Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Nanodiamonds as pH-switchable oxidation and reduction catalysts with enzyme-like activities for immunoassay and antioxidant applications

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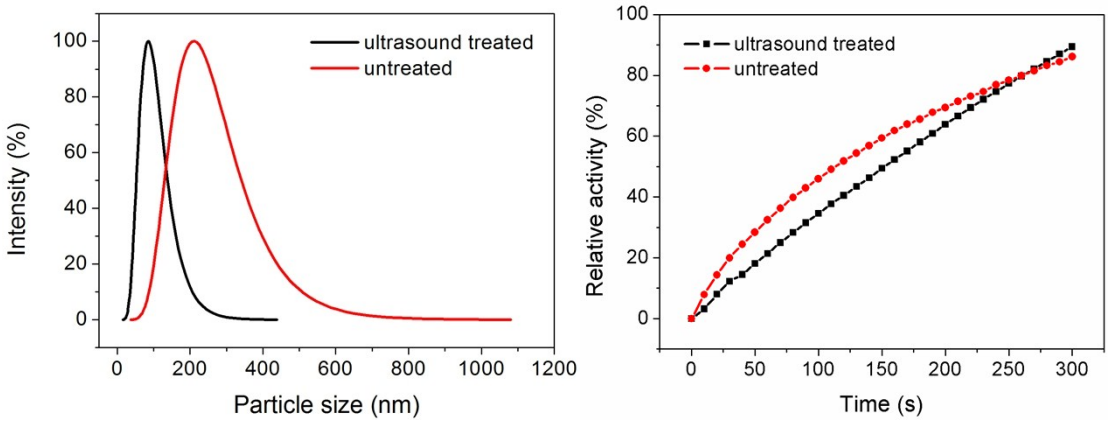
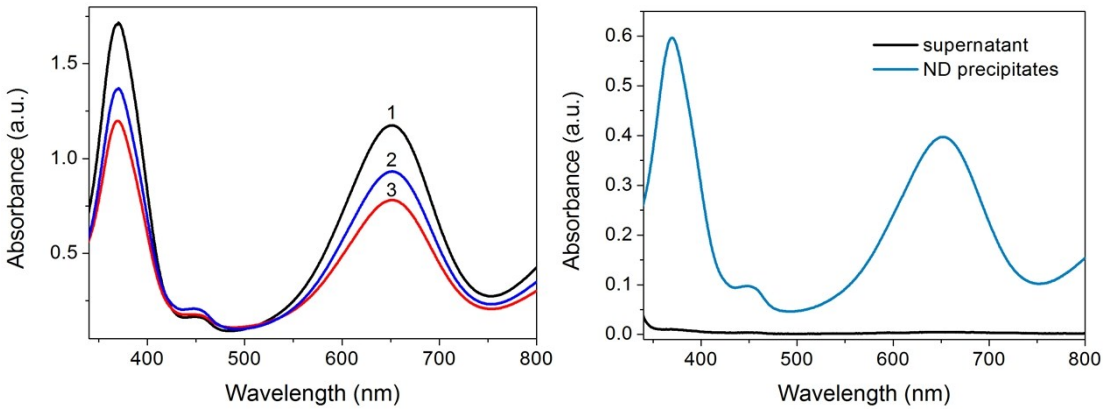
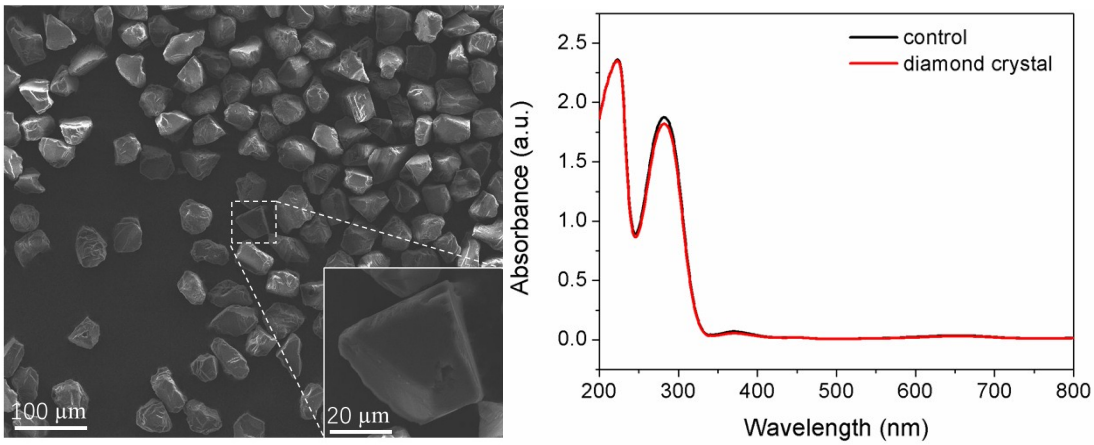


(a) (b)

Figure S1. (a) Size distribution analysis of NDs by DLS. The particle-size distribution reveals that the average particle size of ultrasound-treated and untreated NDs are 85.4 nm and 210.4 nm, respectively. (b) Comparison of peroxidase kinetic spectrums of ultrasound-treated and untreated NDs, respectively, under the same conditions.



(a) (b)



(c) (d)

Figure S2. (a) NDs from different sources show similar peroxidase-like activity. 1) NDs obtained from HeYuan ZhongLian Nanotechnology Co. Ltd. 2) NDs obtained from Sigma-Aldrich. 3) NDs obtained from Element Six Company. (b) Demonstration that NDs activity does not result from iron leaching. The activity of the supernatant was then compared to that of the NDs. (c-d) Demonstration that diamond crystals with uncovered surface show negligible peroxidase-like activity. (c) SEM image of diamond crystal powders with diameter of 40-60 μm. The inset shows the uncovered crystal surface of the diamond. (d) The color variation of the solution with diamond crystal powders.

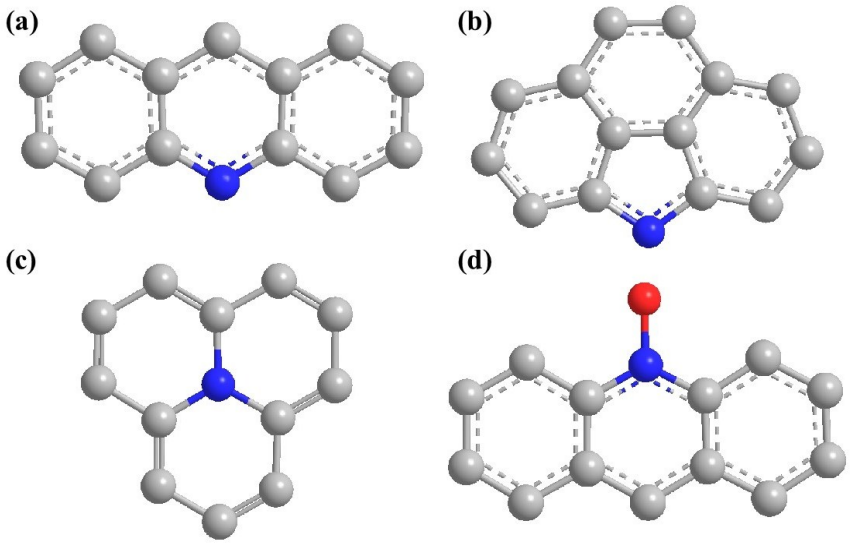


Figure S3. A schematic representation of bonding configurations for N in carbon materials: (a) pyridinic N, (b) pyrrolic N, (c) graphitic N and (d) pyridine-N-oxide.

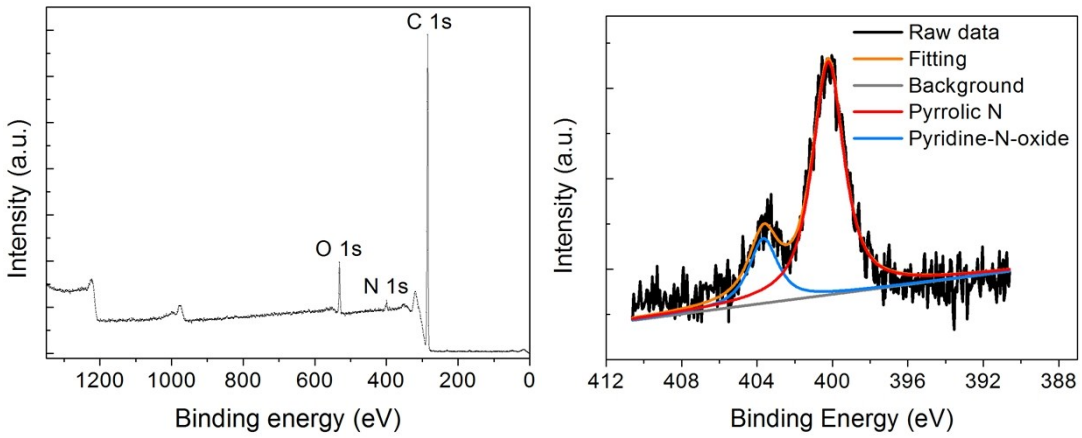


Figure S4. (a) The survey XPS spectrum of NDs. (b) High-resolution N 1s XPS spectrum of NDs.

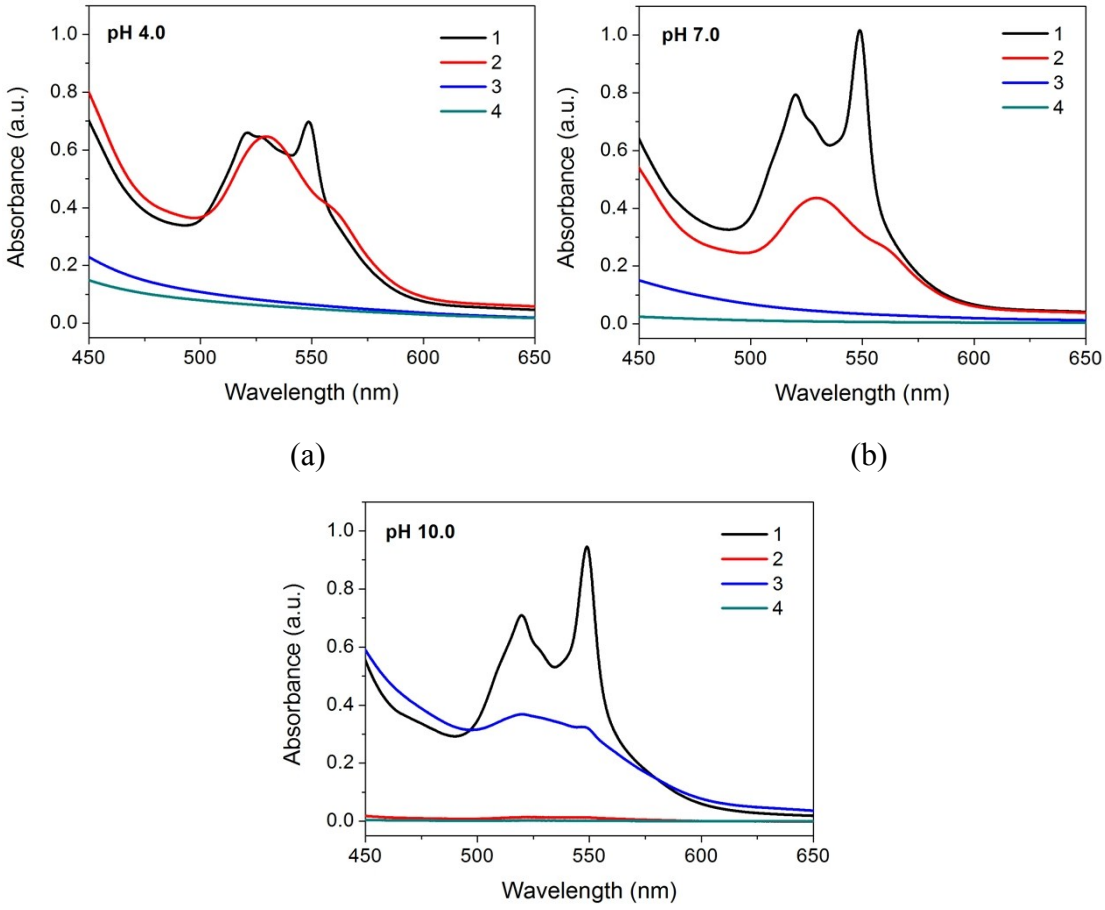


Figure S5. Effects of pH and H_2O_2 on Cyt C oxidation. Cyt C. UV-Vis absorption spectra for Cyt C incubated in pH 4.0 (a), pH 7.0 (b) and pH 10.0 (c), respectively. 1) Cyt C. 2) Cyt C+ NDs. 3) Cyt C+ H_2O_2. 4) Cyt C+ NDs+ H_2O_2.

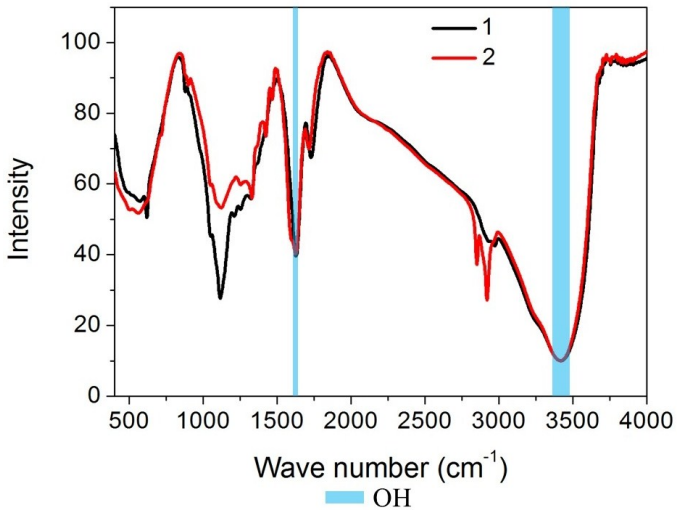


Figure S6. FTIR spectra of NDs obtained from HeYuan ZhongLian Nanotechnology Co. Ltd (1) and Sigma-Aldrich (2). The peaks around 1630 cm^{-1} and 3400 cm^{-1} belong to bending H-O-H vibrations and stretching O-H vibrations, respectively.

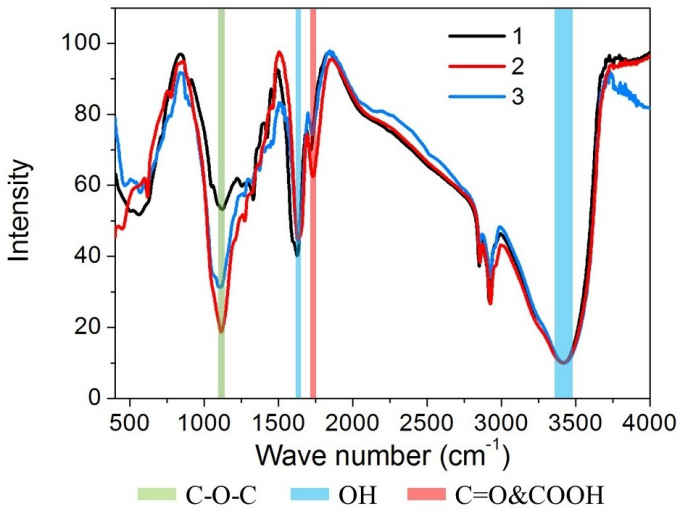


Figure S7. FTIR spectra of NDs-raw (1), NDs-acid (2), and NDs-acid incubated with deionized water for one month and washed till the supernatant showing neutral pH value (3).