Electronic Supplementary Material (ESI) for New Journal of Chemistry.


# Supporting information

## An efficient hierarchically synthesized $Fe_2P$ nanoparticles embedded in N, P-doped mesoporous carbon catalyst for oxygen reduction reaction

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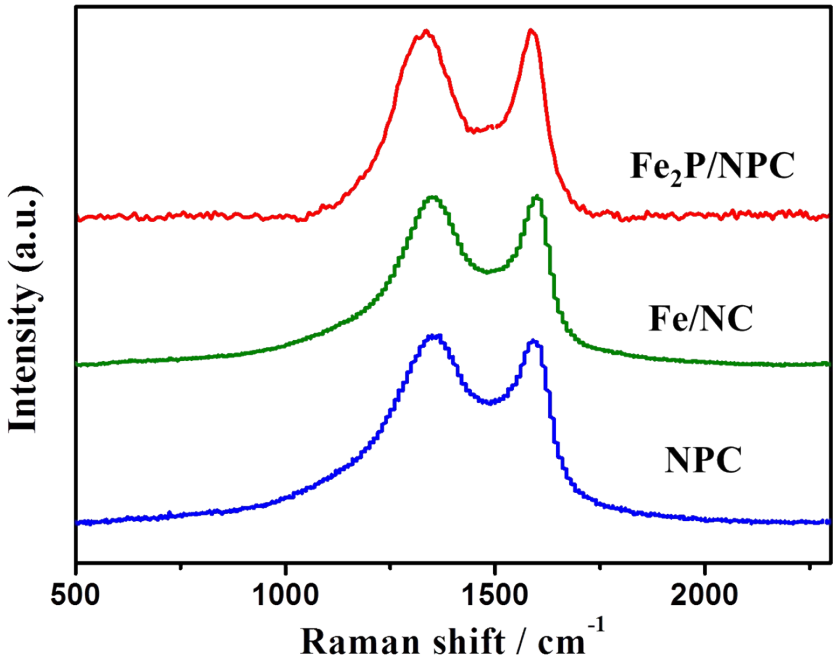


**Fig. S1** Raman spectra of Fe/NC, NPC and $Fe_2P$/NPC catalysts.

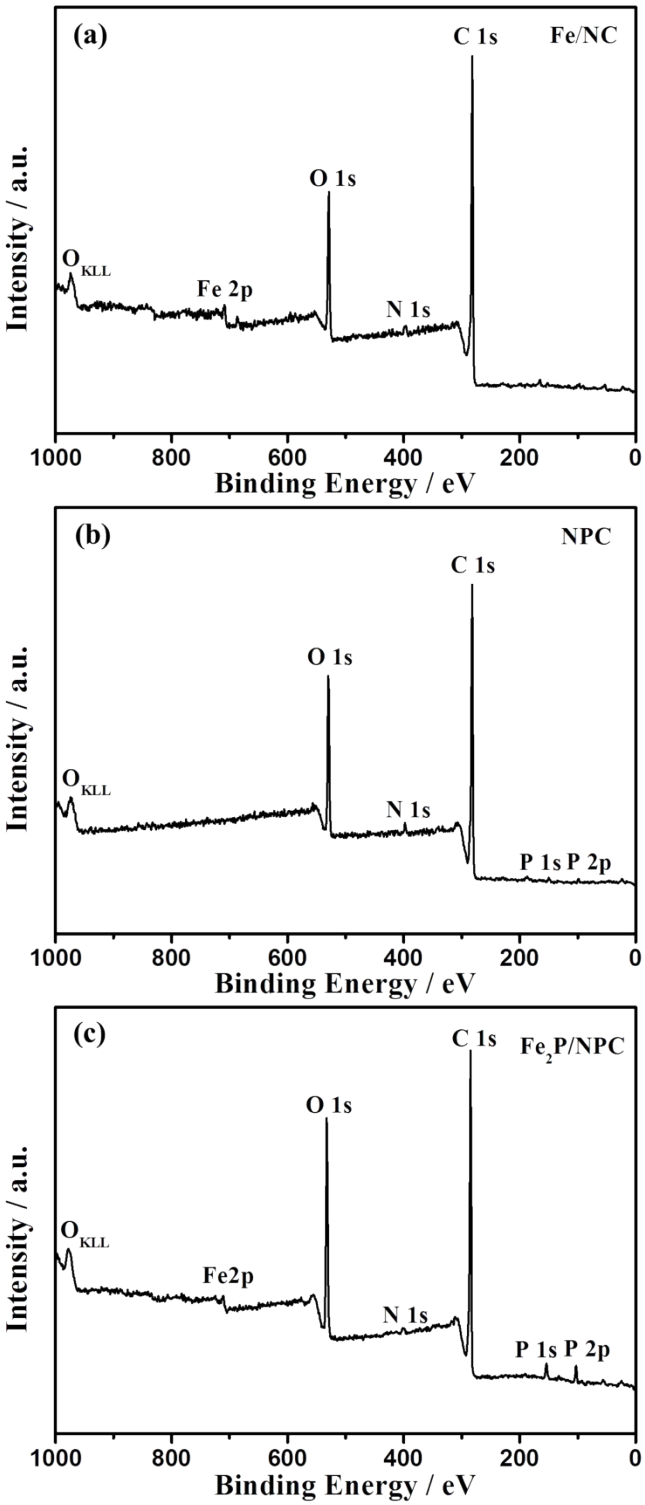


**Fig. S2** XPS survey spectra for (a) Fe/NC, (b) NPC and (c) $Fe_2P$/NPC catalysts.

**Table S1**. The total contents of N, Fe, P, O, C and the relative amounts of different types of N species for Fe/NC, NPC, $Fe_2P$/NPC and the corresponding catalytic parameters for ORR.

| Samples | $Fe_2P$/NPC | Fe/NC | NPC |
|---|---|---|---|
| **N (at. %)** | **1.5** | **2.59** | **1.28** |
| $N_1$: Pydinic N | 24.3 | 4.57 | 16.46 |
| $N_2$: Graphitic N | 47.8 | 39.86 | 34.5 |
| $N_3$: Pyrrolic N | 23.1 | 26.7 | 25.1 |
| $N_4$: Oxidized N | 4.8 | 28.9 | 23.9 |
| **Fe (at. %)** | **0.78** | **1.2** | **/** |
| **P (at. %)** | **1.0** | **/** | **1.62** |
| **O (at. %)** | **21.2** | **15.43** | **18.56** |
| **C (at. %)** | **75.5** | **80.78** | **78.55** |
| $E_{onset}$ **(V)** | **0.02** | **-0.01** | **-0.09** |
| $J_{limit}$ **(mA cm$^{-2}$)** | **6.1** | **5.6** | **4.1** |

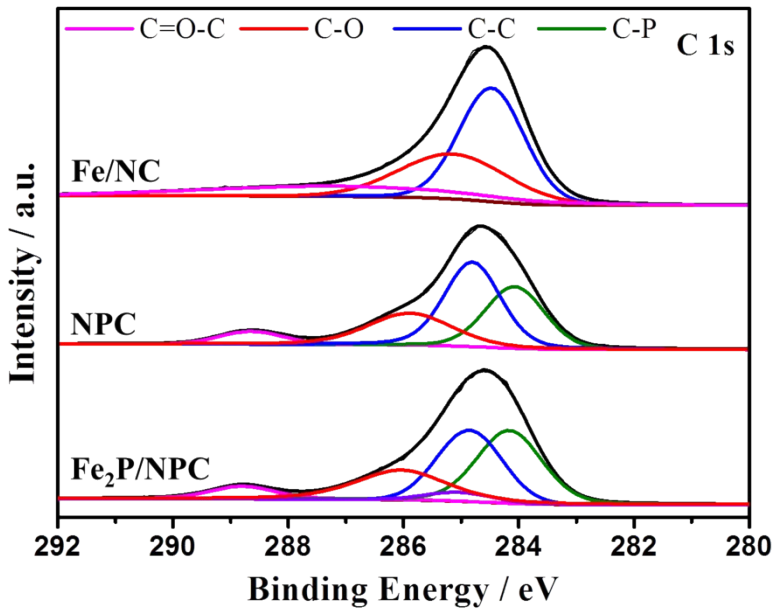


**Fig. S3** High-resolution C 1s spectra of Fe/NC, NPC, and $Fe_2P$/NPC catalysts.

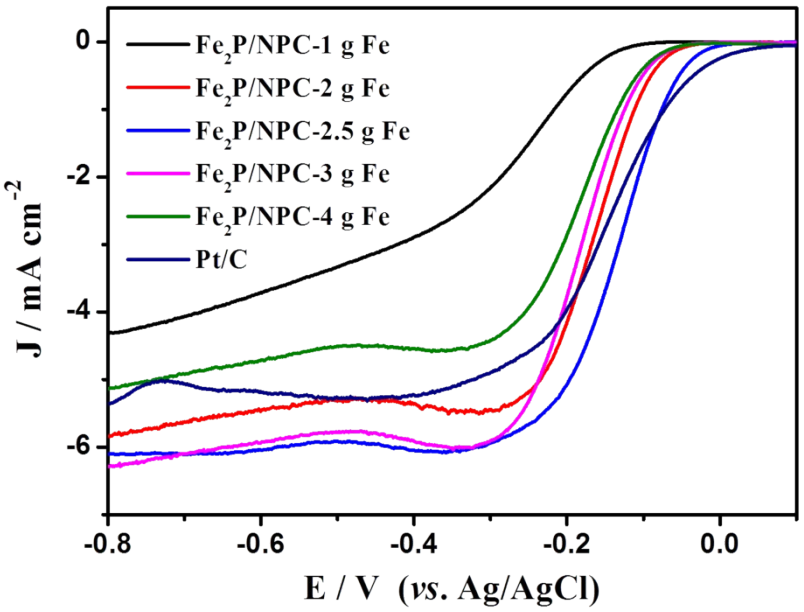


**Fig. S4** CV curves of $Fe_2P$/NPC with different Fe precursor feeding content in $O_2$-saturated 0.1 M KOH solution with a rotation speed of 1600 rpm at room temperature, scan rate: 10 mV $s^{-1}$.

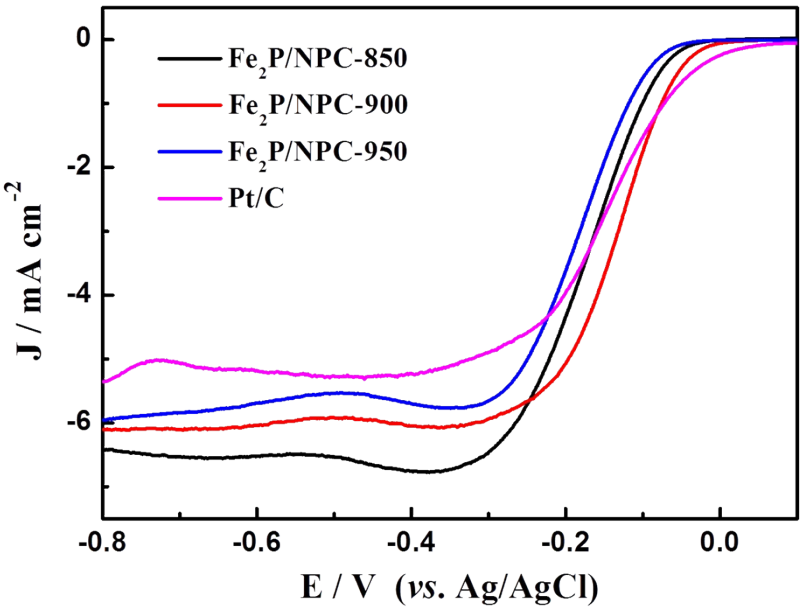


**Fig. S5** CV curves of $Fe_2P$/NPC-T (T=850, 900, 950 °C) in $O_2$-saturated 0.1 M KOH solution with a rotation speeds of 1600 rpm at room temperature, scan rate: 10 mV $s^{-1}$.

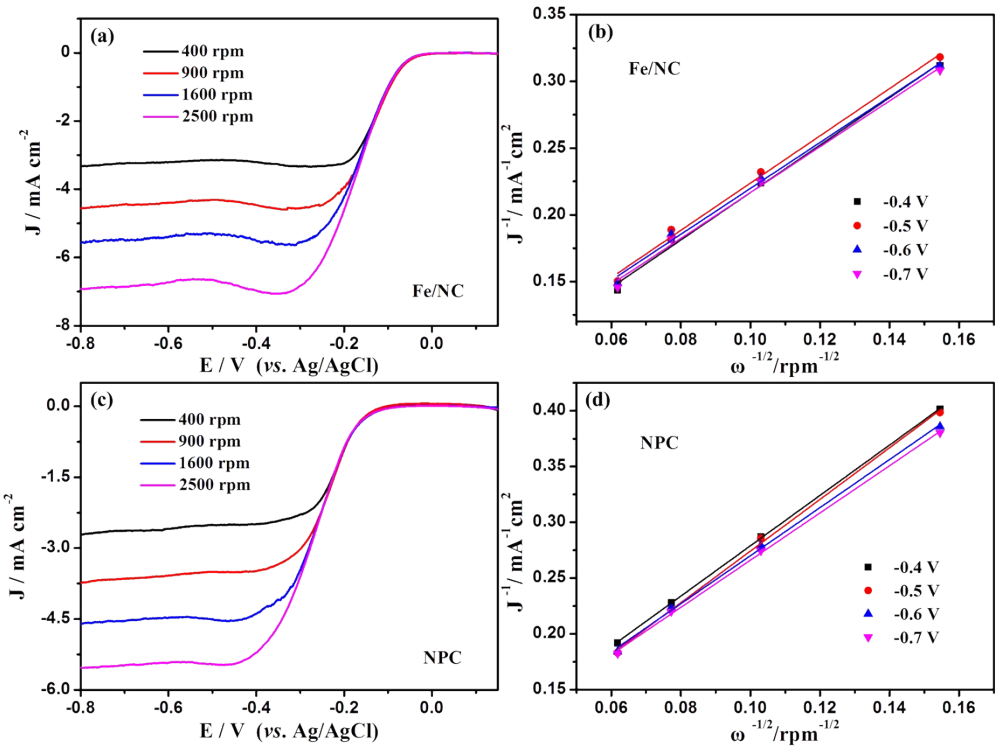


**Fig. S6** LSV curves of Fe/NC (a) and NPC (c) catalysts in $O_2$-saturated 0.1 M KOH solution at different rotation speeds from 400 to 2500 rpm at room temperature, scan rate: 10 mV $s^{-1}$. Corresponding Koutecky-Levich plots of Fe/NC (b) and NPC (d) catalysts at different potentials varied from -0.4 to -0.7 V.

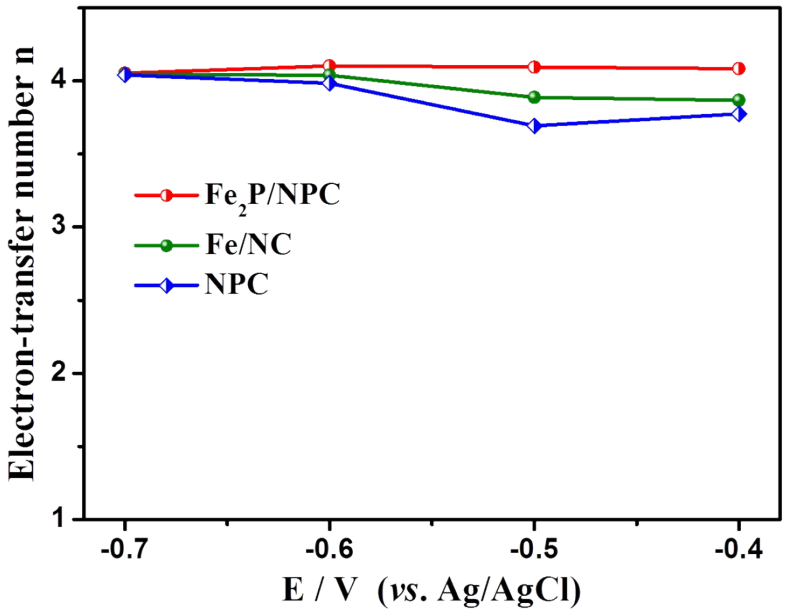


**Fig. S7** The dependence of electron transfer number *n* on potential for Fe/NC, NPC, and $Fe_2P$/NPC catalysts.

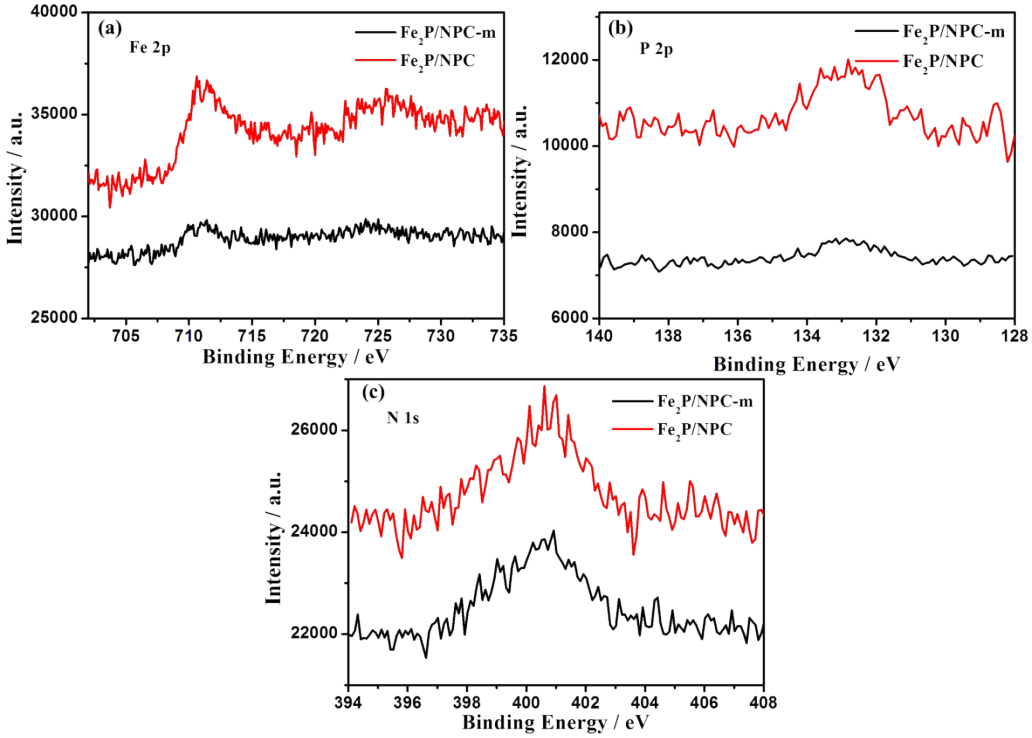


**Fig. S8** High-resolution (a) Fe 2p spectra, (b) P 2p spectra, and (c) N 1s spectra of $Fe_2P$/NPC-m and $Fe_2P$/NPC catalysts.

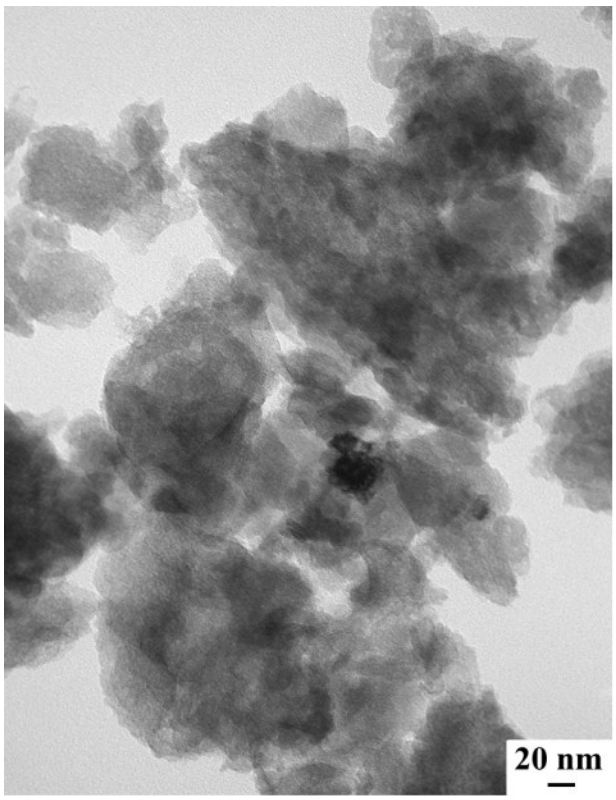


**Fig. S9** The TEM image of $Fe_2P$/NPC-m catalyst.

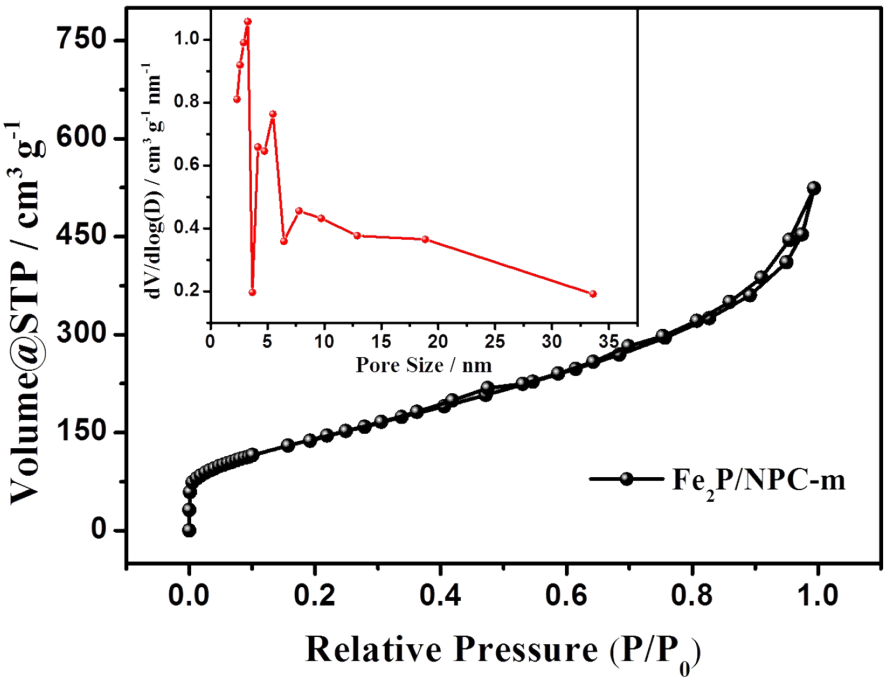


**Fig. S10** $N_2$ adsorption-desorption isotherm and pore size distribution curve of $Fe_2P$/NPC-m catalyst.

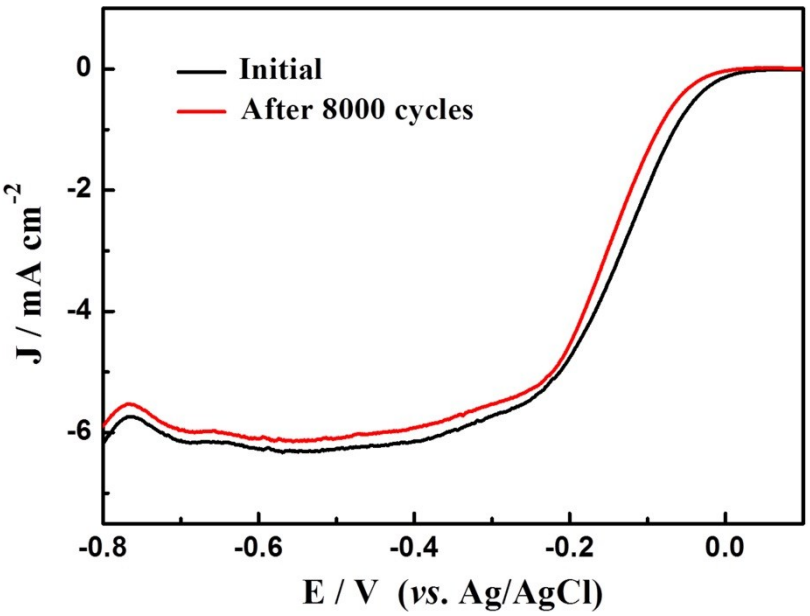


**Fig. S11** CV curves of commercial 20 wt. % Pt/C for ORR in $O_2$-saturated 0.1 M KOH solution before and after continuous 8000 cycles between -0.4-0.1 V at a rotation rate of 1600 rpm at room temperature, scan rate: 10 mV $s^{-1}$.