

Supplementary Material

Phosphorus modification of cobalt–iron nanoparticles embedded in a nitrogen-doped carbon network for oxygen reduction reaction

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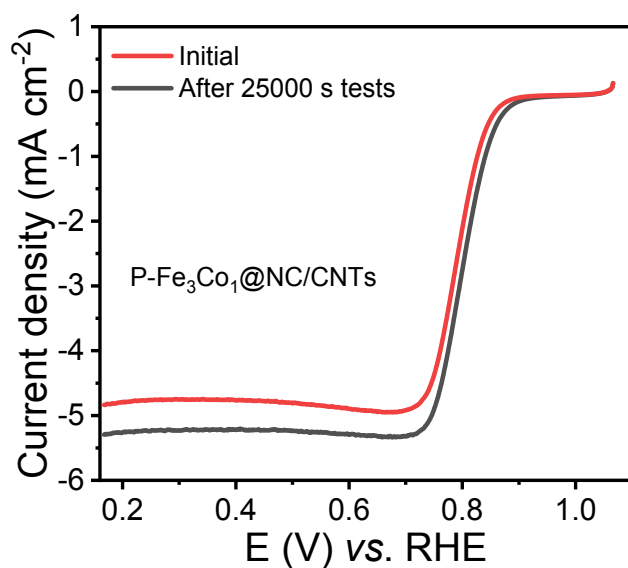


Fig. S1. ORR polarization curves before and after 25000s potential cycles for P-Fe₃Co₁@NC/CNTs catalyst.

The ORR polarization curves before and after 25000s durability evaluation at 0.6 V in an O₂-saturated 0.1 M KOH solution are shown in Fig. S1. The activity of P-Fe₃Co₁@NC/CNTs decreased slightly after 25000s durability evaluation. This result corresponds to the durability evaluation results of Fig. S1.

The morphology of the P-FeCo@NC/CNTs on carbon paper substrate before and after discharge over 12 h are shown in Fig. S2. It can be seen that the morphology of the P-FeCo@NC/CNTs on carbon paper substrate did not change significantly before and after 12 h reaction. The Nafion ionomers protects the P-FeCo@NC/CNTs catalysts well.

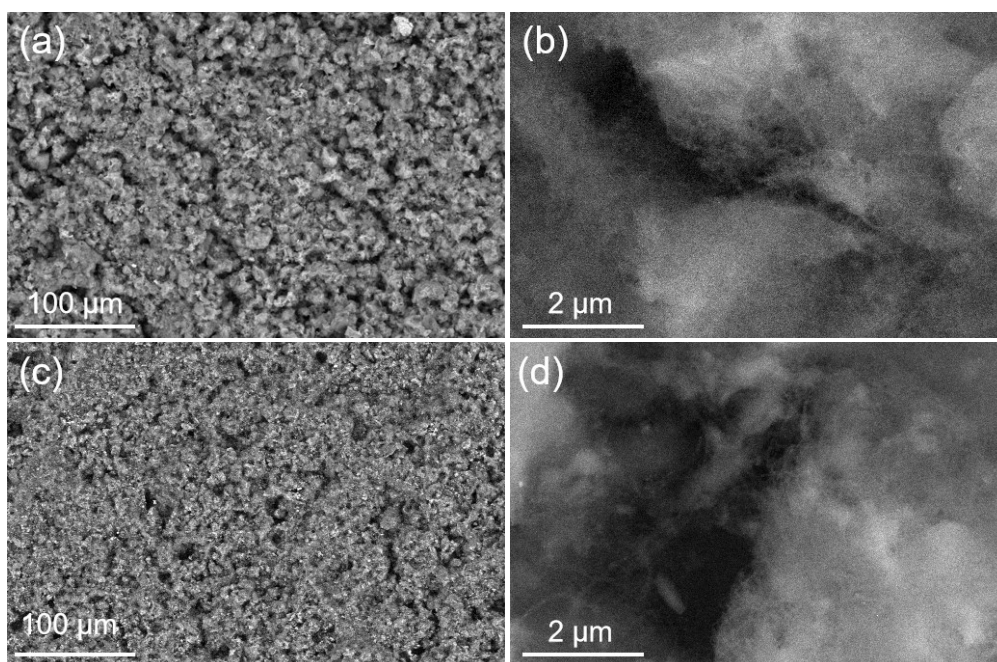


Fig. S2 The morphology of the P-FeCo@NC/CNTs on carbon paper substrate before and after discharge over 12 h.

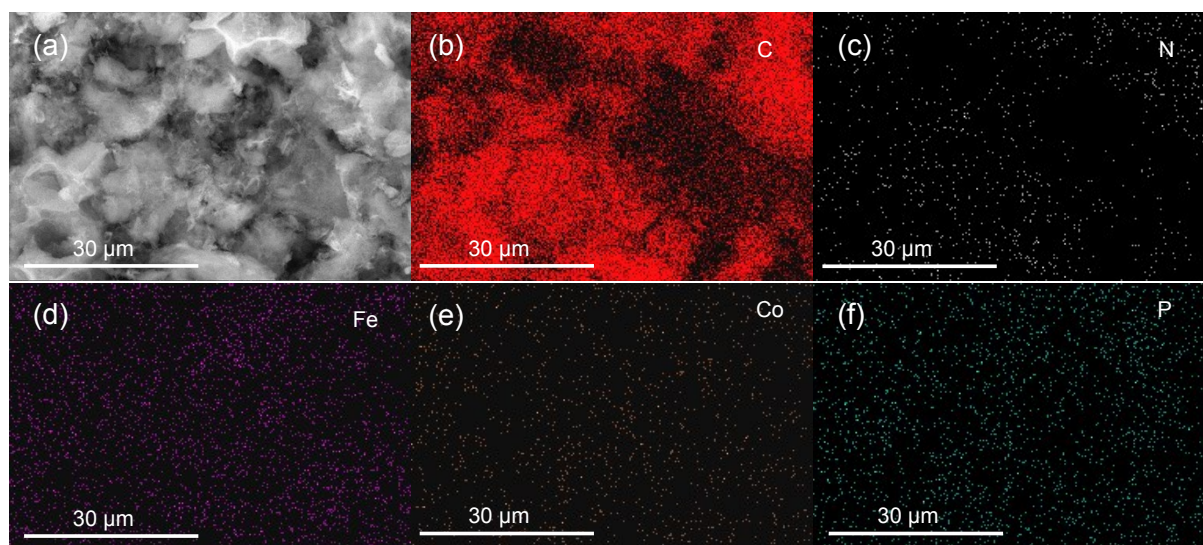


Fig. S3 SEM image and corresponding elemental mapping of C, N, Fe, Co and P of P-FeCo@NC/CNTs.

The EDS mapping of C, N, Fe, Co and P elements evenly distributed across the whole structures of P-FeCo@NC/CNTs on carbon paper substrate.

Table S1. Comparison of the catalytic performances of the P-FeCo@NC/CNTs prepared herein and other electrocatalysts reported in literature.

Catalyst	Loading (mg cm ⁻²)	onset potential (V vs. RHE)	half-wave Potential (V vs. RHE)	limiting current Density (mA cm ⁻²)	Reference
P-Fe ₃ Co ₁ @NC/CNTs	~0.4	0.86	0.802	5.29	This work
FeCo-N-C	~0.255	0.967	0.816	4.86	<i>Chemcatchem</i> , 2020, 12 , 5780-5788.
Fe-N-C	0.38	0.98	0.831	4.2	<i>Mater. Res. Express</i> , 2020, 7 , 025506.
FeCo@NC-750	0.8	0.94	0.8	4.82	<i>Adv. Mater. Interfaces</i> , 2018, 5 , 1701448.
FeCoNi/N-CNTs	~0.4	0.811	0.749	5.28	<i>J. Alloys Compd</i> , 2021, 857 , 158249.
FeP@SA-Fe/HC-900	~0.5	0.941	0.843	~6.1	<i>J. Coll. Interf. Sci</i> , 2021, 583 , 371-375.
FeCu-N/C	~1.0	1.055	0.865	6.06	<i>J. Alloys Compd</i> , 2021, 826 , 154152.