Supplementary Information (SI) for New Journal of Chemistry.

Supplementary Information

Facile one-pot fabrication of versatile N-doped carbonaceous hybrids with hollow architecture

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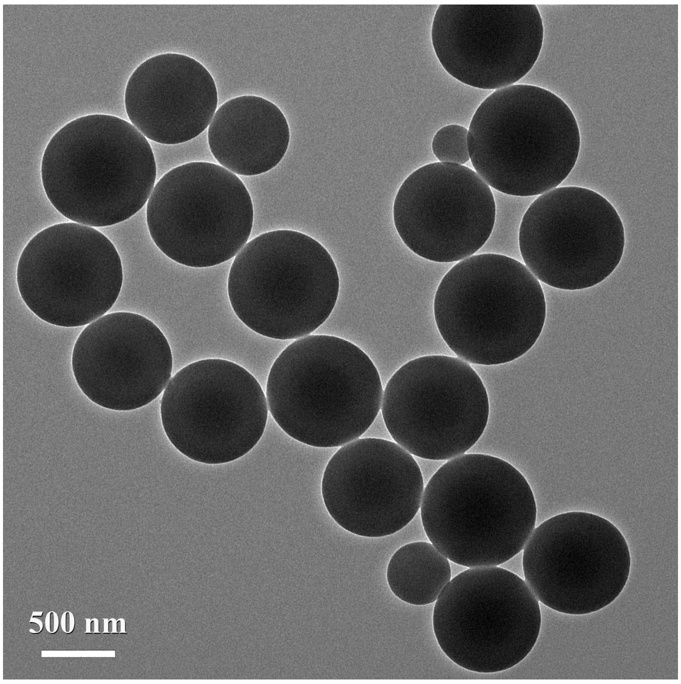

Fig. S1 TEM image of product from conventional extended Stöber process

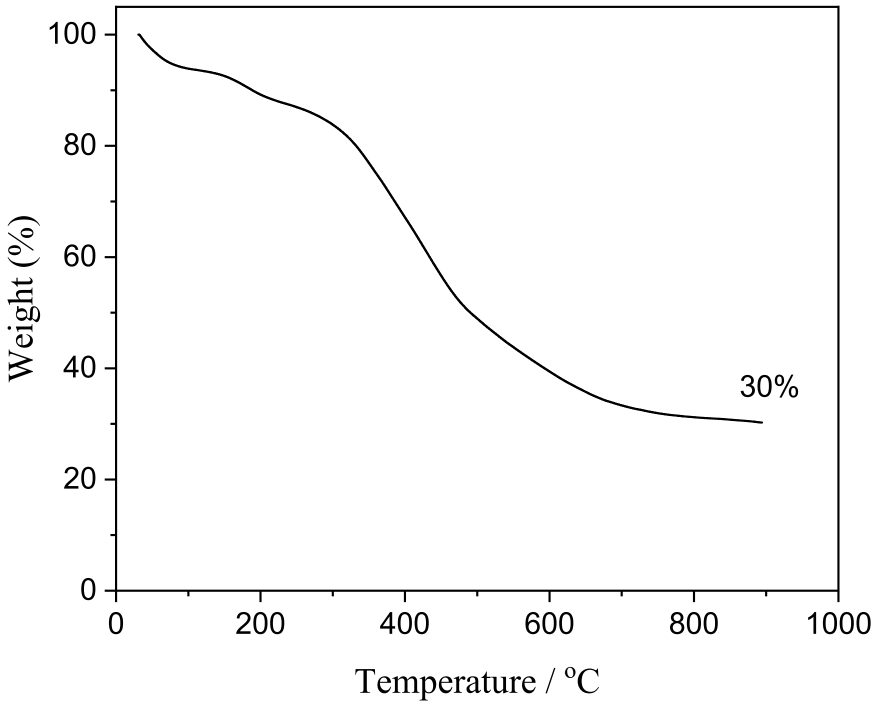

Fig. S2 TG curve of H-APF under N_2 atmosphere

Table S1 Element analysis for carbon hollow spheres

Sample	N(wt%)	C(wt%)	H(wt%)
H-C	3.2	72.4	3.0
H-NC	12.3	69.8	2.0

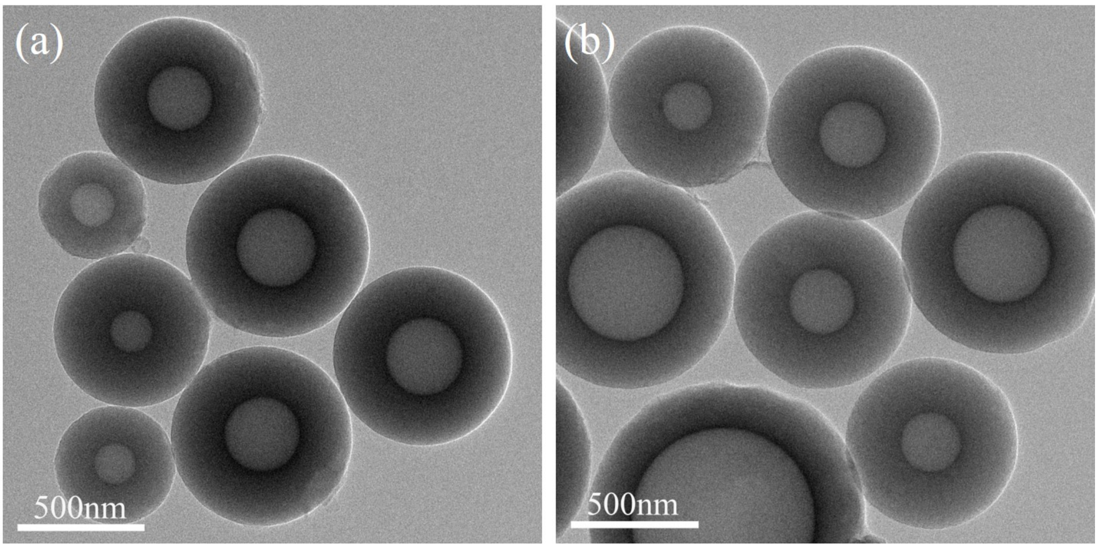

Fig. S3 TEM images of carbonized samples at 700°C (a) and 800°C (b).

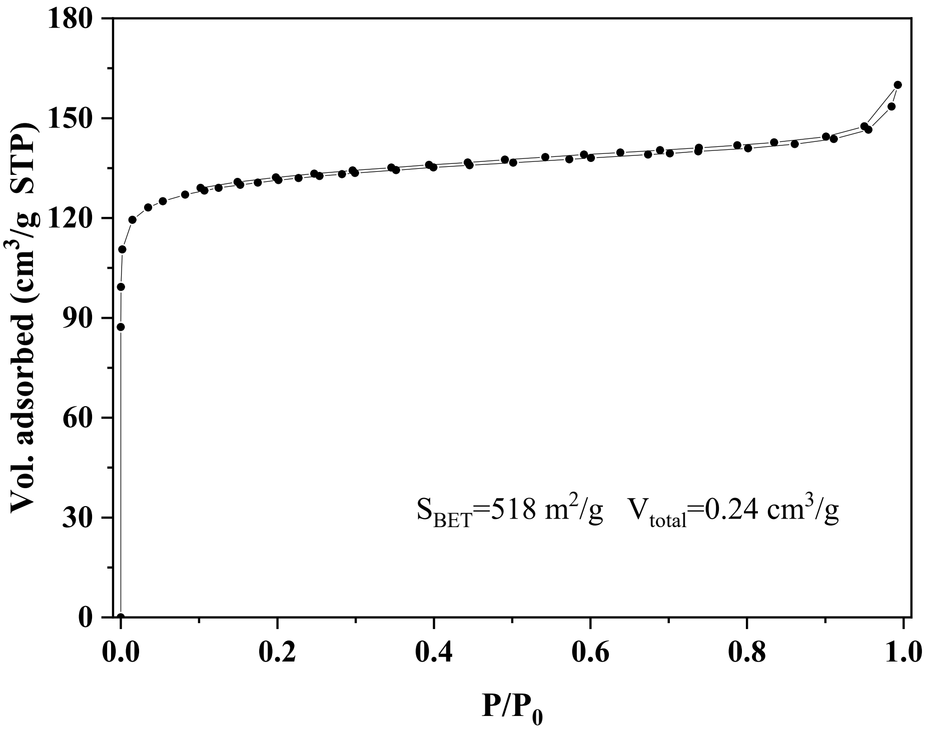

Fig. S4 N_2 physical adsorption/desorption isotherm of H-NC

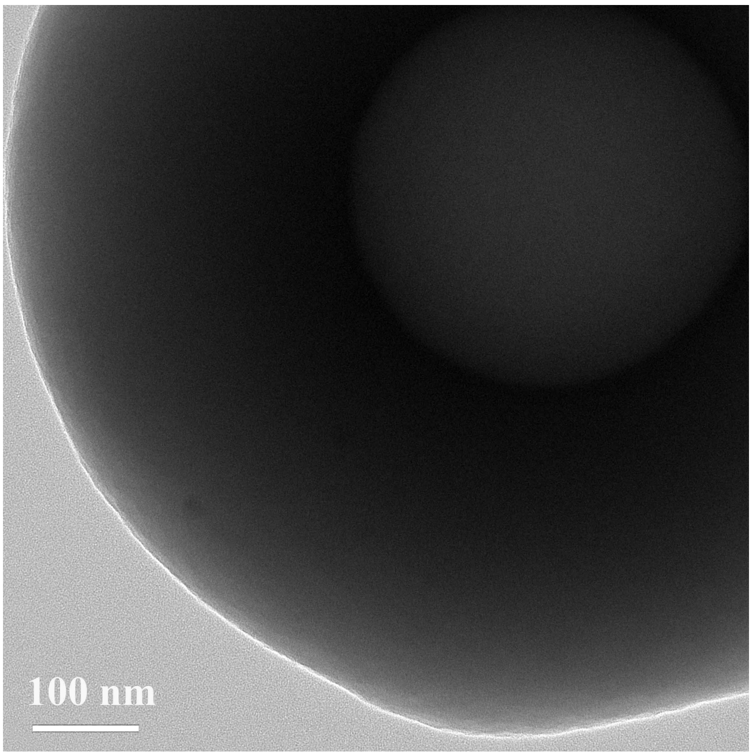

Fig. S5 TEM image of Pt/H-APF synthesized through same method as Au/H-APF

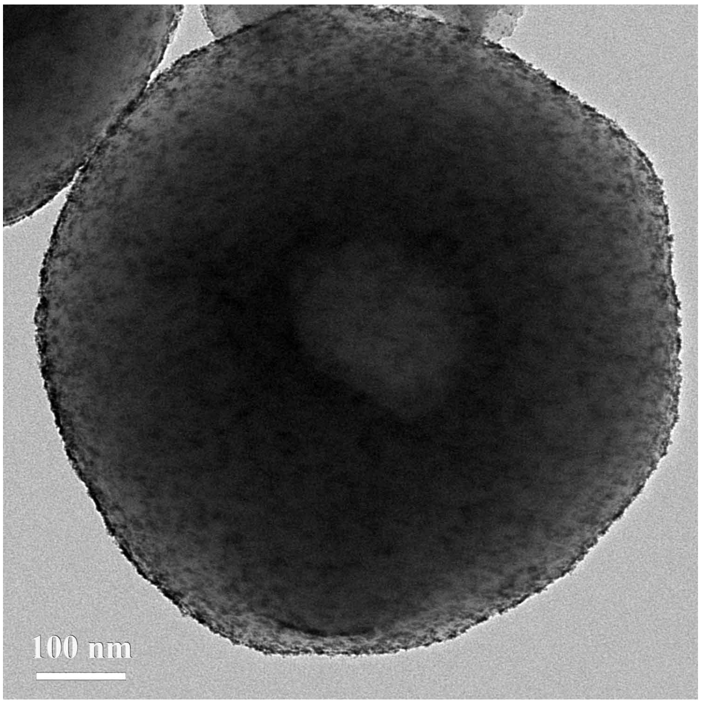

Fig. S6 TEM image of Pt/H-APF after 4 cycle reaction.

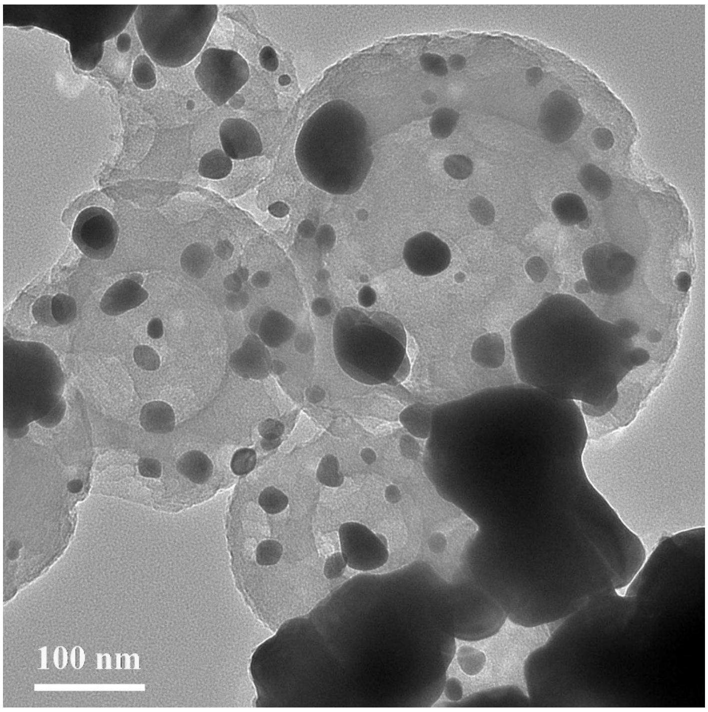

Fig. S7 TEM image of Au/H-APF after carbonization (600 ^{o}C for 4h)

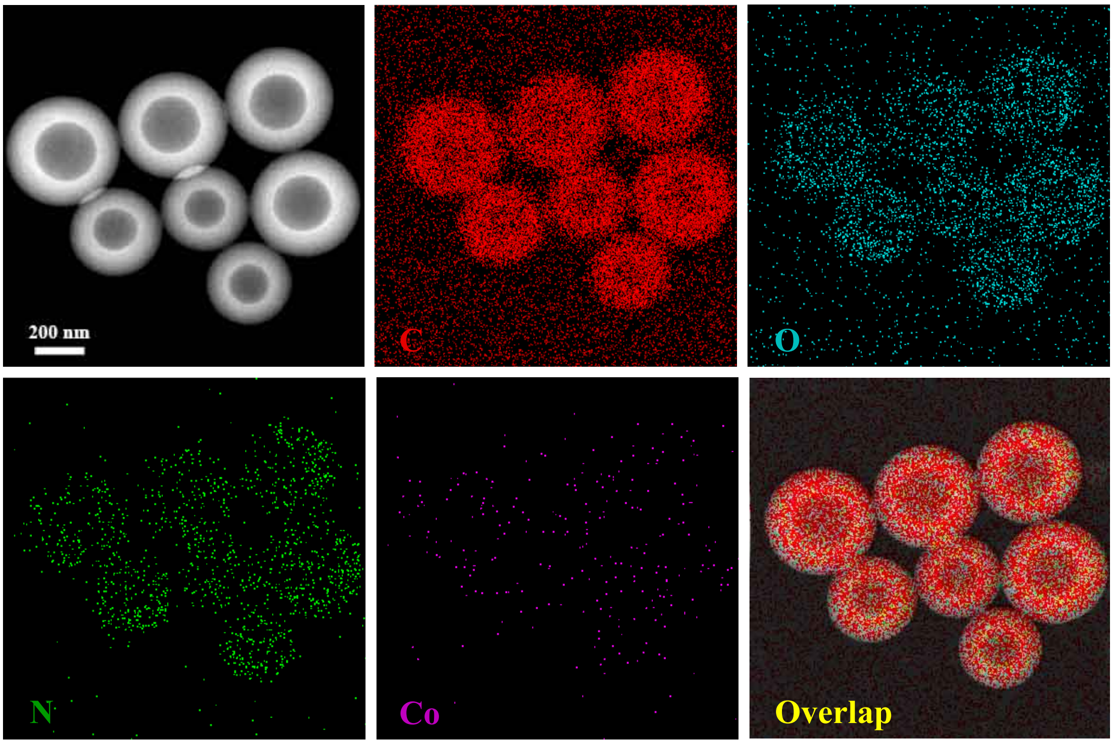

Fig. S8 Dark-field STEM image of H-Co-NC and corresponding element mapping.

Table S2 Summary of synthesis approaches for carbonaceous hollow sphere hybrids.

Materials	Synthesis approach	Precursors	Conditions	Applications	Ref.
Mesoporous carbon hollow sphere	Hard-templating approach	Phenol, paraformaldehyde, poly(divinylbenzene)	373 K for 12 h + 403 K for 24 h, NaOH or HF leaching to remove SiO_2 template		1
N-doped carbon hollow sphere	Hard-templating approach, CVD	Benzene	900 ^oC and 1000 ^oC for 4 h, 20wt% HF leaching to remove SiO_2 template	Anodes in lithium-ion batteries	2
Fe,N-doped carbon hollow sphere	Hard-templating approach	Histidine	SiO_2 template is modified by PDDA, PSS fore several times, HF leaching to remove template	Electrocatalytic oxygen reduction	3
Pt,N-doped carbon hollow sphere	Hard-templating approach	Dopamine hydrochloride	Carbon-coating and SiO_2 template removing	Electrocatalytic H_2-evolution	4
NiS-doped carbon hollow sphere	Hard-templating approach	Resorcinol and formalin	Ni-silicate coating and CTAB modification and RF coating, template etching	Lithium-sulfur batteries	5
Hollow carbon nanoparticles	Soft- templating approach	α-cyclodextrin	F127 as soft template, 200 ^oC for 6 h	Anodes in lithium-ion batteries	6
Pt,Co-carbon hollow nanosphere	Soft- templating approach	2, 4-dihydroxybenzoic acid and hexamethylenetetramine	P123/Sodium oleate emulsion as template, hydrothermal process	Heterogeneous catalysis	7

(continued on next page)

Table S2 (continued)

Materials	Synthesis approach	Precursors	Conditions	Applications	Ref.
Multilevel hollow carbon sphere (N, Au, Pd doping)	Self-templating approach	3-aminophenol and formaldehyde	Controlling polymerization degree by reducing time and adding organic solvent to etch the polymer.	Heterogeneous catalysis	8
Hollow carbon nanoshells	Self-templating approach	Resorcinol and formaldehyde	Controlling polymerization degree by reducing time and adding organic solvent to etch the polymer.		9
carbonaceous hollow sphere with N, Au, Pt, Fe, Co dopants	One-pot synthesis process	3-aminophenol and formaldehyde	Controlling polymerization degree by DDA/hexane and in-situ etched by mother liquid, ambient temperature	Heterogeneous catalysis and electrocatalytic oxygen reduction	This work

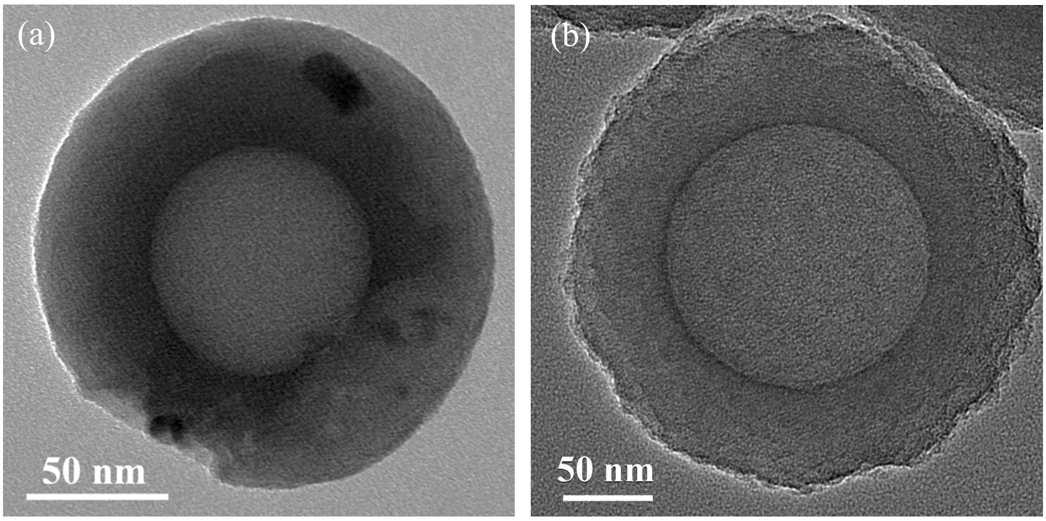

Fig. S9 TEM images of (a) H-Fe-NC and (b) H-Co-NC

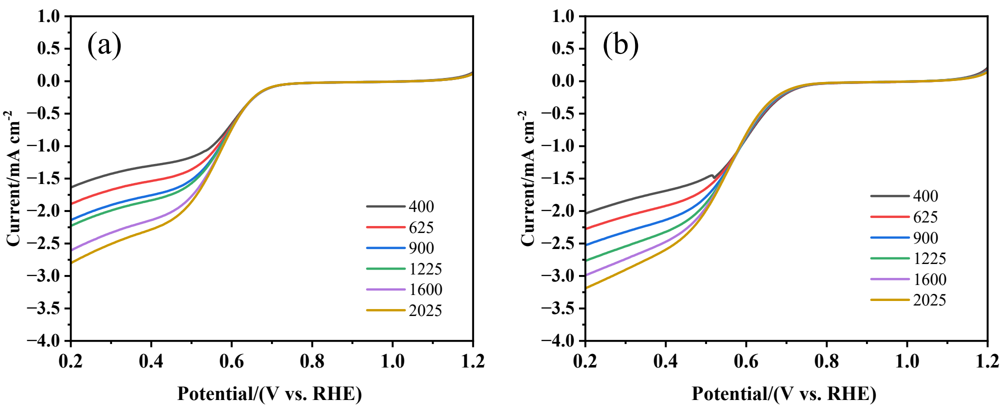

Fig. S10 LSV curves of (a) H-Fe-NC and (b) H-Co-NC at different rotating speeds

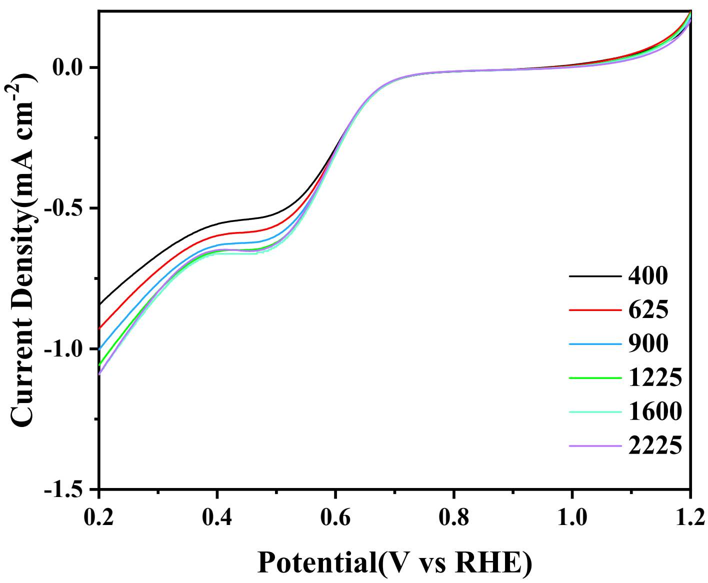

Fig. S11 LSV curves of H-NC at different rotating speeds

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