Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Electronic Supporting Information for

Ferric carbide nanocrystals encapsulated in nitrogen-doped carbon nanotubes as an outstanding environmental catalyst

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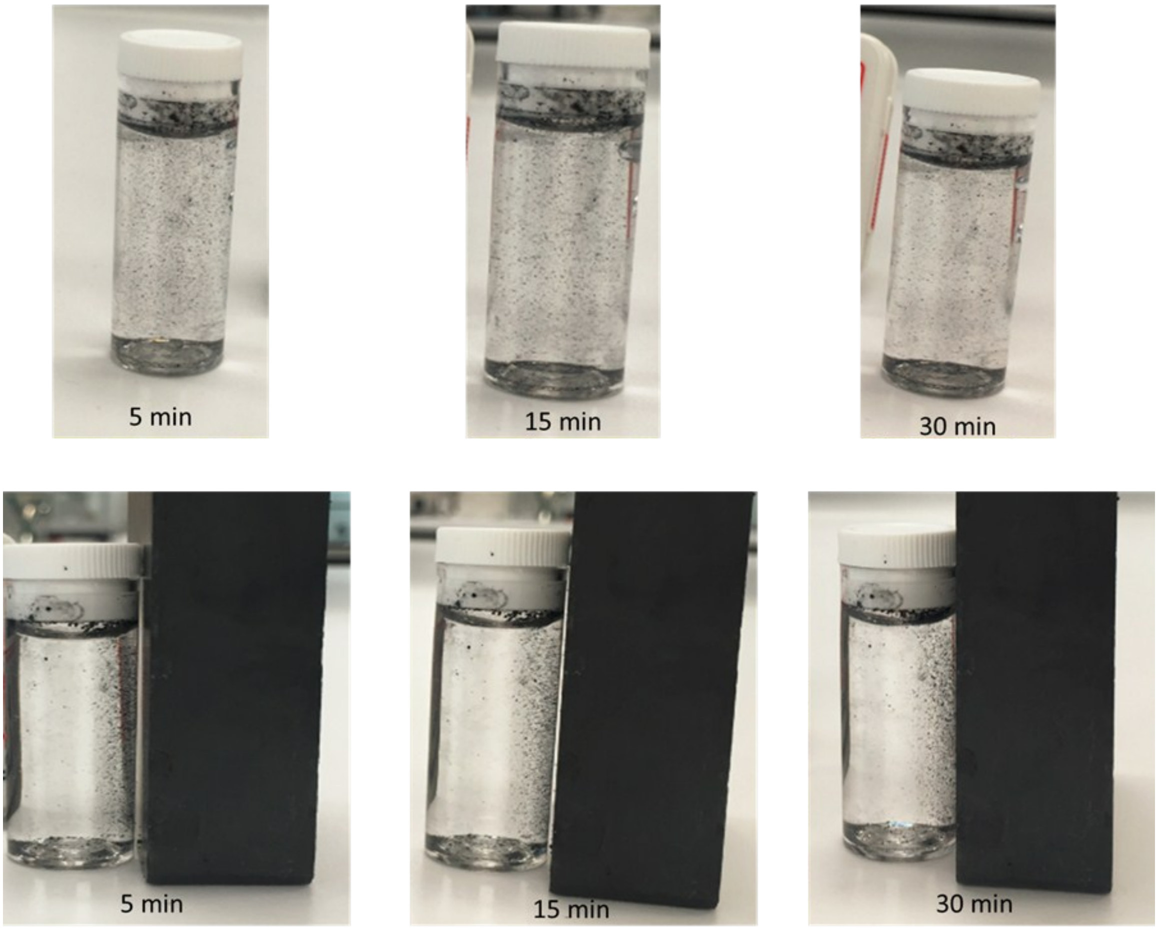

FigureS1 Photographs of magnetic separation tests of Fe_3C@NCNT-800 after different time

Figure S1 shows photographs of Fe_3C@NCNT-800 dispersion in water and their response under an external magnetic field. As illustrated in the photograph, by sonicating for 2 min, Fe_3C@NCNT-800 can be well dispersed in the deionized water and form a stable suspension before magnetic separation. If a magnet was placed close to the vial, Fe_3C@NCNT-800 nanoparticles were attracted towards the magnet very quickly and accumulated to the side wall of the vial near the magnet. And the solution became clear and transparent with the presence of the magnet. After removing the magnet and repeating the above sonicating procedure, Fe_3C@NCNT-800 was rapidly redispersed in water. Therefore, from the above simple experiments, the attraction and dispersion processes can be readily altered by placing or removing an external magnetic field, indicating good water dispersion and magnetic separation for effective water-solid separation.[1, 2]

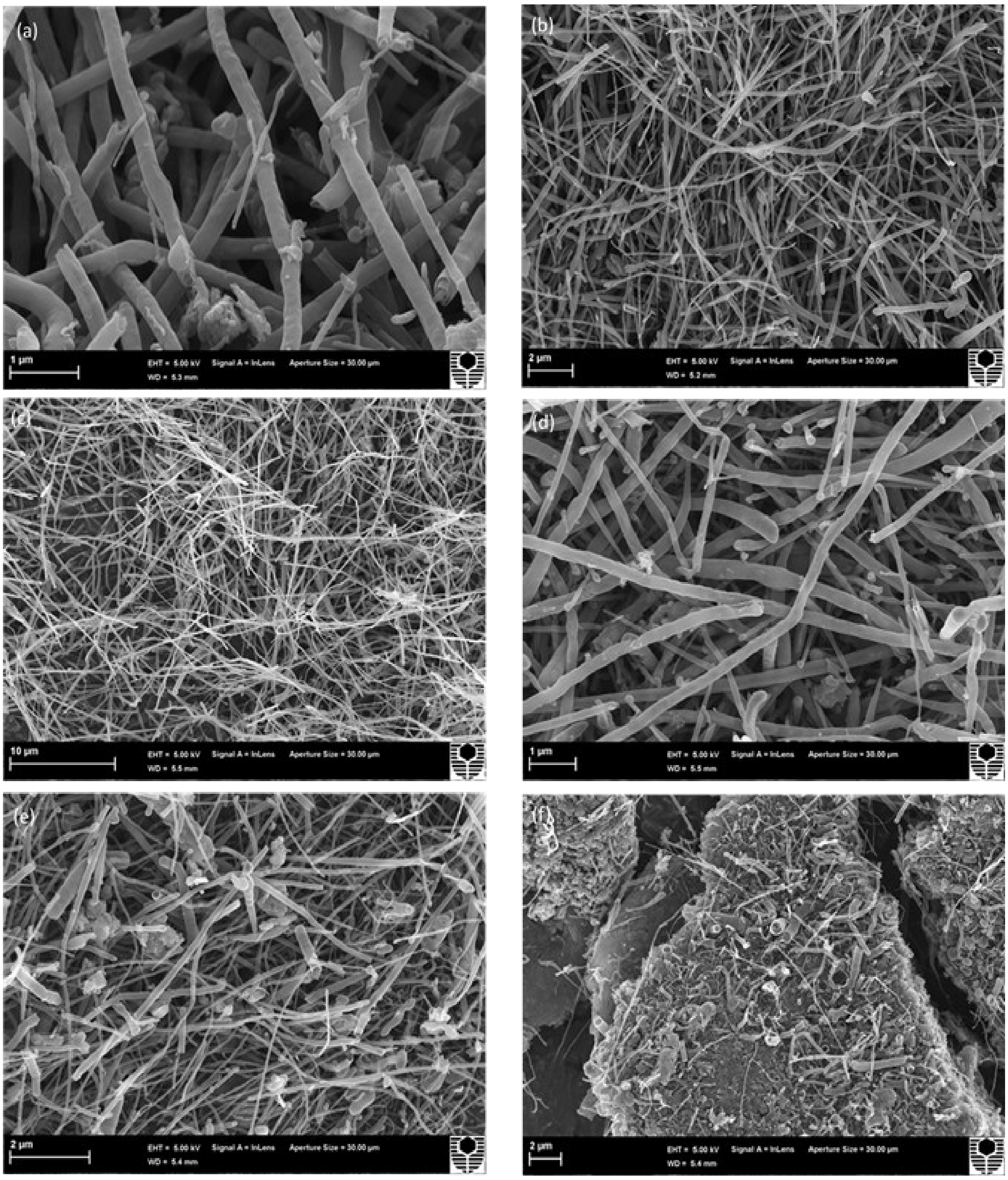

Fig.S2 SEM images for Fe_3C@NCNT catalysts prepared at (a) (b) 700 ^{o}C, (c) (d) 800 ^{o}C and (e) (f) 900 ^{o}C.

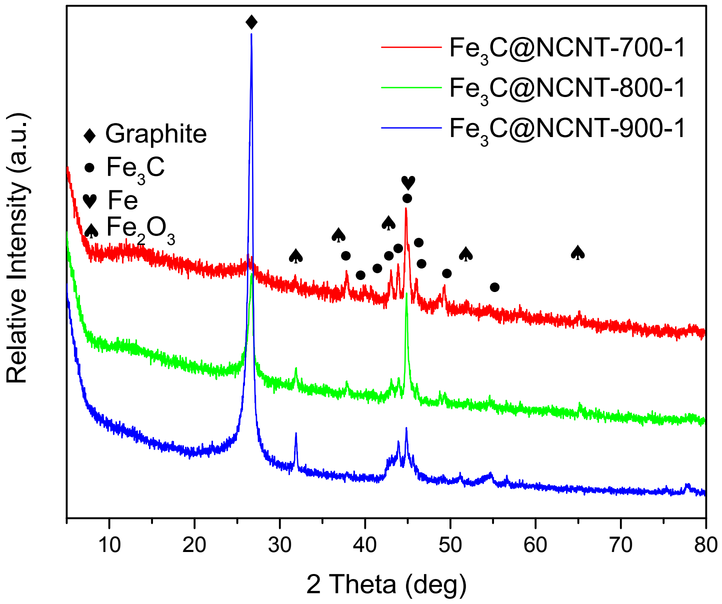

Fig. S3 XRD patterns of Fe_3C@NCNT after the first run.

Table S1 The content of iron ions detected by ICP

	Fe_3C@NCNT-700	Fe_3C@NCNT-800	Fe_3C@NCNT-900
Iron ions (mg/L)	0.13	0.23	0.11

As shown in Table S1, after 3 h phenol degradation, the metal ion concentrations remained in the solution were very low and can be neglected. Therefore, iron ions were not the reasons for excellent catalytic degradation of Fe_3C@NCNT catalysts.

Table S2 Elemental analysis of N element of Fe_3C@NCNT samples

	Fe_3C@NCNT-700	Fe_3C@NCNT-800	Fe_3C@NCNT-900
N (wt%)	5.19	1.47	0.62

As shown in Table S2，N content in Fe_3C@NCNT-700 was 5.19 wt%, higher than that obtained by XPS (2.08 wt%). However, Fe_3C@NCNT-800 and Fe_3C@NCNT-900 had N contents at 1.47 wt% and 0.62 wt%, respectively, lower than those obtained by XPS (3.15 wt% and 4.22 wt%, respectively). These results implied that N doping of Fe_3C@NCNT-700 mainly occurred in the bulk. On the contrary N dopants of Fe_3C@NCNT-800 and Fe_3C@NCNT-900 were mainly agglomerated on the surfaces. The doped N profiles further suggested that Fe_3C@NCNT-800 and Fe_3C@NCNT-900 had better catalytic performances than Fe_3C@NCNT-700 because of the more pyridinic and pyrrolic N on the surfaces.

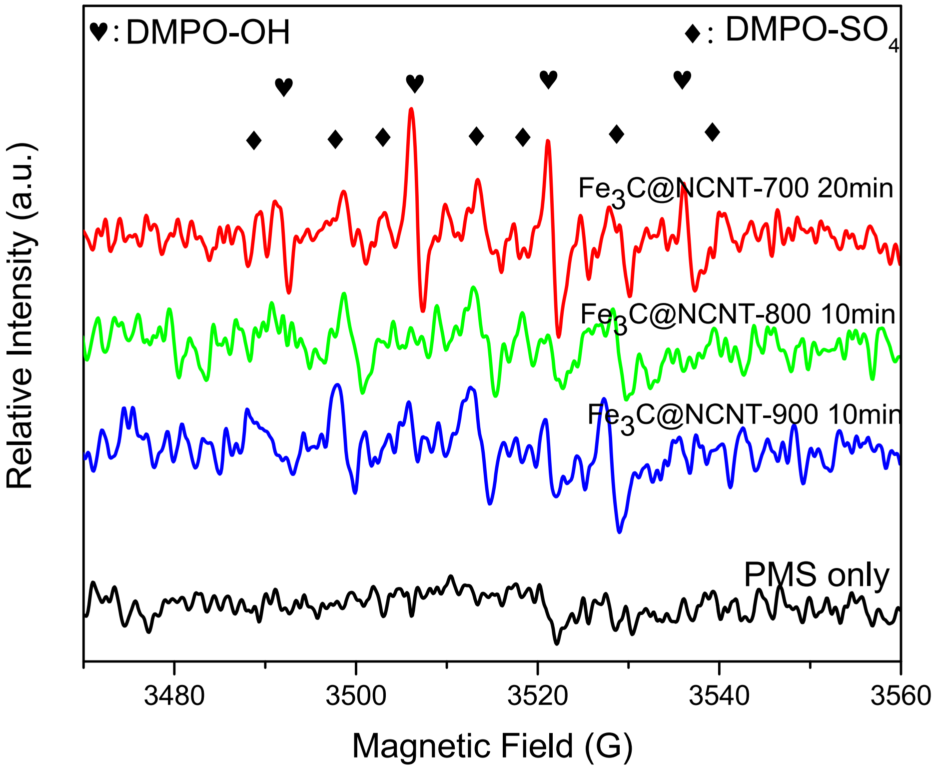

Fig.S4 EPR spectra of PMS activation with Fe_3C@NCNT composites at different time.

We employed electron paramagnetic resonance (EPR) to probe the generation and evolution of reactive radicals using 5,5-dimethyl-1-pyrroline (DMPO) as a radical spin trapping agent.[3]

Notes and references

1. Y. Wang, H. Sun, H. M. Ang, M. O. Tadé and S. Wang, *J. Colloid Interface Sci.*, 2014, **433**, 68-75.
2. Y. Wang, H. Sun, H. M. Ang, M. O. Tadé and S. Wang, *Chem. Engin. J.*, 2014, **245**, 1-9.
3. X. Duan, H. Sun, Y. Wang, J. Kang and S. Wang, *ACS Catal.*, 2015, **5**, 553-559.