**Supporting Information**

**Study of the mechanism of nitrogen doping in carbon supports on promoting electrocatalytic oxygen reduction reaction with platinum nanoparticles**

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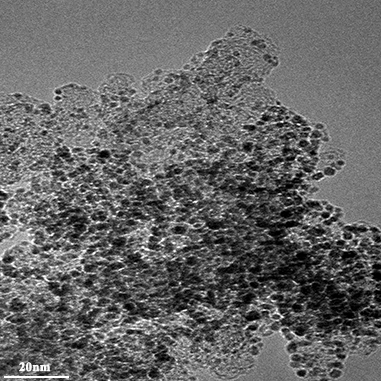
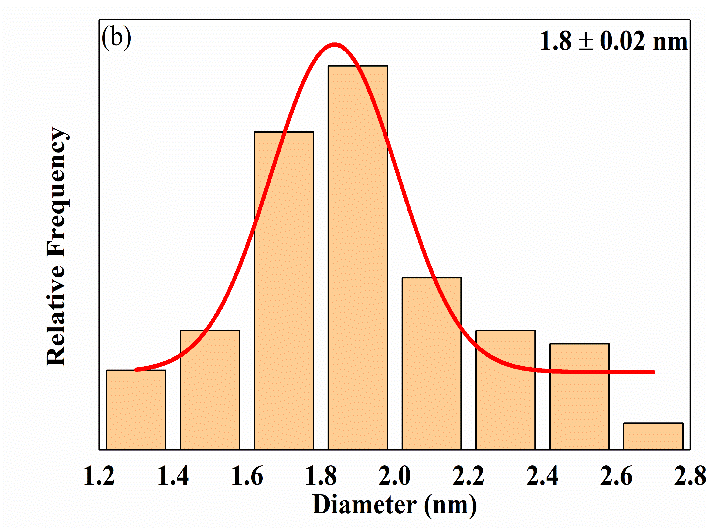
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Fig. S1. TEM images of carbon nanoparticle (a. b) and Nano-NC-800 support (c. d).



Fig.S2. XRD patterns of carbon nanoparticles, the Nano-NC-700, the Nano-NC-800, and Nano-NC-900.



(a)

Fig.S3. TEM images of Pt/Nano-C (a) and the corresponding size distribution of Pt nanoparticles of (b).



Fig.S4. LSV of the Pt/Nano-NC-700, Pt/Nano-NC-800, and Pt/Nano-NC-900 catalysts in O2-saturated 0.1M HClO4 at a scan rate of 5 mV/s.



Fig.S5. CVs of the Pt/Nano-NC-800, Pt/Nano-C and JM Pt/C catalysts at a scan rate of 50 mV/s in Ar-saturated 0.1M HClO4.



Fig. S6. Mass activity and specific activity of the Pt/Nano-NC-700, Pt/Nano-NC-800, Pt/Nano-NC-900, Pt/Nano-C, and JM Pt/C catalysts at 0.9 V (V vs RHE).

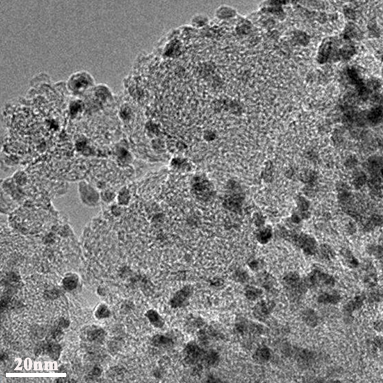
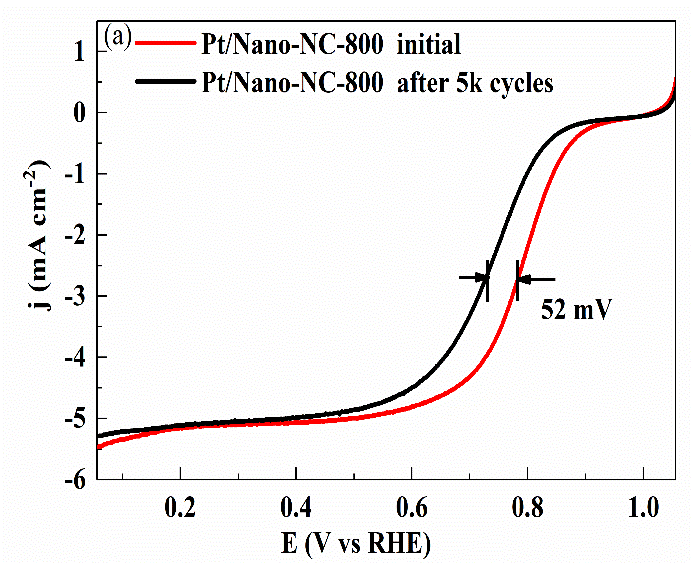
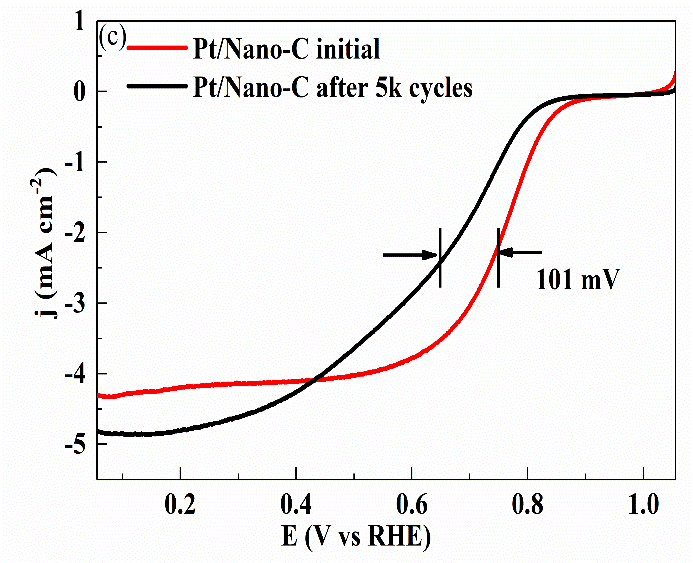
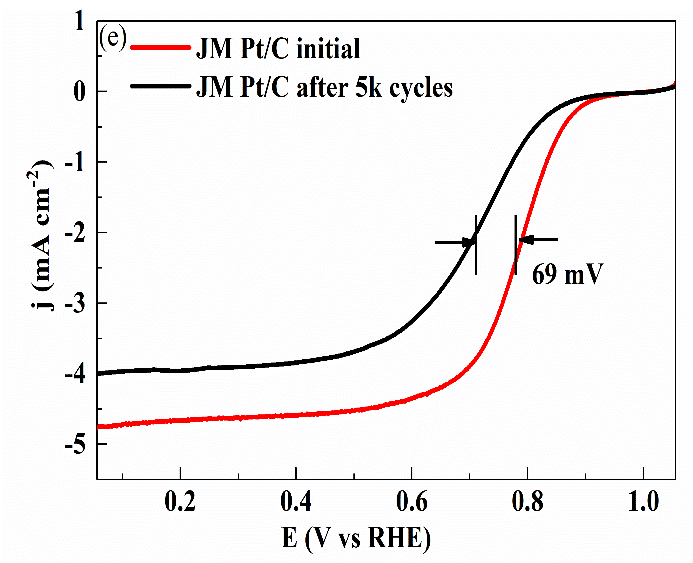




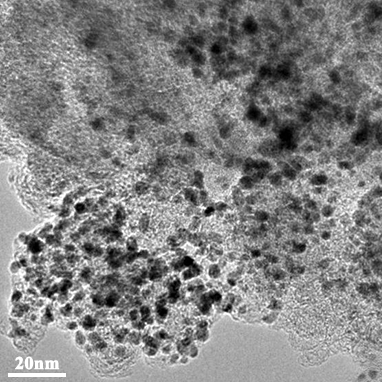
Fig.S7. LSVs in O2-saturated 0.1 M HClO4 at different RDE rotation rates and the corresponding Koutecky–Levich plots (insets) of the (a)Pt/Nano-NC-700, (b)Pt/Nano-NC-900, (c)Pt/Nano-C, and (d) JM Pt/C catalysts.



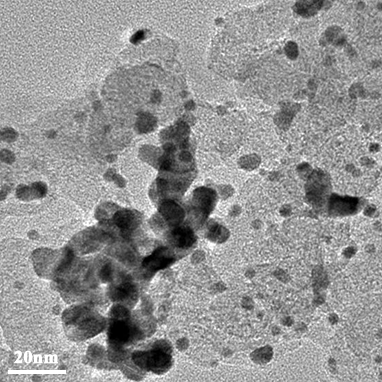
Fig.S8. (a) The RRED curves of Pt/Nano-NC-800;(b) H2O2% yield of Pt/Nano-NC-800 and JM Pt/C based on RRED test data.



(b)



(d)



(f)

Fig.S9. LSV of the (a) Pt/Nano-NC-800, (c) Pt/Nano-C, and (e)JM Pt/C catalysts before and after 5000 cycling tests. TEM images of the (b))Pt/Nano-NC-800, (d) Pt/Nano-C, and (f) JM Pt/C catalysts after 5000 cycles.



Fig.S10. LSV of the Pt/Nano-NC-800 and JM Pt/C catalysts before and after 10000 cycling tests.



Fig.S11. Comparison of the specific activity of Pt/Nano-NC-700, Pt/Nano-NC-800, Pt/Nano-NC-900, Pt/Nano-C, and JM Pt/C catalysts after 5000 cycles.

Table S1. BET surface area and pore size of carbon nanoparticles, Nano-NC-700, Nano-NC-800, and Nano-NC-900.

|  |  |  |  |
| --- | --- | --- | --- |
| Sample | BET surface area(m2 g-1) | Pore Size(nm) | |
| Pt/Nano-C | 1195 | － |
| Pt/Nano-NC-700 | 1205 | 6.8 |
| Pt/Nano-NC-800 | 1300 | 7.4 |
| Pt/Nano-NC-900 | 1362 | 7.6 |

Table S2. Results of the fits of the Pt 4f XPS. For each single component, the binding energy (eV) and amount (%) values are given

|  |  |  |  |
| --- | --- | --- | --- |
| Sample | Pt0 | Pt2+ | Pt4+ |
| Pt/Nano-C | 71.5 eV  24.0% | 72.2 eV  47.9% | 73.6 eV  28.1% |
| Pt/Nano-NC-700 | 71.7 eV  35.2% | 72.6 eV  41.2% | 74.6 eV  23.4% |
| Pt/Nano-NC-800 | 71.8 eV  37.8% | 72.4 eV  38.2% | 74.6 eV  24.0% |
| Pt/Nano-NC-900 | 71.6 eV  33.8% | 72.3 eV  37.5% | 74.3 eV  28.6% |

Table S3. Comparison of ORR activity of Pt/Nano-NC-800 catalyst with other catalysts.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Catalyst | Half wave  Potential(V) | Limiting  diffusion current  (mA cm-2) | ECSA  (m2g-1) | Sweep rate  (mV s-1) | Electrolyte | Ref |
| Pt/BG3 | 0.51 | 4.60 | 49.57 | 10 | 0.1M HClO4 | [[1](#_ENREF_1)] |
| Pt/MGTC | ~0.77 | ~6.80 |  | 10 | 0.5M H2SO4 | [[2](#_ENREF_2)] |
| Pt-CeOxNW/C | 0.69 |  |  | 10 | 0.5M H2SO4 | [[3](#_ENREF_3)] |
| Pt/TfGnPs | 0.75 | 3.33 |  | 10 | 0.1M HClO4 | [[4](#_ENREF_4)] |
| Pt-Ni(trace)/GNs | 0.76 | 4.36 | 40.94 | 5 | 0.5M H2SO4 | [[5](#_ENREF_5)] |
| Pt-WP-CL/AEG | 0.61 | 7.01 | 123.05 | 10 | 0.5M H2SO4 | [[6](#_ENREF_6)] |
| PtP2@PNC | 0.74 | 5.50 | 70 | 5 | 0.1M HClO4 | [[7](#_ENREF_7)] |
| Cu@Pt/NCNT | 0.70 |  | 16.2 | 5 | 0.5M H2SO4 | [[8](#_ENREF_8)] |
| Pt/N-OHPC | 0.76 | 4.80 | 59.5 | 5 | 0.5M H2SO4 | [[9](#_ENREF_9)] |
| Pt/Nano-NC-800 | 0.80 | 5.37 |  | 5 | 0.1M HClO4 | This work |

**Supporting References**

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