Electrochemical Synthesis of Ammonia from N_2 and H_2O Using A Typical Non-noble Metal Carbon-based Catalyst under Ambient Conditions

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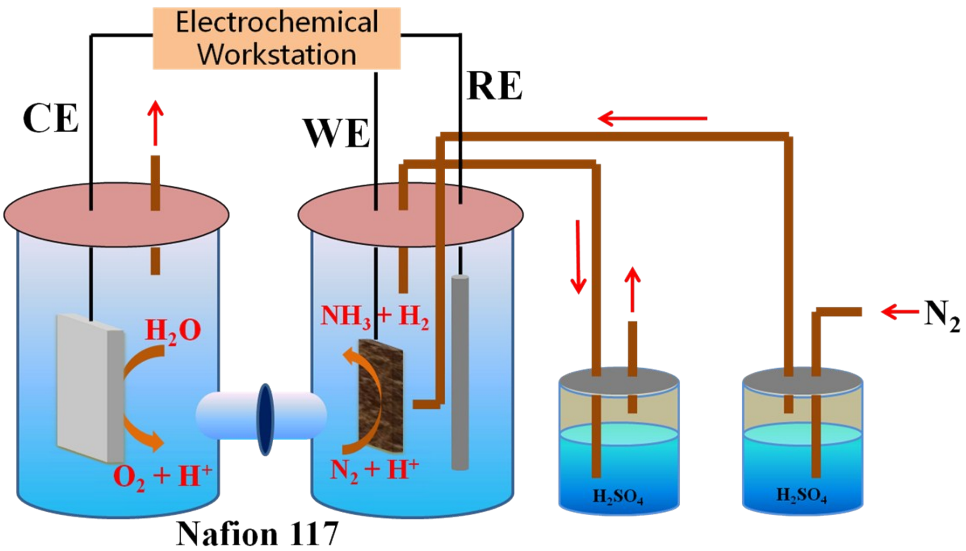

Figure.S1 The schematic diagram of the experimental device

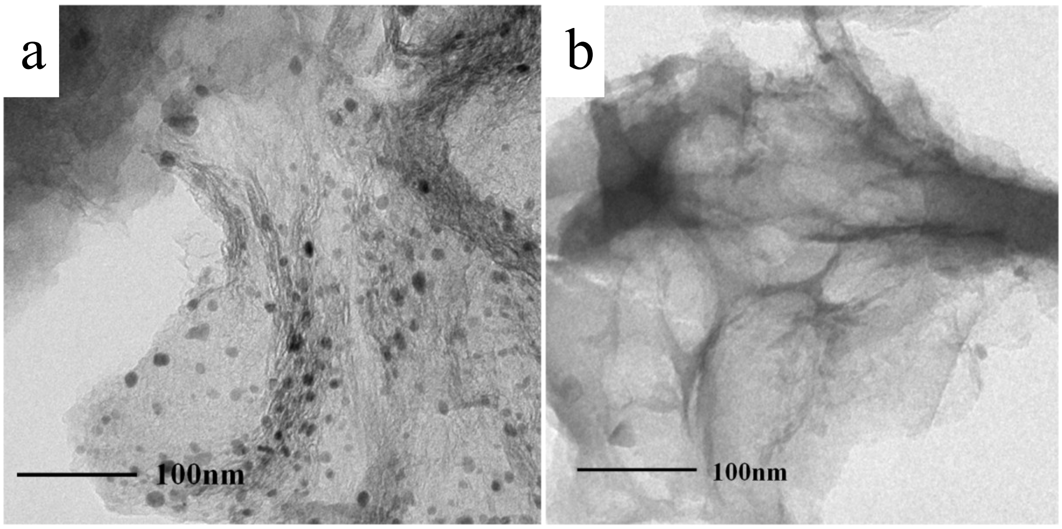

Figure.S2 TEM of (a) the Fe-doped carbon (CF) and (b) the N-doped carbon (NC)

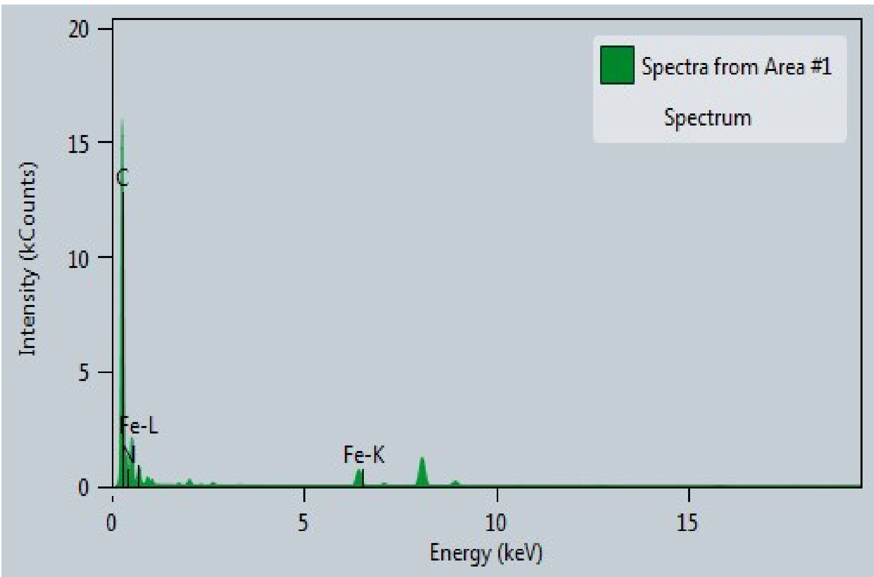

Figure.S3 EDS spectrum for the resultant NCF.

element	C	N	Fe
Content(%)	87.34	6.17	6.49

Table. S1 Percentage of different elements for NCF.

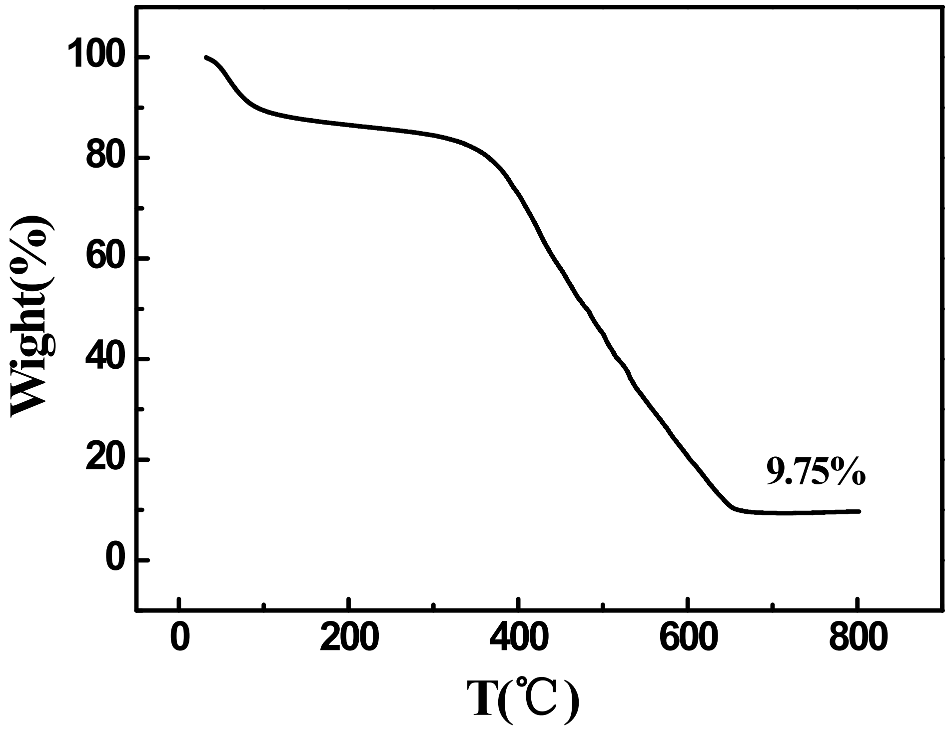

Figure. S4 TGA for the resultant NCF.

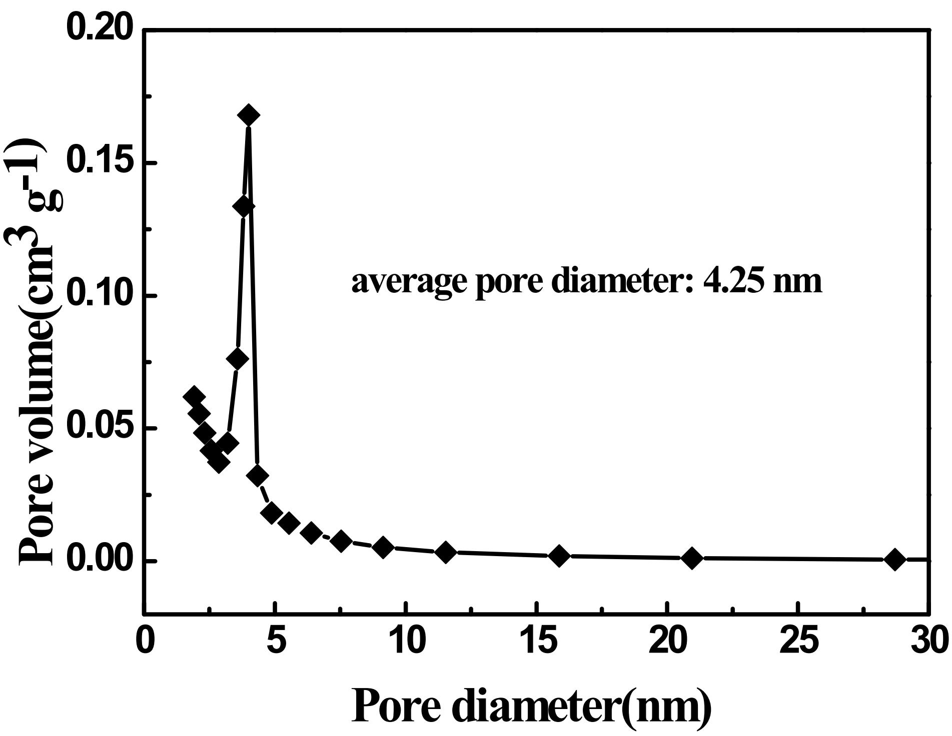

Figure.S5 BJH pore diameter distribution of NCF.

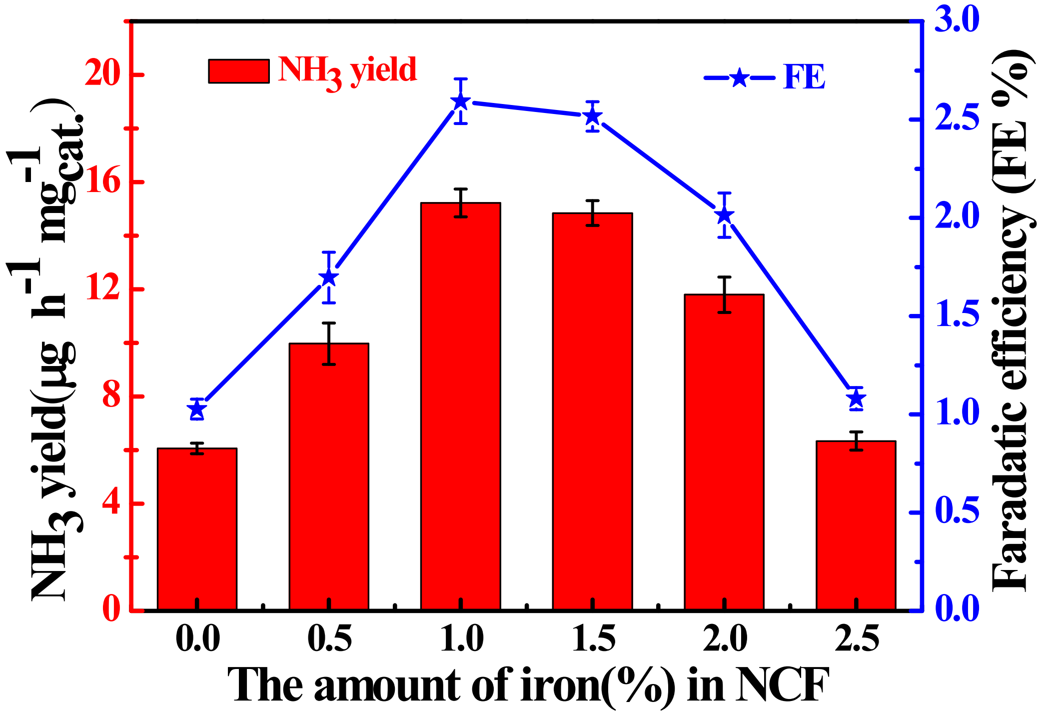

Figure. S6 Yield rate and FE of NH_3 with different iron content about NCF.

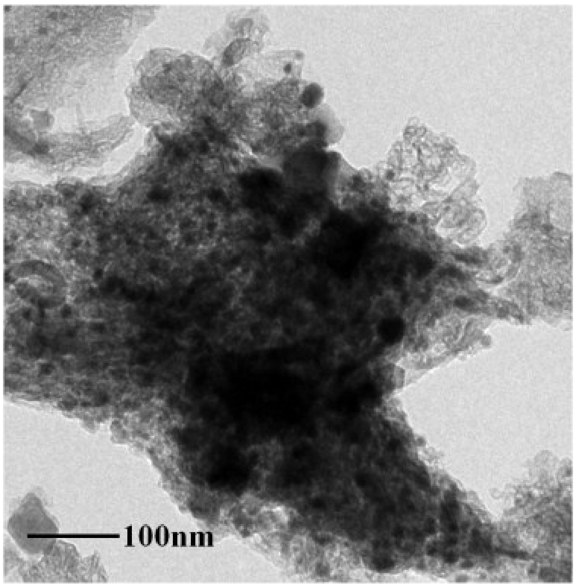

Figure. S7 TEM images of the NCF-$Fe_{2.5}$.

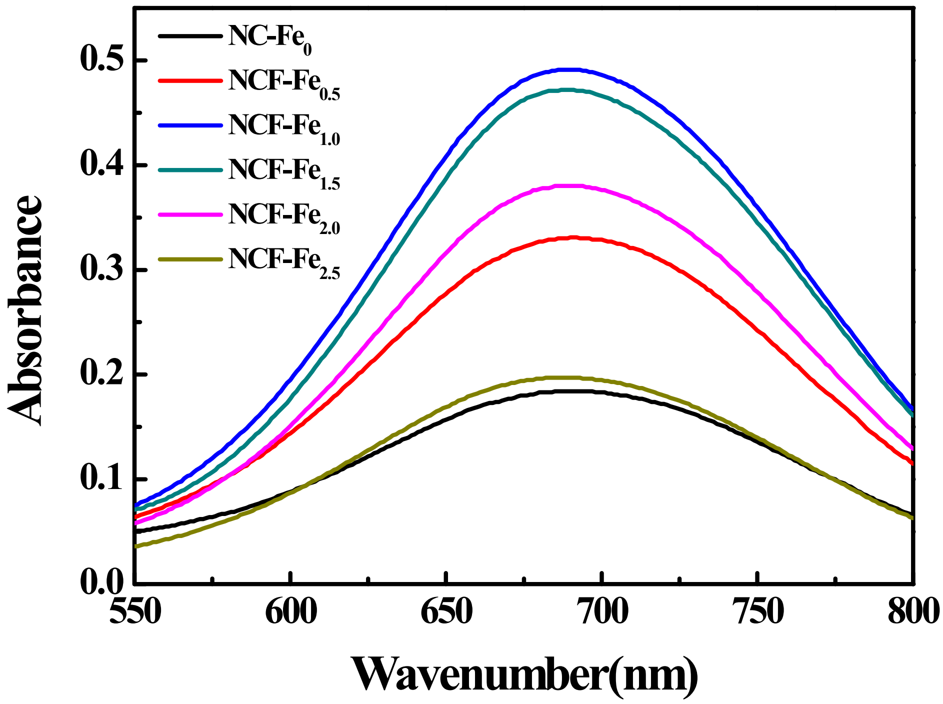

Figure. S8 UV-Vis curves of indophenol tests under different iron content about NCF.

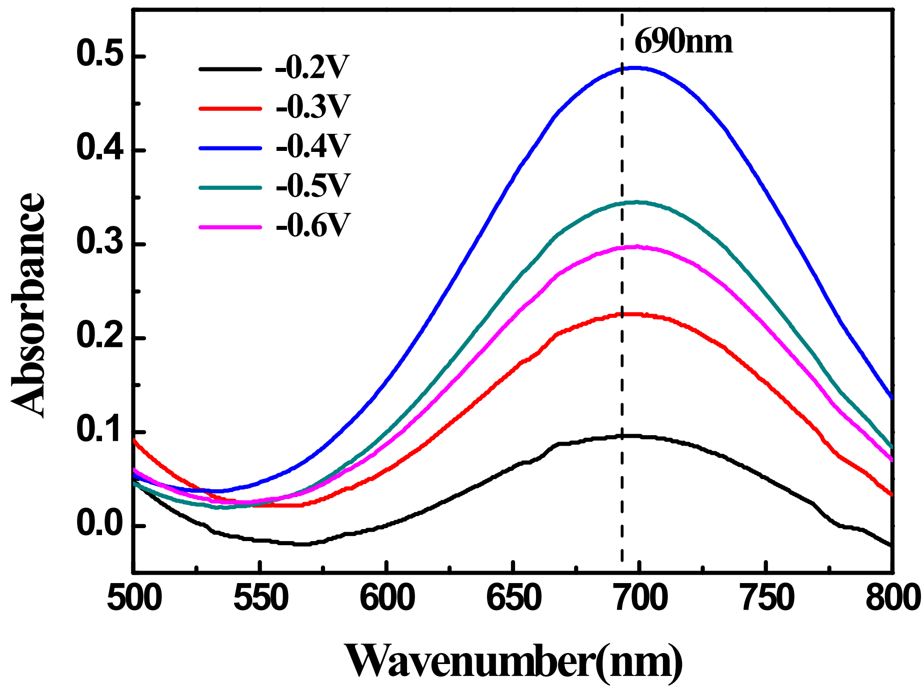

Figure.S9 UV-Vis curves of indophenol tests under different potentials.

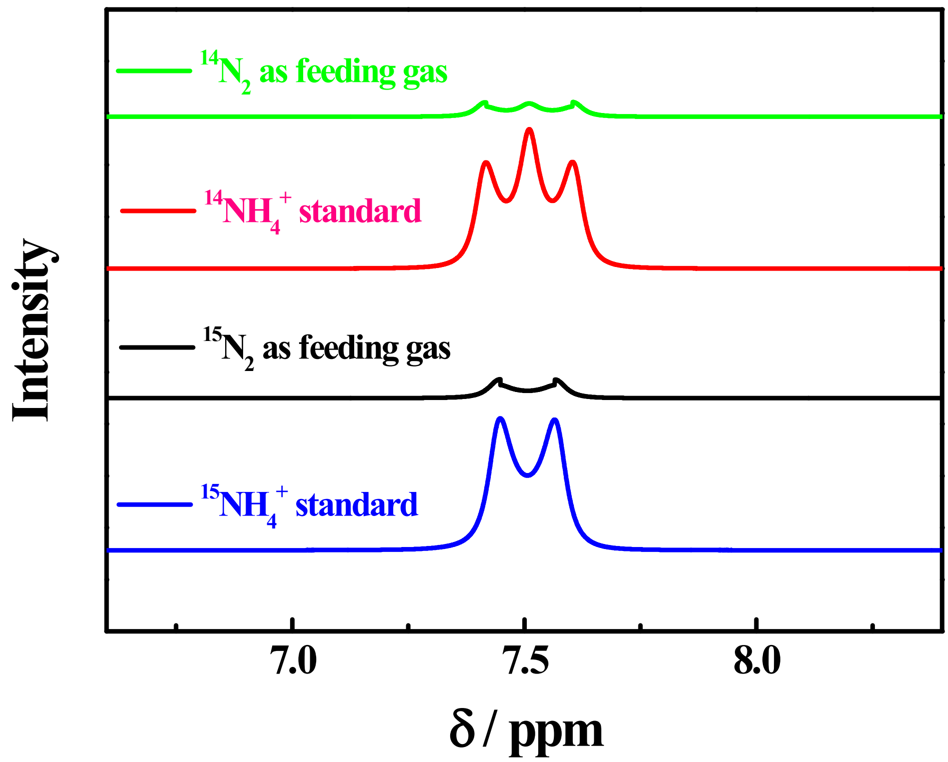

Figure.S10 ^1H NMR spectra of the $^{15}NH_4^+$ or $^{14}NH_4^+$ standards and the electrochemical NRR product using the NCF catalyst in the $^{15}N_2$ and $^{14}N_2$ atmosphere, respectively.

Table S2. Comparison of the NH_3 electrosynthesis activity for NCF with other NRR catalysts.

System/Catalyst	Conditions	NH3 Yield	FE	Testing Method	Reference
NCF	**ambient**	**15.804 μg h^{-1} $mg_{cat.}^{-1}$**	**2.72%**	**Indophenol method**	**This work**
Pt/C	**80℃**	9.37×10^{-6} mol m^{-2} s^{-1}	0.83%	Nessler's reagent	*RSC Adv.* **2013**, 3, 18016.
Mo nanofilm	**ambient**	3.09×10^{-11} mol s^{-1} cm^{-2}	0.72%	Indophenol method	*J. Mater. Chem. A*, **2017**, **5**, 18967–18971
MoS_2/CC	**ambient**	8.08×10^{-11} mol s^{-1} cm^{-2}	1.17%	Indophenol method	*Adv. Mater.*, **2018**, 30, 1800191
MoO_3 nanosheet	**ambient**	29.43 μg h^{-1} $mg_{cat.}^{-1}$	1.9%	Indophenol method	*J. Mater. Chem. A*, **2018**, 6, 12974-12977
TA-reduced Au/TiO_2	**ambient**	21.4 μg h^{-1} $mg_{cat.}^{-1}$	8.11%	Indophenol method	*Angew. Chem. Int. Ed.*, **2018**, 57, 6073−6076.
α-Au/CeO_x-RGO	**ambient**	8.31 μg h^{-1} $mg_{cat.}^{-1}$	10.1%	Indophenol method	*Adv. Mater.* **2017**, 29, 1700001.
γ-Fe_2O_3	**ambient**	0.212 μg h^{-1} $mg_{cat.}^{-1}$	1.9%	spectrophotometry	*ACS Sustain. Chem. Eng.*, **2017**, **5**, 10986–10995.
Fe_2O_3/CNTs	**ambient**	3.59×10^{-12} mol s^{-1} cm^{-2}	0.15%	Indophenol method	*Angew. Chem., Int. Ed.*, **2017**, 56, 2699–2703.
N-doped nanocarbon	**ambient**	27.2 μg h^{-1} $mg_{cat.}^{-1}$	1.42%	spectrophotometry	*ACS Catal.*, **2018**, 8, 1186−1191.
Ru(7.8wt%)-Y_5Si_3	**500℃**	1.9 mmol g^{-1} h^{-1}		Ion chromatography	*J. Am. Chem. Soc.* **2016**, *138*, 3970-3973
$La_{0.8}Cs_{0.2}Fe_{0.8}Ni_{0.2}O_{3-\delta}$	**600 °C**	1.23×10^{-10} mol s^{-1} cm^{-2}	0.55%	ammonia meter	*Electrochim. Acta*, **2014**, 123, 582–587.
Fe_2O_3(Salicylic Method)	**250 °C, 25 bar**	----	35%	Indophenol method	*Science* **2014**, *345*, 637.