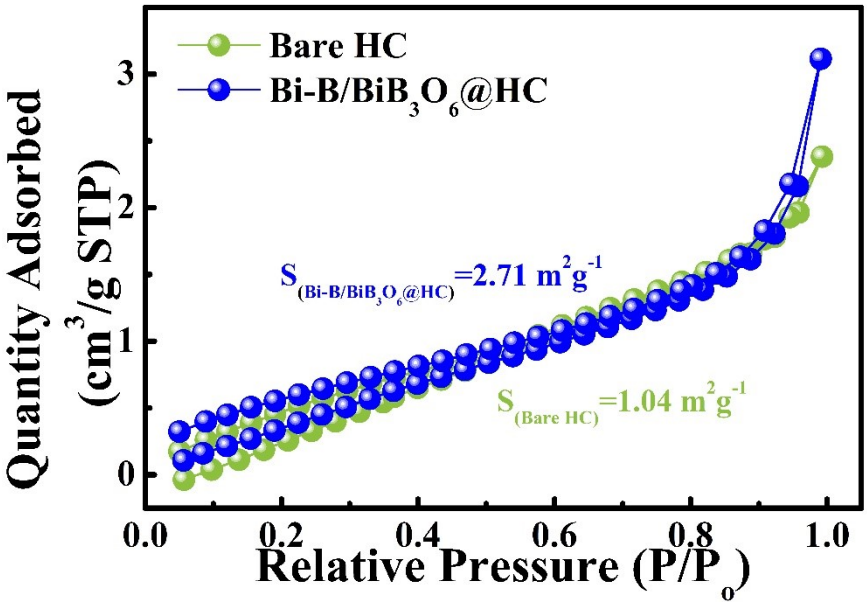


Fig. S5. Nitrogen adsorption-desorption isotherm curves of bare HC and Bi-B/BiB_3O_6@HC electrodes.

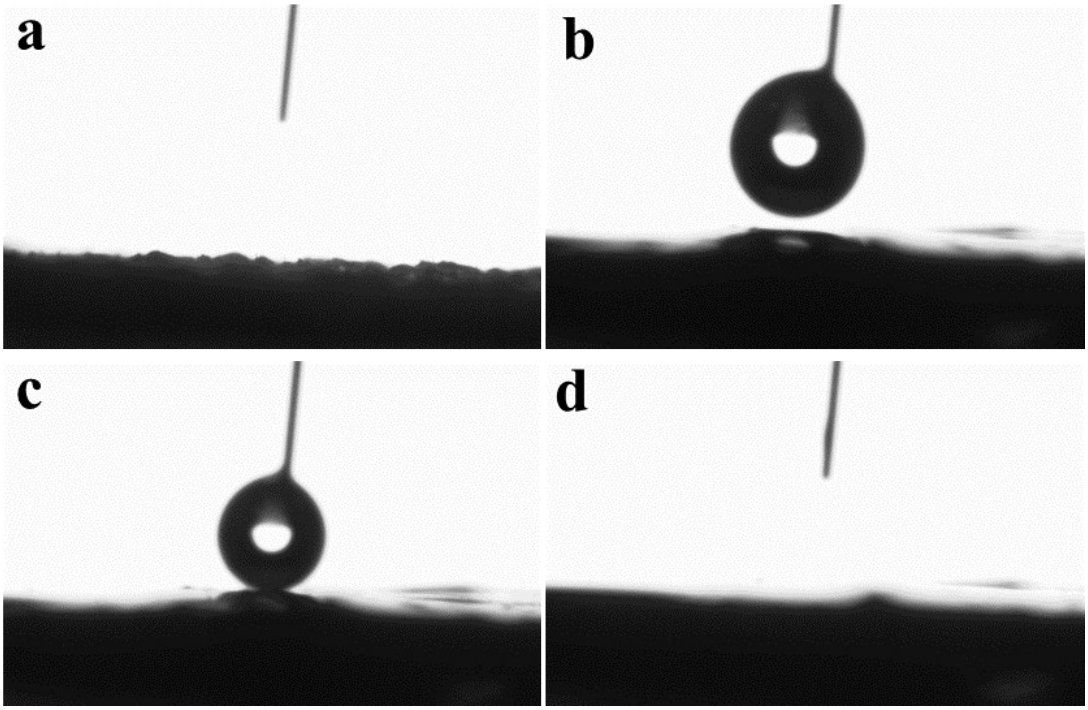


Fig. S6. Contact angle measurements of Bi-B/BiB_3O_6@HC electrode.

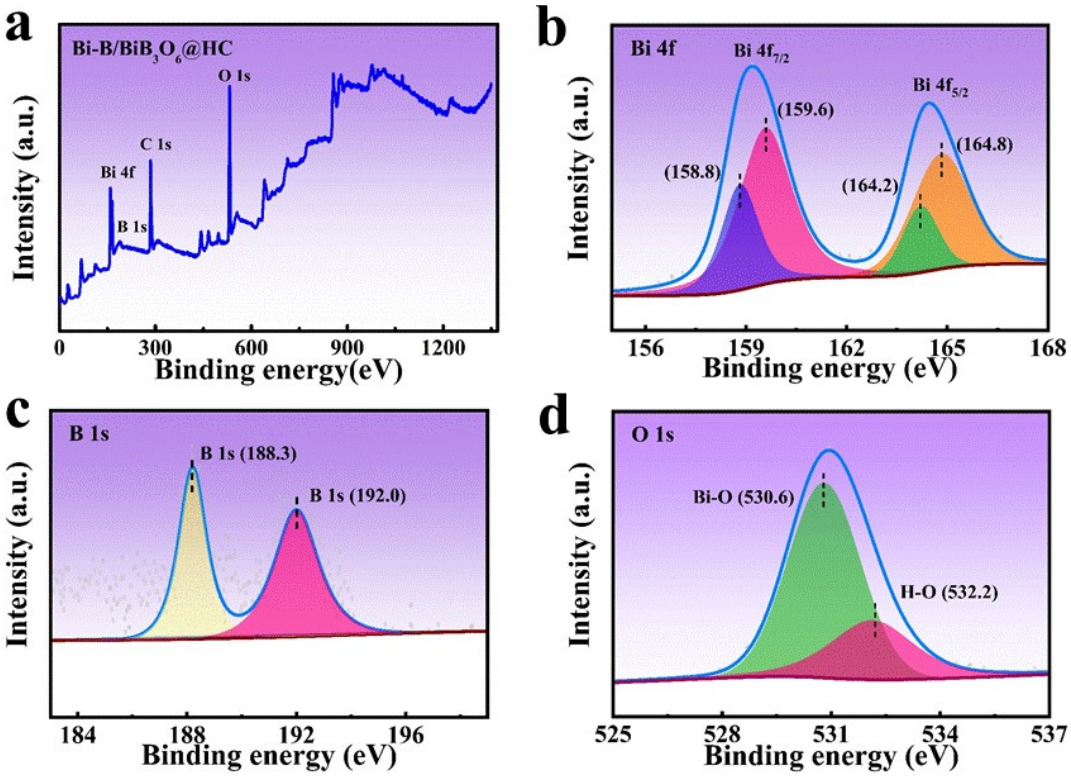


Fig. S7. (a) Full XPS patterns of Bi-B/BiB_3O_6@HC electrode and the corresponding high-resolution. (b) Bi 4f. (c) B 1s. (d) O 1s.

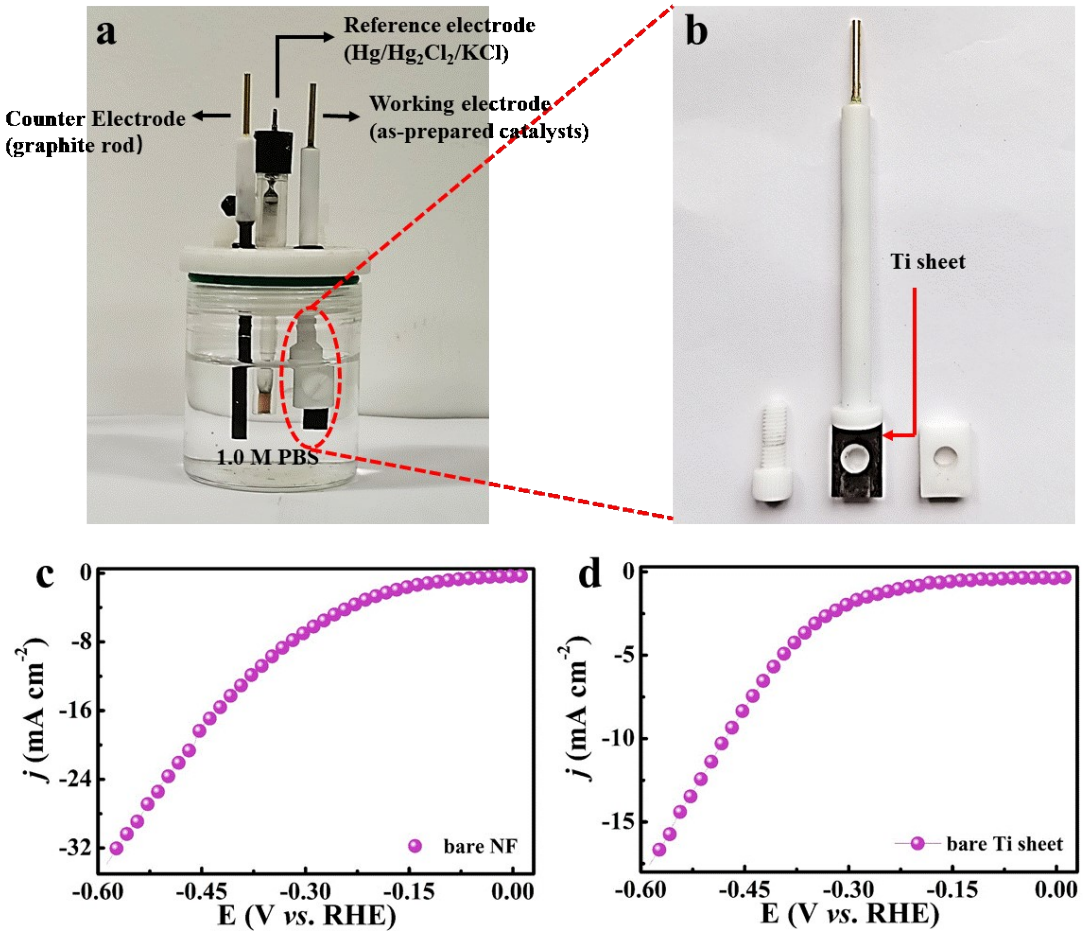


Fig. S8. (a) Photograph of the three-electrode cell for neutral water splitting HER measurements; (b) photograph of working electrode; (c) LSV curve of bare NF; (d) LSV curve of bare Ti sheet.

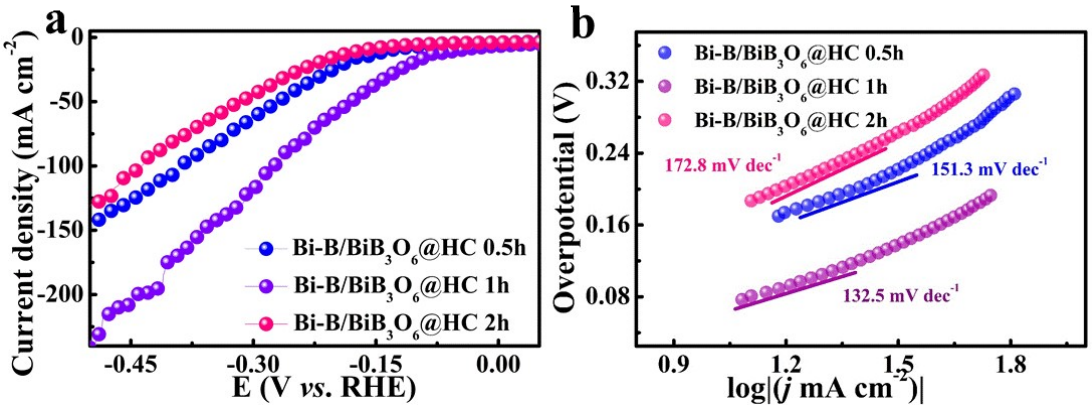


Fig. S9. (a) LSV curves; (b) Tafel slopes of Bi-B/BiB_3O_6@HC electrode at different electroless plating time without *iR*-correction in 1.0 M KOH + 0.5 M NaCl.

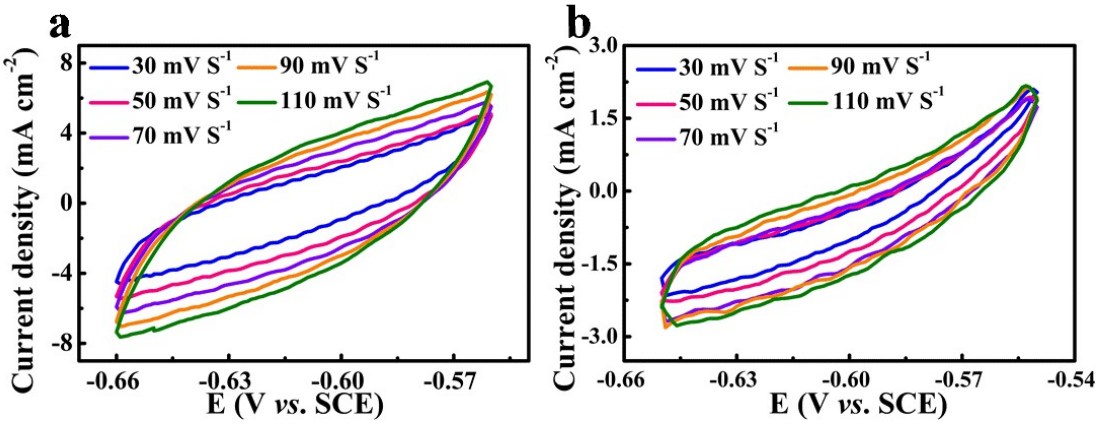


Fig. S10. Cyclic voltage (CV) measurements of (a) Bi-B/BiB_3O_6@HC and (b) Bi-B/BiB_3O_6@NF in the non-Faradaic current range at scan rates of 30, 50, 70 ,90 and 110 mV S^{-1}.

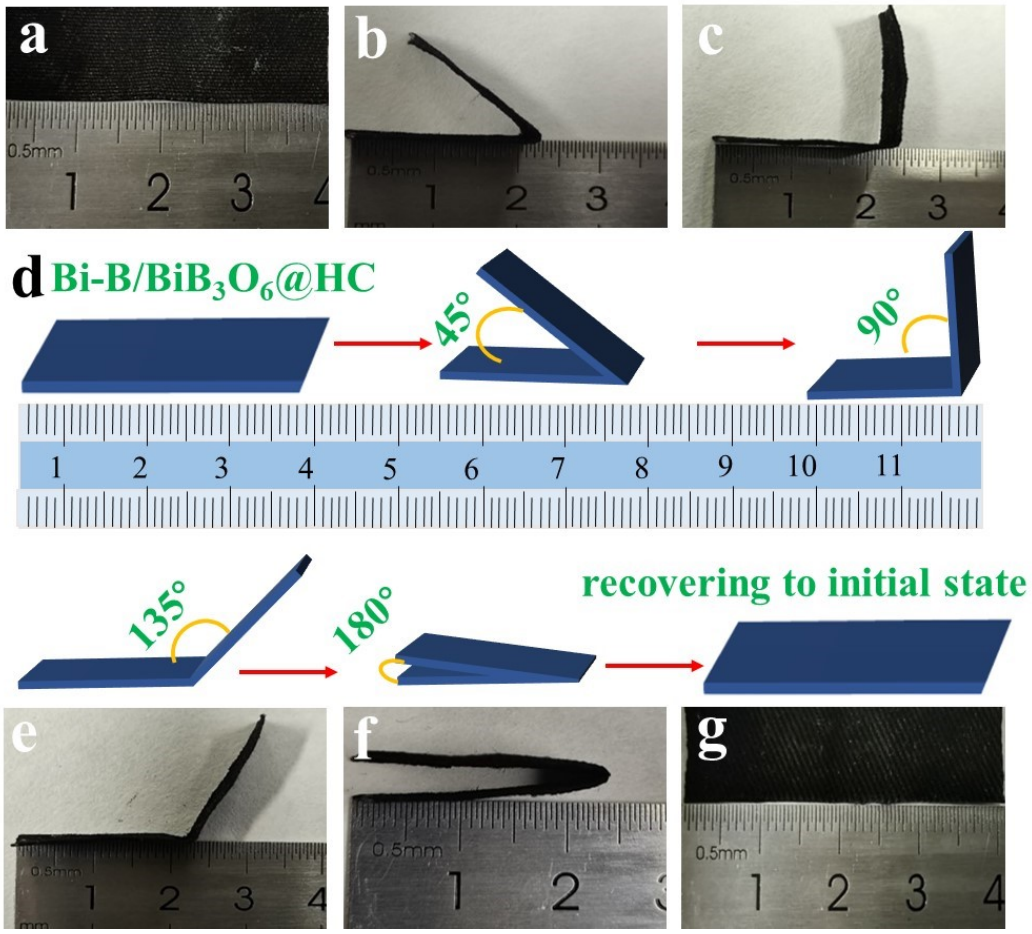


Fig. S11. Photograph of folding scheme of Bi-B/BiB_3O_6@HC flexible electrode.

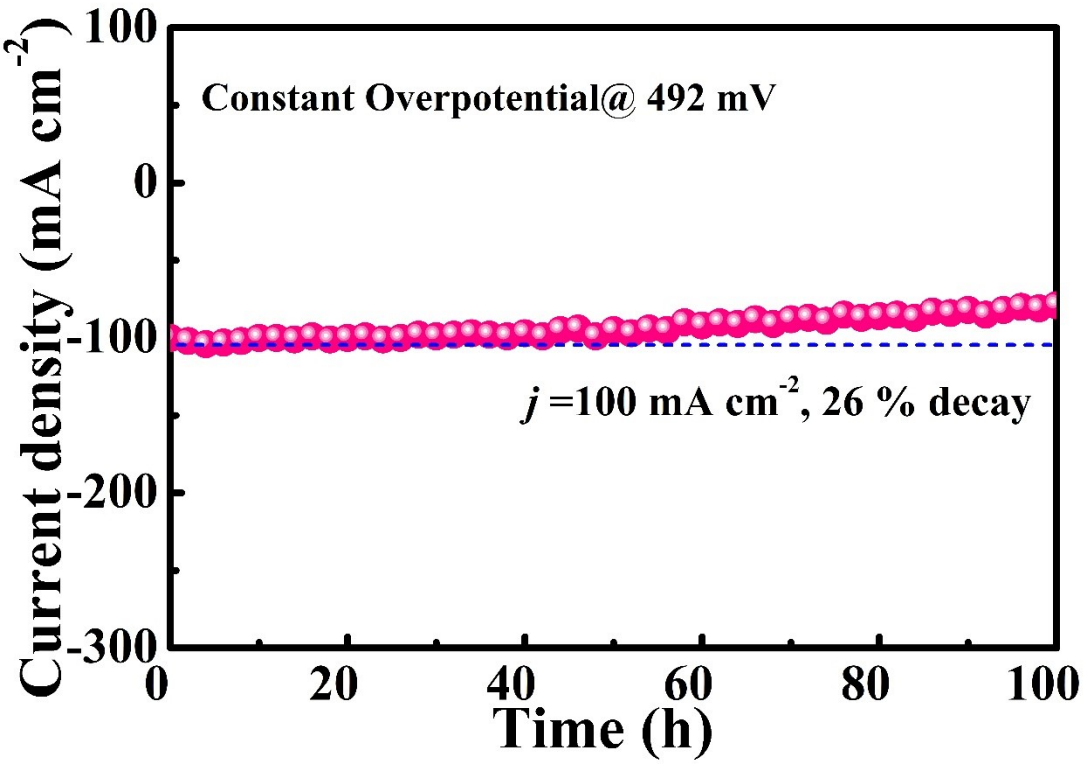


Fig. S12. Chronopotentiometric measurements of stability of Bi-B/BiB_3O_6@HC electrode at the current density of 100 mA cm^{-2} for 100 h.

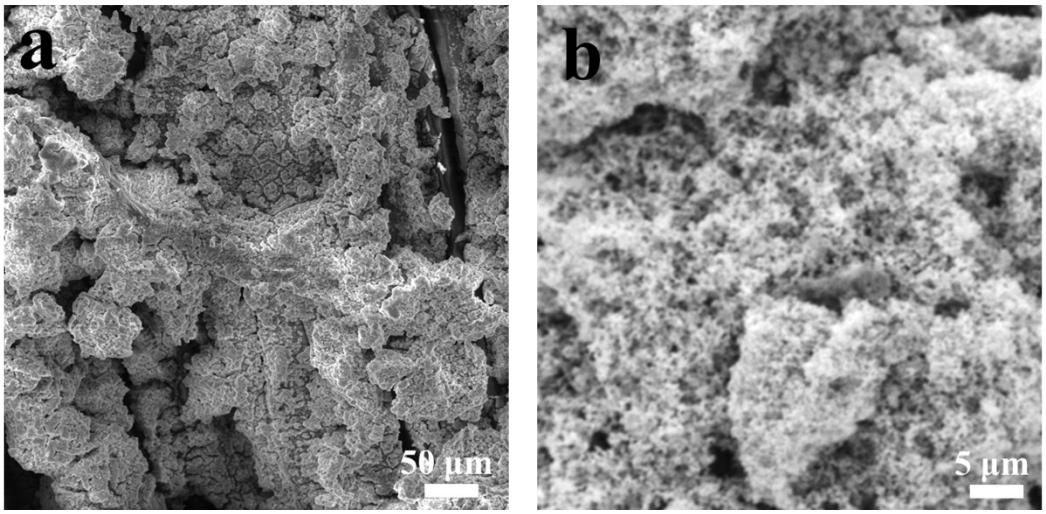


Fig. S13. SEM images of chronoamperometric measurements of stability of Bi-B/BiB_3O_6@HC electrode at the current density of 100 mA cm^{-2} after 36 h.

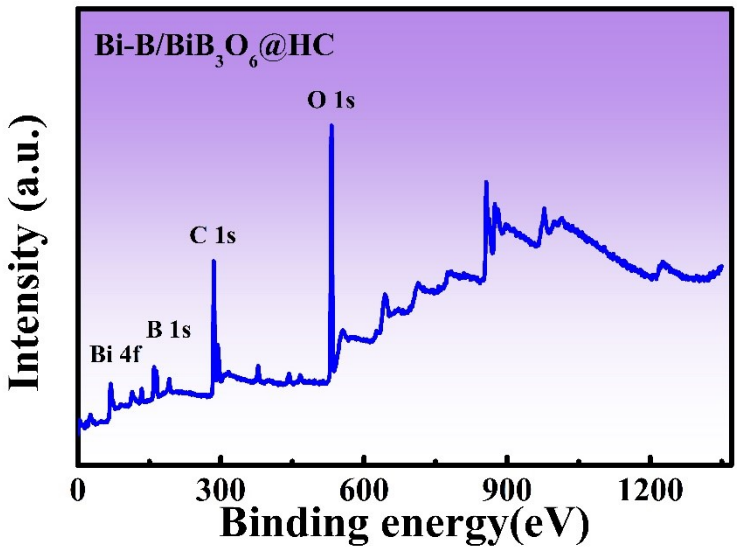


Fig. S14. XPS pattern of HER-cycled Bi-B/BiB_3O_6@HC electrode.

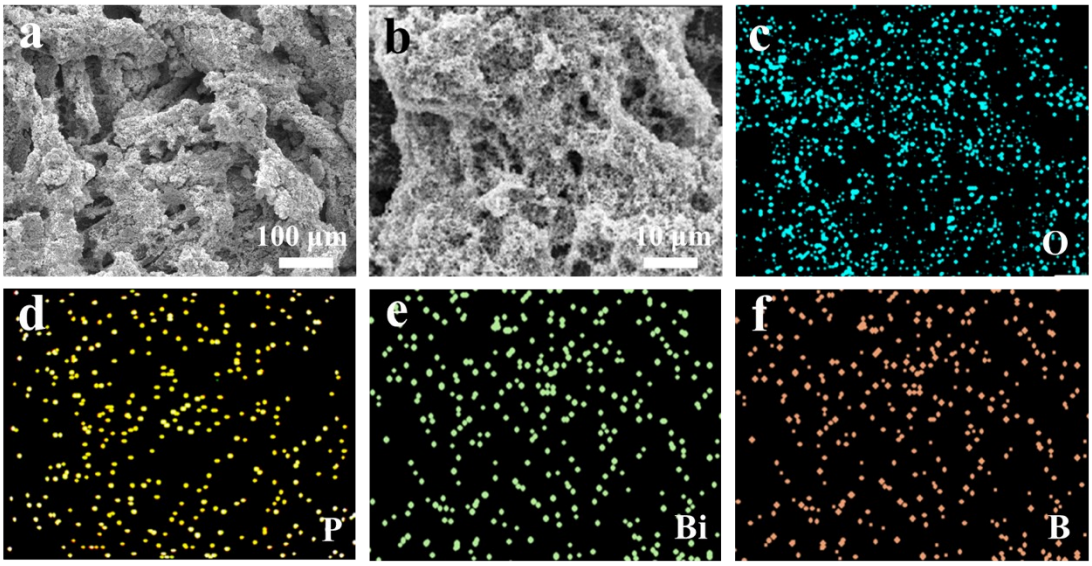


Fig. S15. (a-b) SEM images of Bi-B-P/BiB_3O_6@HC at different magnification, and corresponding elemental mapping of (c) O element; (d) P element; (e) Bi element; and (f) B element.

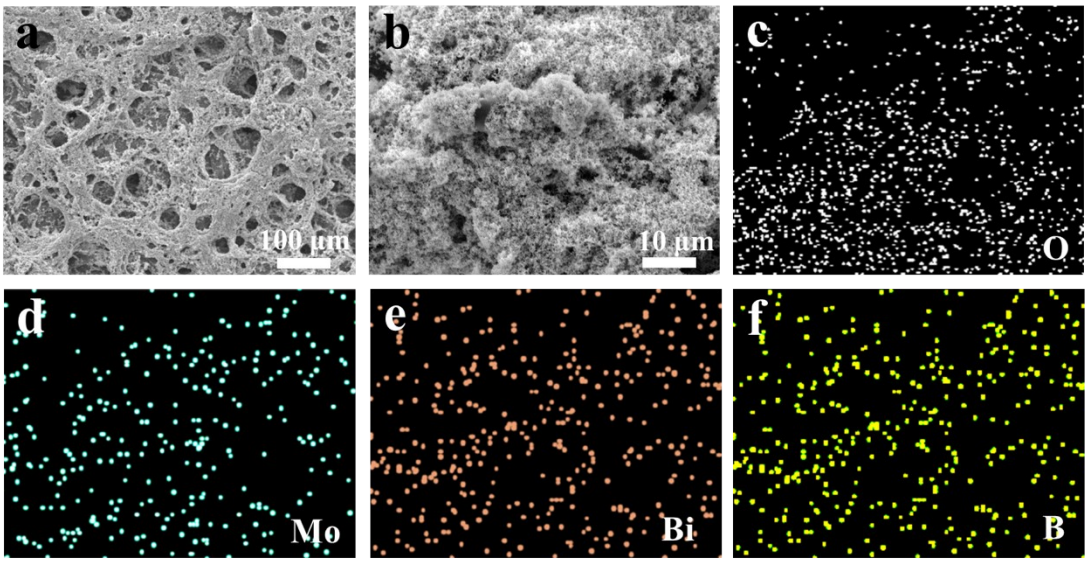


Fig. S16. (a-b) SEM images of Bi-B-Mo/BiB_3O_6@Paper at different magnification, and corresponding elemental mapping of (c) O element; (d) Mo element; (e) Bi element; and (f) B element.

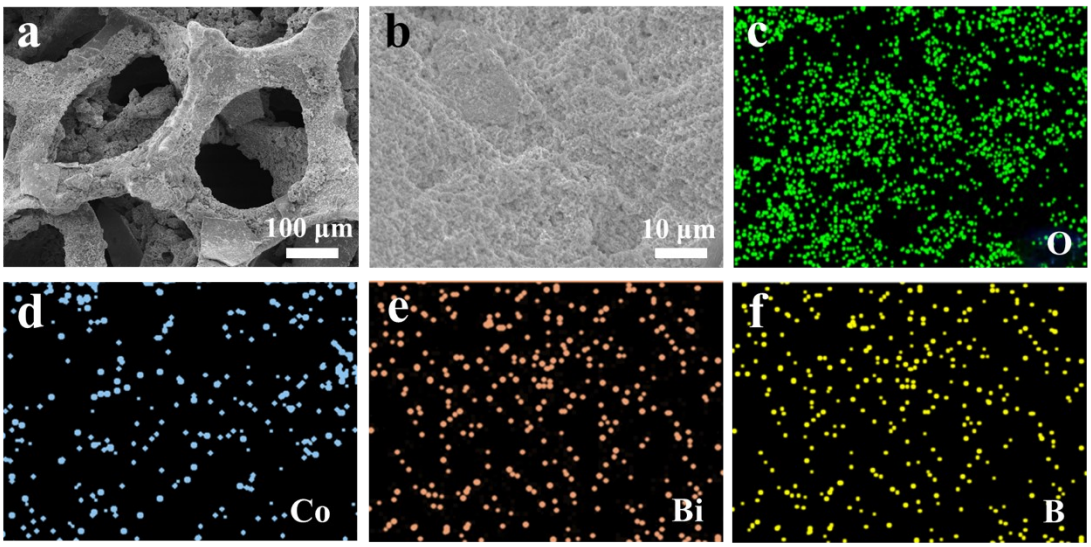


Fig. S17. (a-b) SEM images of Bi-B-Co/BiB_3O_6@NF at different magnification, and corresponding elemental mapping of (c) O element; (d) Co element; (e) Bi element; and (f) B element.

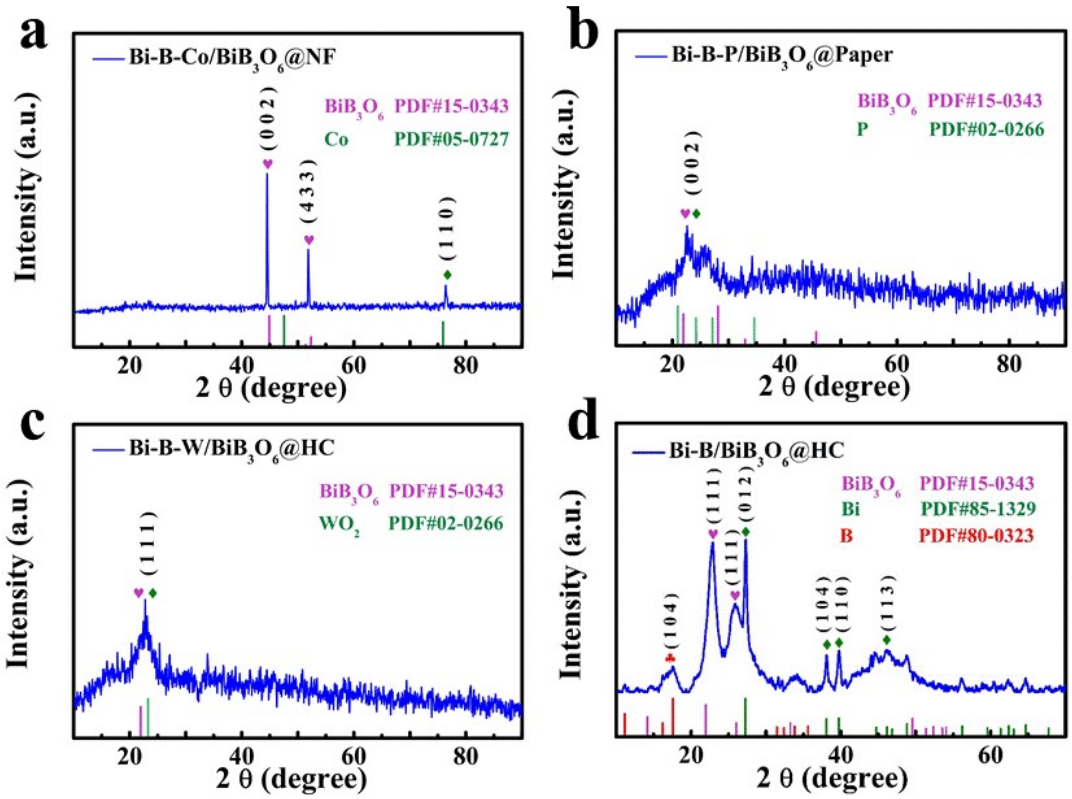


Fig. S18. XRD patterns of (a) Bi-B-Co/BiB_3O_6@NF; (b) Bi-B-P/BiB_3O_6@Paper; (c) Bi-B-W/BiB_3O_6@HC; and (d) Bi-B/BiB_3O_6@HC.

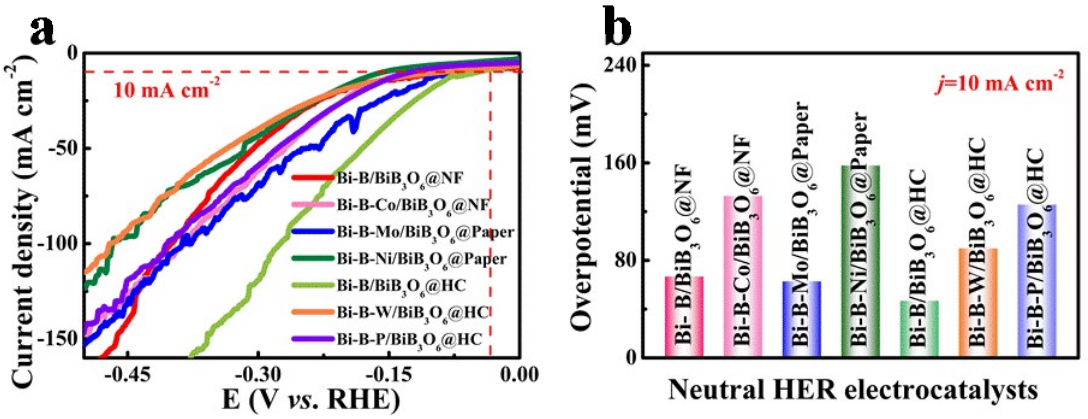
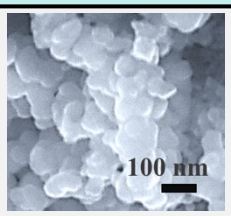
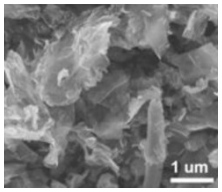
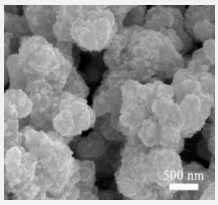
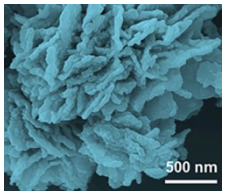
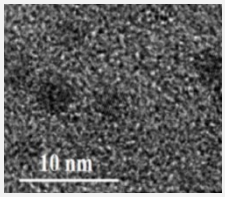
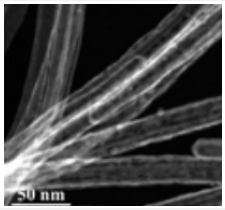
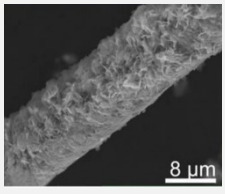


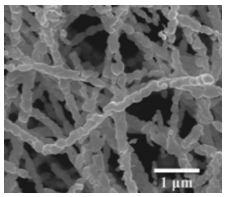
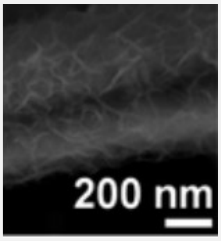
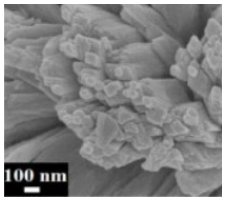
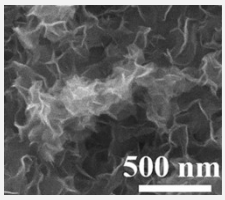
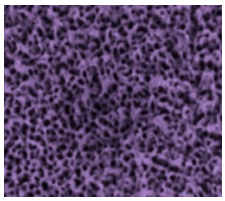
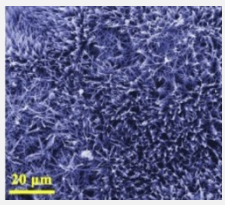
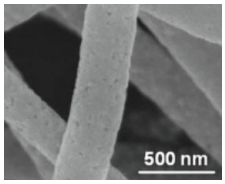
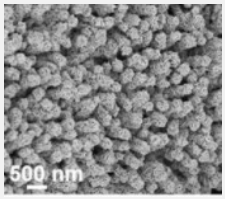
Fig. S19. (a) LSV curves and (b) histogram at 10 mA cm^{-2} of Bi-B/BiB_3O_6@NF, Bi-B-Co/BiB_3O_6@NF, Bi-B-Mo/BiB_3O_6@Paper, Bi-B-Ni/BiB_3O_6@Paper, Bi-B/BiB_3O_6@HC, Bi-B-W/BiB_3O_6@HC and Bi-B-P/BiB_3O_6@HC in 1.0 M KOH + 0.5 M NaCl.

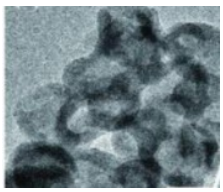
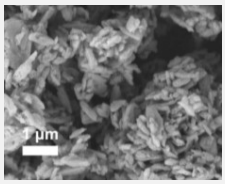
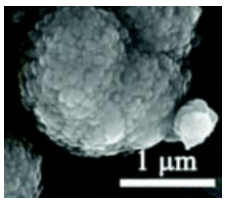
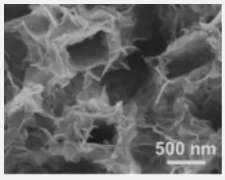
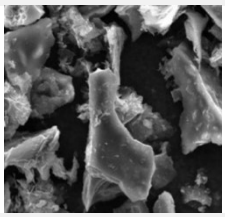
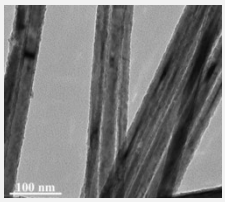
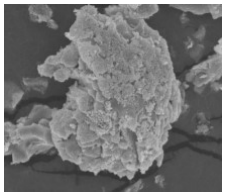
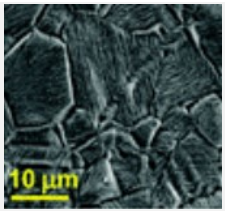
Table S1. ICP-AES analysis results of Bi-B based catalytic electrodes.

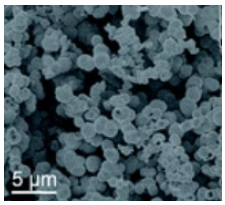
	B	Bi	Ni	W	Mo	P	Co	Atomic ratio
Bi-B/BiB_3O_6@HC	4.52	1.38	-	-	-	-	-	3.28:1
Bi-B/BiB_3O_6@HC Post-HER	3.63	1.19	-	-	-	-	-	3.05:1
Bi-B/BiB_3O_6@NF	3.5	1.09	-	-	-	-	-	3.21:1
Bi-B-W/BiB_3O_6@HC	2.47	0.92	-	0.17	-	-	-	14.52:5.41:1
Bi-B-Ni/BiB_3O_6@Paper	3.07	1.03	0.21	-	-	-	-	14.61:4.9:1
Bi-B-Mo/BiB_3O_6@Paper	4.10	1.59	-	-	0.272	-	-	15:5.84:1
Bi-B-P/BiB_3O_6@HC	4.14	1.34	-	-	-	0.24	-	17.25:5.58:1
Bi-B-Co/BiB_3O_6@NF	3.36	1.08	-	-	-	-	0.22	15.27:4.9:1

Table S2. Comparison of the HER performance of Bi-B/BiB_3O_6@HC with other electrocatalysts in PBS according to Figure 2h.

Catalysts	Electrolyte	η_{10} (mV)	Tafel slope (mV dec^{-1})	Morphology	Reference
Bi-B/BiB_3O_6@HC	1.0 M PBS	88.5	74.6		**This work**
MoS_2/NLG-3	1.0 M PBS	142	72.9		[1]
Co-Ni-P/NF	1.0 M PBS	95	151		[2]
pFe/FeP	1.0 M PBS	125	66		[3]
Ru/GC	1.0 M PBS	115	173.7		[4]
RhCu NWs- 2	0.1 M PBS	165	211		[5]
NSOC/CS	1.0 M PBS	103	113.7		[6]

$NiRh_2O_4$	1.0 M PBS	156	224.4		7
CoMoNiS-NF-31	1.0 M PBS	117	56		8
Fe-CoP	1.0 M PBS	134	50.1		9
MoS_2/NVO	1.0 M PBS	96	70		10
S-MoP	1.0 M PBS	140	98		11
Cu@WC	1.0 M PBS	173	119		12
Co, Mo_2C-CNF	1.0 M PBS	206	92.8		13
CoSAs-MoS_2/TiN NRs	1.0 M PBS	203	82.7		14

$WS_2/CoS_2/CC$	1.0 M PBS	175	81		15
TM-Mo_2C@NCF	1.0 M PBS	109	110		16
Cu-Ni_3S_2	1.0 M PBS	128	151.0		17
Mo-CoP/NC/TF	1.0 M PBS	130	84.1		18
K-$G_{4.0}T_{2.0}Mo_{1.0}$	pH=7	150	197.2		19
RuCu NWs	0.01 M PBS	190	314		20
Co_9S_8/NF	1.0 M PBS	193.9	168.3		21
Karst NF	1.0 M PBS	110	99		22

$NiS_{2(1-X)}Se_{2x}$	1.0 M PBS	124	81		[23]

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