Electronic Supporting Information：

Iron-based nanoparticles embedded in graphitic layer of carbon architectures as stable heterogeneous Friedel-Crafts acylation catalysts

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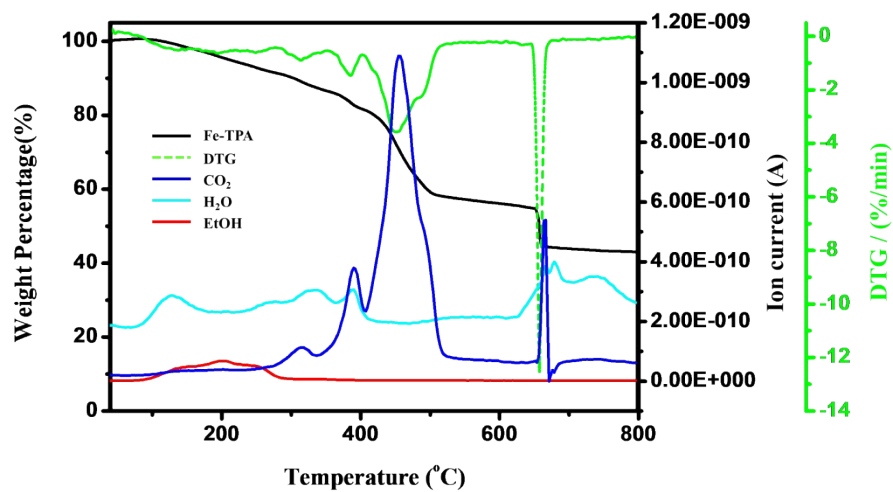
Email address: jiamj@jlu.edu.cn (M. Jia)

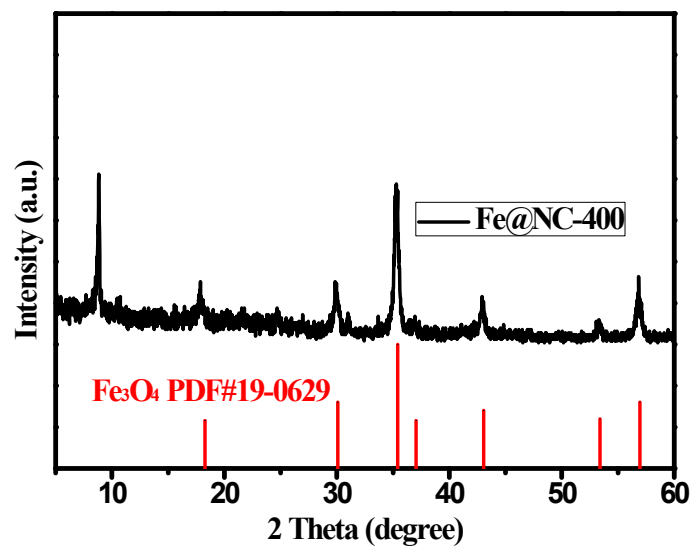**Fig. S1** TG-MS profiles of the Fe-TPA under inert atmosphere.
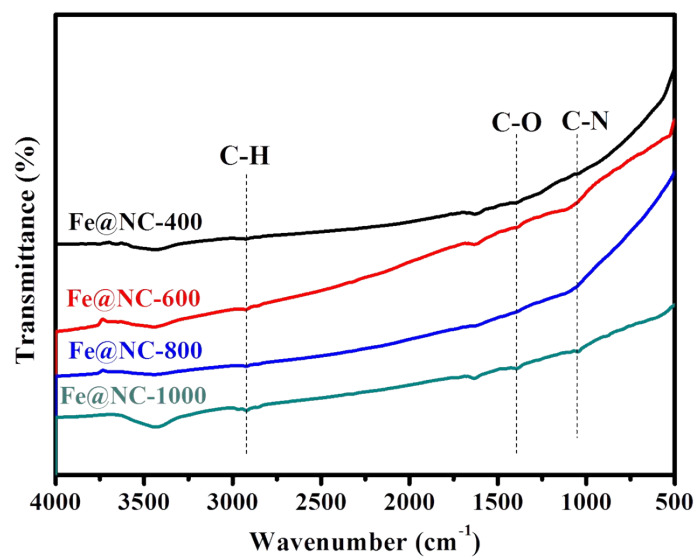
Fig. S2 XRD pattern of Fe@NC-400.

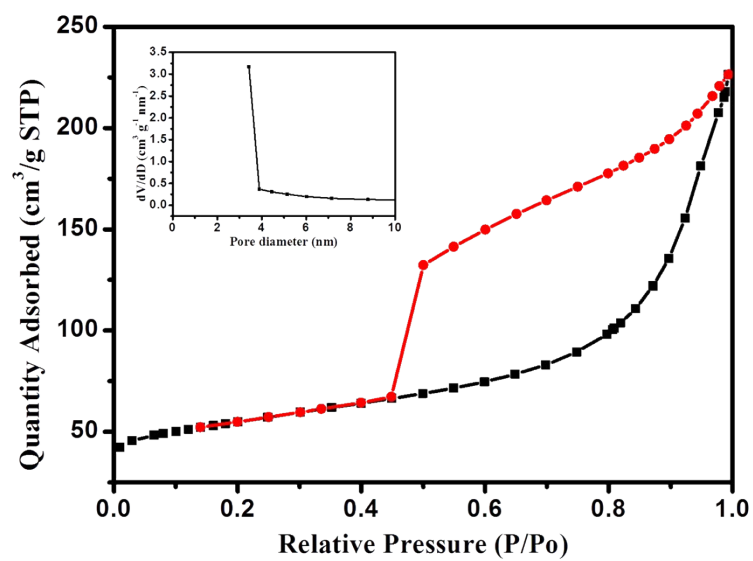**Fig. S3** FT-IR spectra of the Fe@NC-*T* catalysts.

Fig. S4 Nitrogen isothermal adsorption-desorption curves for Fe@C-800. Inset: pore size distribution profile based on the DFT model.
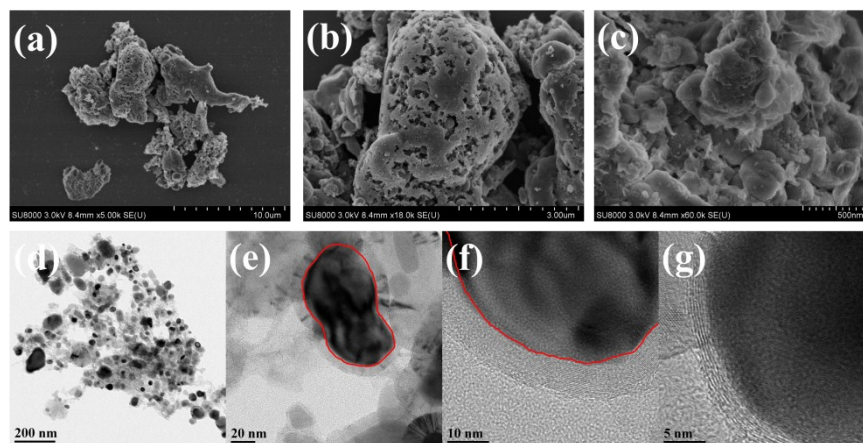
Fig. S5 (a-c) SEM and (d-g) TEM/HRTEM images of Fe@NC-800.

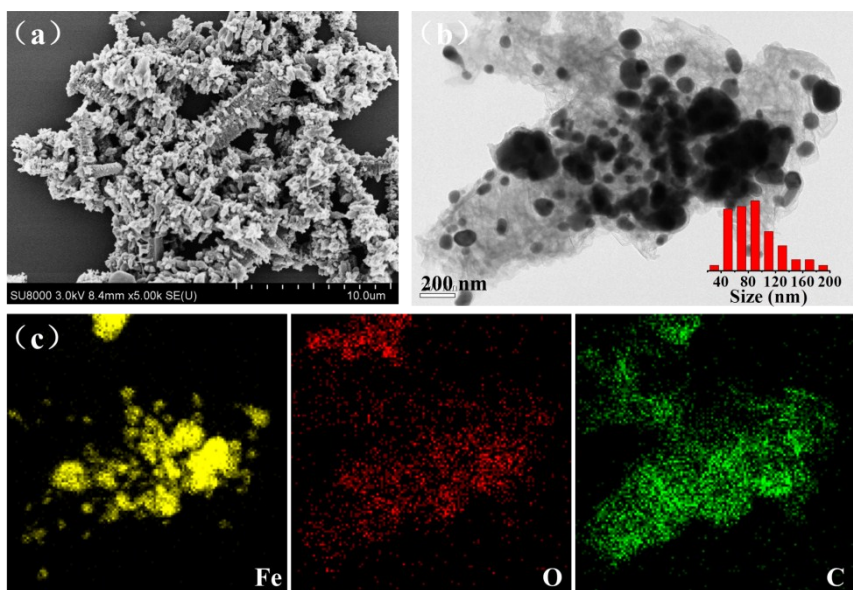**Fig. S6** (a) SEM and (b) TEM images of Fe@C-800. (c) Elemental mapping revealing the elemental distribution.
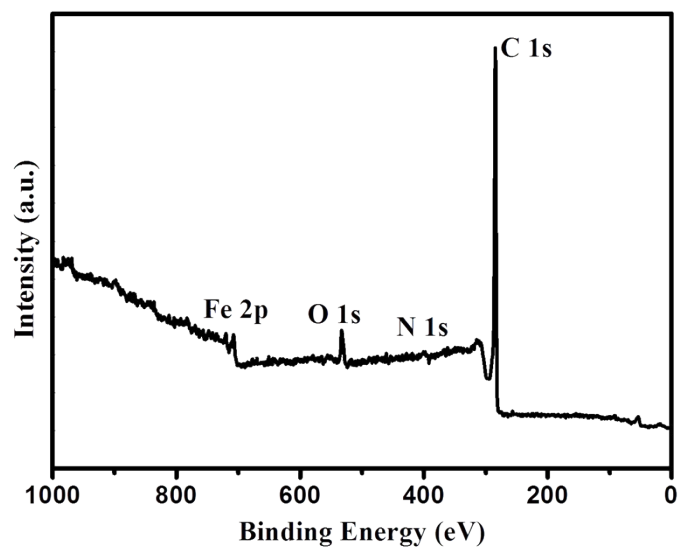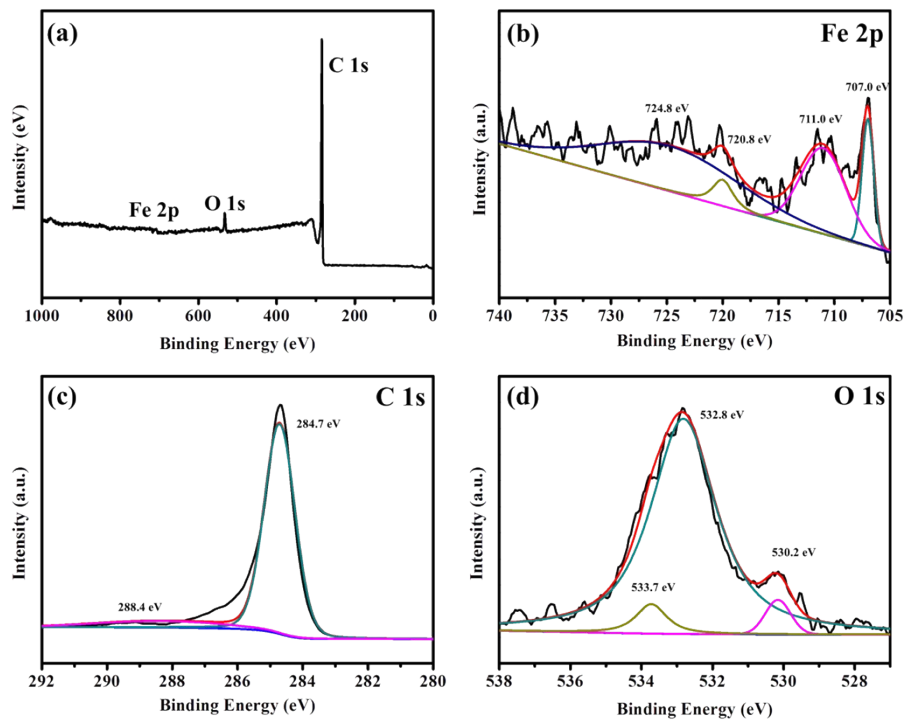
Fig. S7 XPS survey spectra of Fe@NC-800.

Fig. S8 XPS survey spectra of (a) Fe@C-800, (b) Fe 2p, (c) C 1s and (d) O 1s of Fe@C-800.
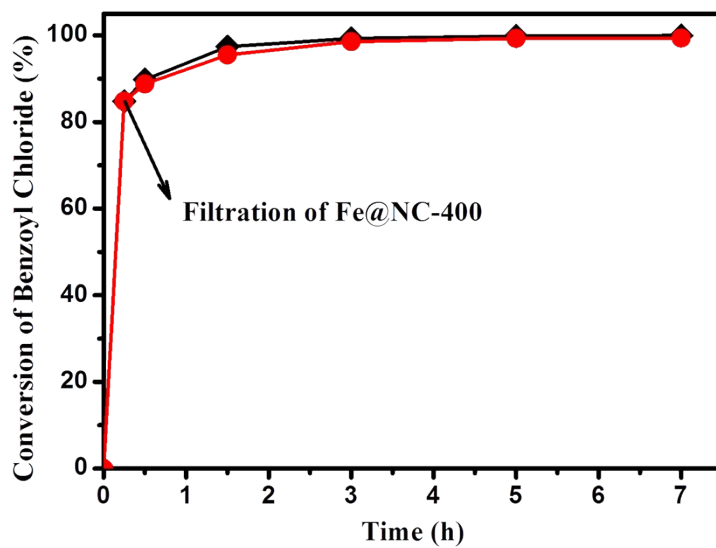
Fig. S9 Friedel-Crafts acylation property over (◆) Fe@NC-400 and the leaching test (●). Reaction conditions: 130 °C reaction temperature; 20 mmol m-xylene, 10 mmol benzoyl chloride, and 10 mmol dodecane; 50 mg catalyst.
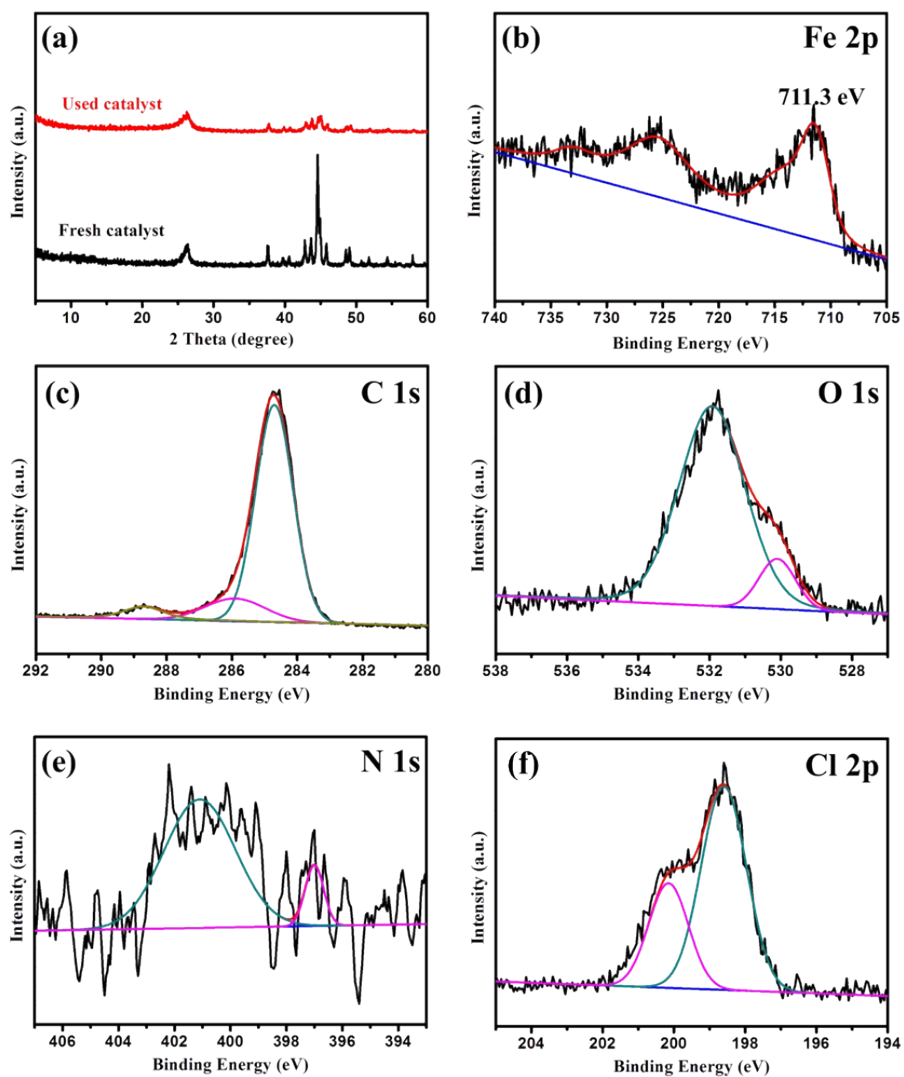
Fig. S10 (a) XRD diffraction patterns of fresh and used Fe@NC-800 catalysts after five consecutive cycles; and XPS survey spectra of (b) Fe 2p, (c) C 1s, (d) O 1s, (e) N 1s and (f) Cl 2p of the used Fe@NC-800 catalyst.

Table S1 Summary of the porous properties of Fe@NC-*T* and Fe@C-800 catalysts.

	$S_{BET}{}^{a}$ $(m^2\,g^{-1})$	$S_{micro}{}^{b}$ $(m^2\,g^{-1})$	$S_{meso}{}^{c}$ $(m^2\,g^{-1})$	$V_{pore}{}^{d}$ $(cm^3\,g^{-1})$
Fe@NC-600	232	147	85	0.24
Fe@NC-800	174	51	123	0.35
Fe@NC-1000	119	39	80	0.26
Fe@C-800	180	75	105	0.32

[a] Calculated via the BET method.

[b] Calculated via the t-plot method.

[c] $S_{meso} = S_{BET} - S_{micro}$.

[d] Calculated based on the N_2 adsorption at $p/p_0 = 0.99$.

Table S2 The element compositions of various samples determined from a

PerkinElmer 2400 CHN elemental analyzer and ICP-AES.

Samples	Element analysis				
	C (wt %)	H (wt %)	N (wt %)	O (wt %)	Fe (wt %)
Fe-TPA	39.14	3.24	-	40.76	16.86
Fe-DABCO-TPA	53.59	5.25	7.00	27.33	6.83
Fe@C-800	27.57	0.30	-	12.51	59.62
Fe@NC-800	50.92	0.43	0.51	2.74	45.40
Fe@NC-800*					44.74

* The used Fe@NC-800 catalyst after FCA reactions.

Table S3 The elemental contents on the surface of Fe@NC-800 obtained from XPS.

Samples	Elemental composition (At. %)				
	C 1s	O 1s	Fe 2p	N 1s	Cl 2p
Fe@C-800	94.75	4.81	0.44	-	-
Fe@NC-800	84.56	10.40	1.08	3.97	-
Fe@NC-800*	85.06	5.55	1.27	2.68	5.44

* The used Fe@NC-800 catalyst after FCA reactions.