Supporting Information for

Low-Temperature Carbonization of P-phenylenediamine Guided by Iron Alginate Template for Lithium-Ion Capacitors

Lin Yang[a,b,*], Jingxian Wang[a,b,d], Anchang Li[c,d], Honghai Liu[a,b], Ming Zhang[c,d] and Zhongrong Shen[c,d,*]

[a]*College of Furnishings and Industrial Design, Nanjing Forestry University, Nanjing 210037, China;*
[b]*Jiangsu Co-Innovation Center of Efficient Processing and Utilization of Forest Resources, Nanjing Forestry University, Nanjing 210037, China*
[c]*CAS Key Laboratory of Design and Assembly of Functional Nanostructures, and Fujian Key Laboratory of Nanomaterials, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou 350002, China*
[d]*Xiamen Key Laboratory of Rare Earth Photoelectric Functional Materials & Xiamen Institute of Rare Earth Materials, Haixi Institutes, Chinese Academy of Sciences, Xiamen 361021, China;*
Corresponding authors: yanglin@njfu.edu.cn (L.Y.); z-shen@fjirsm.ac.cn (Z.S.)

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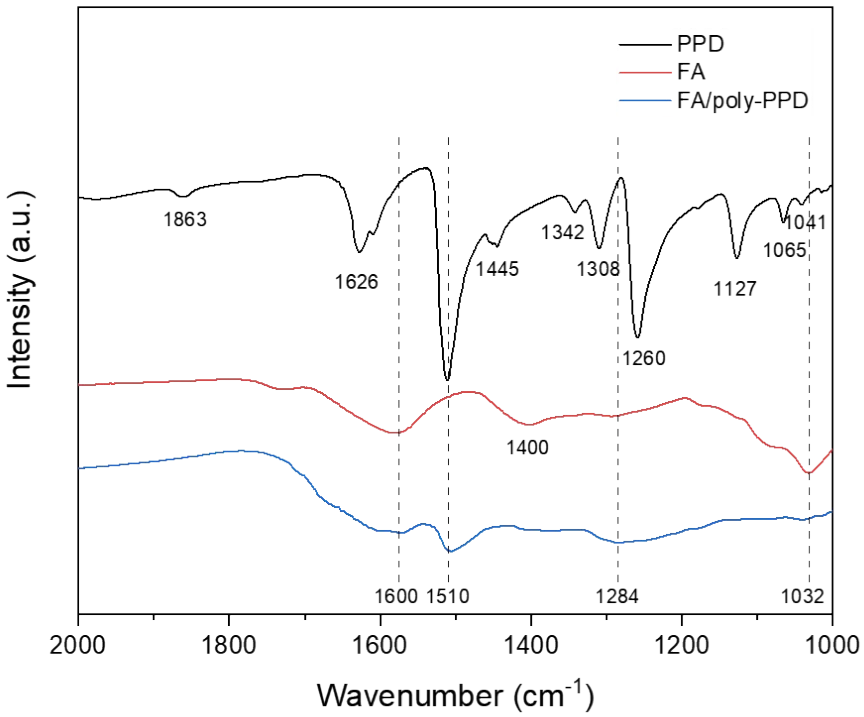

Figure S1. FTIR of PPD, FA and FA/poly-PPD. The test range is 4000-500 cm^{-1}, and the 2000-1000 cm^{-1} band is intercepted here for analysis.

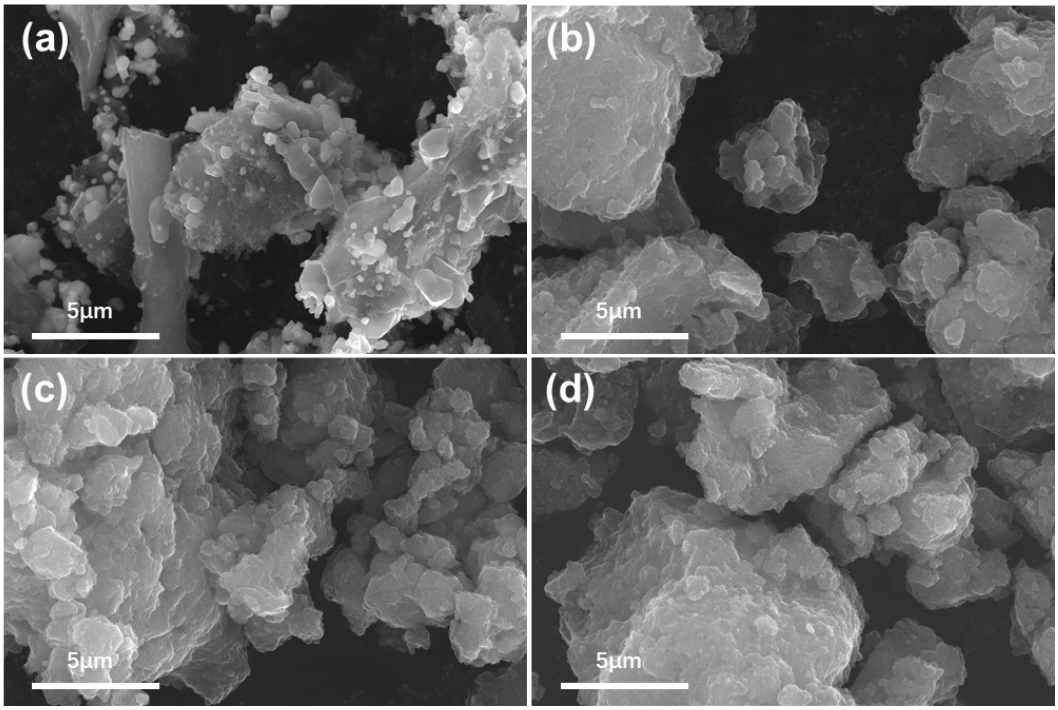

Figure S2. SEM of a) FA/poly-PPD; b) Fe_3C@N-doped C-600; c) Fe_3C@N-doped C-700 and d) Fe_3C@N-doped C-800.

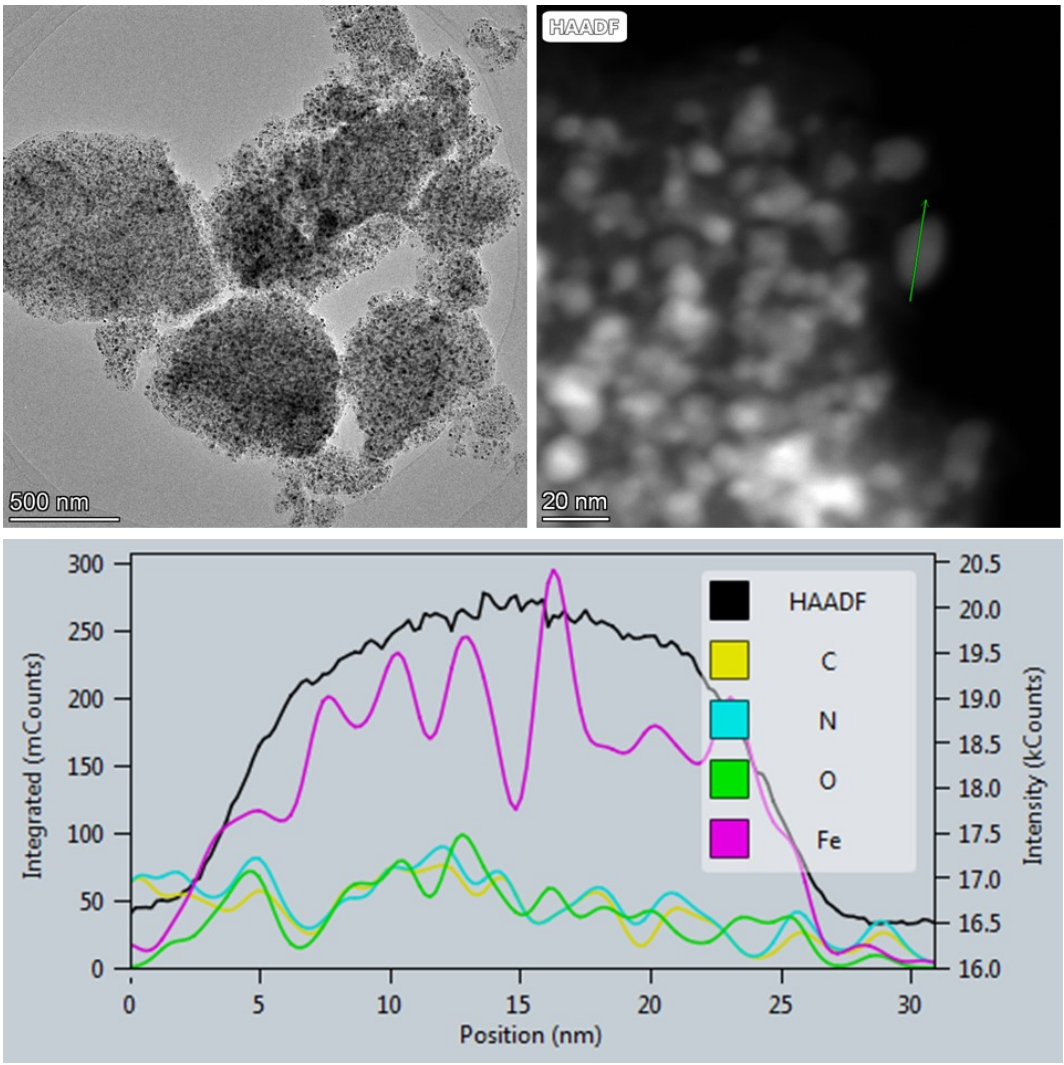

Figure S3. HRTEM, HAADF and line scanning of Fe_3C@N-doped C-600.

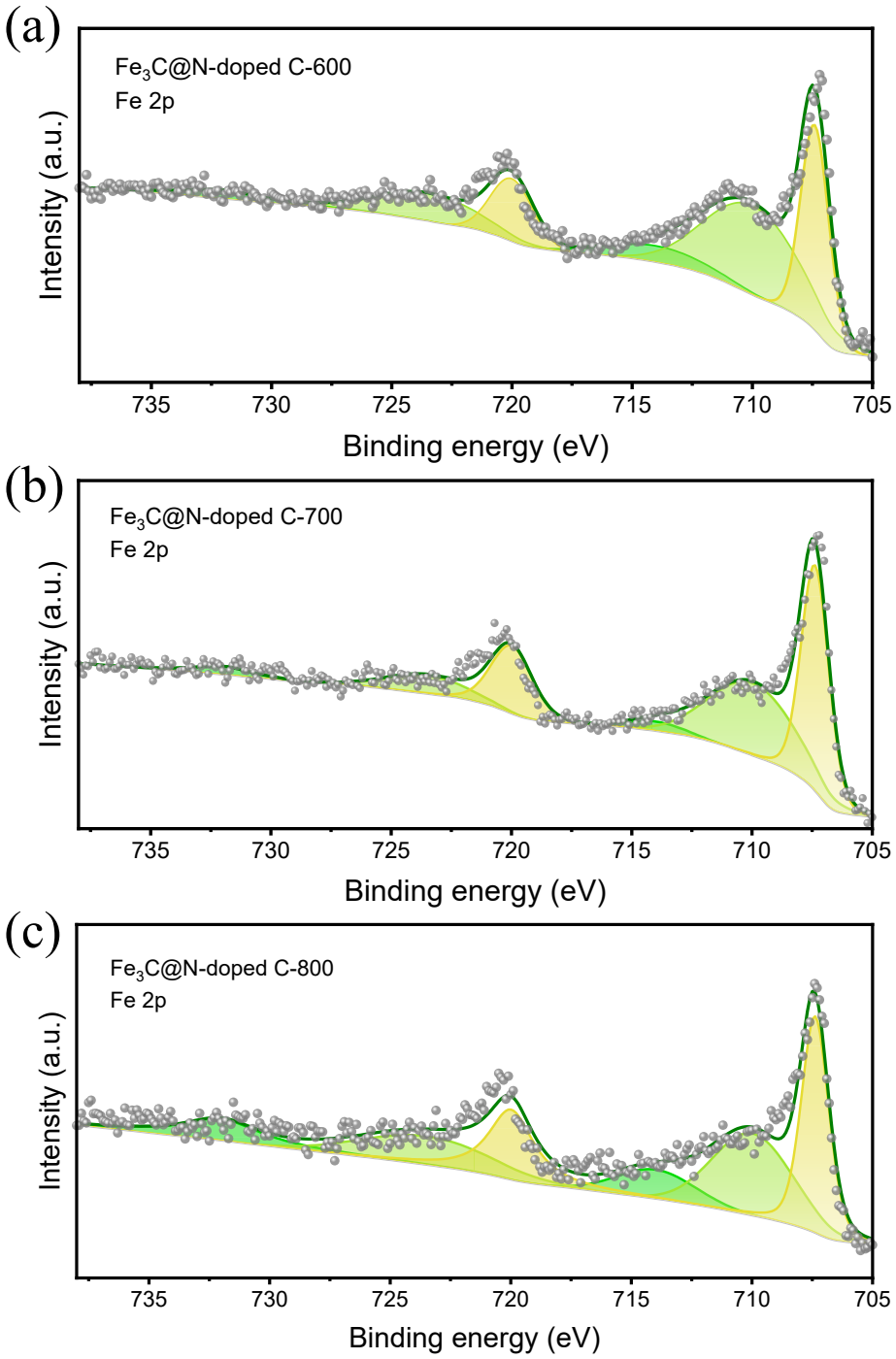

Figure S4. High-resolution Fe 2p XPS spectra of Fe_3C@N-doped C at different carbonization temperatures: (a) Fe_3C@N-doped C-600, (b) Fe_3C@N-doped C-700, and (c) Fe_3C@N-doped C-800.

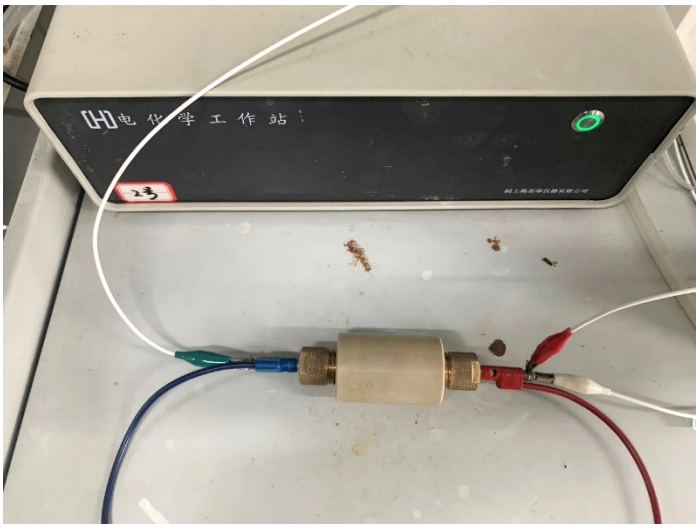

Figure S5. The home-made test device to obtain electrical conductivity of powder samples Fe_3C@N-doped C at different carbonization temperatures, FA@600C and commercial activated carbon material (YP-50F).

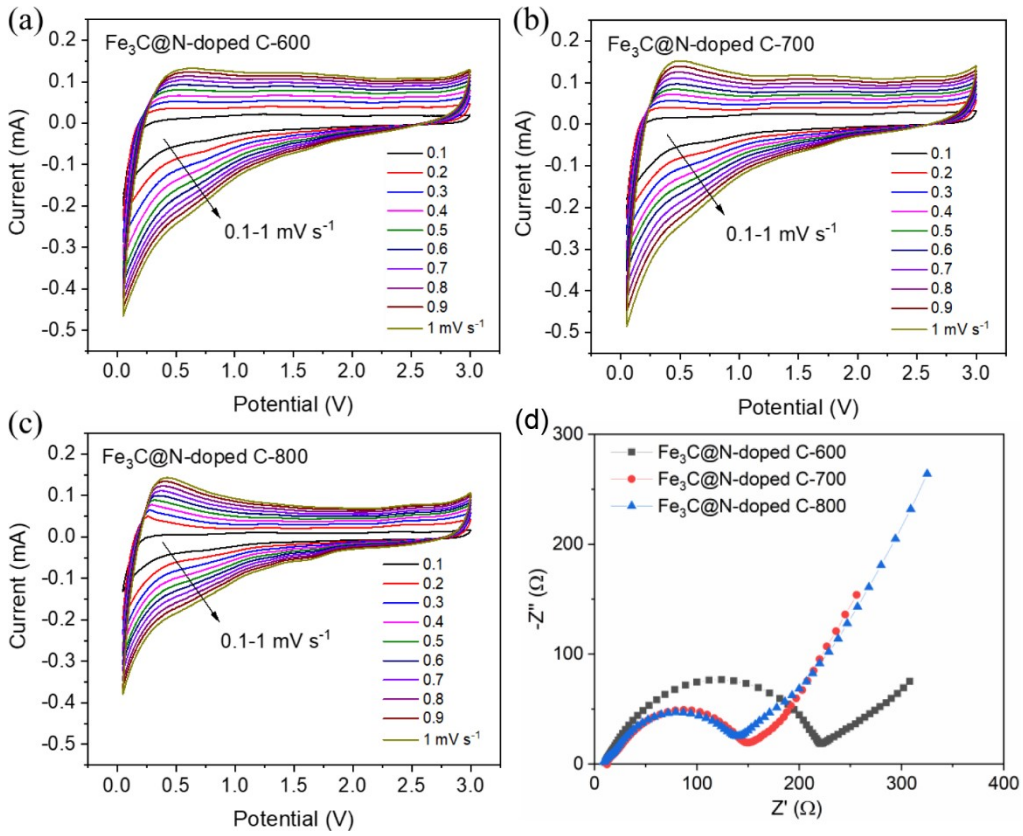

Figure S6. Cyclic voltammograms of LIBs: (a) Fe_3C@N-doped C-600, (b) Fe_3C@N-doped C-700, (c) Fe_3C@N-doped C-800 and (d) EIS spectra of Fe_3C@N-doped C after CV sweeping.

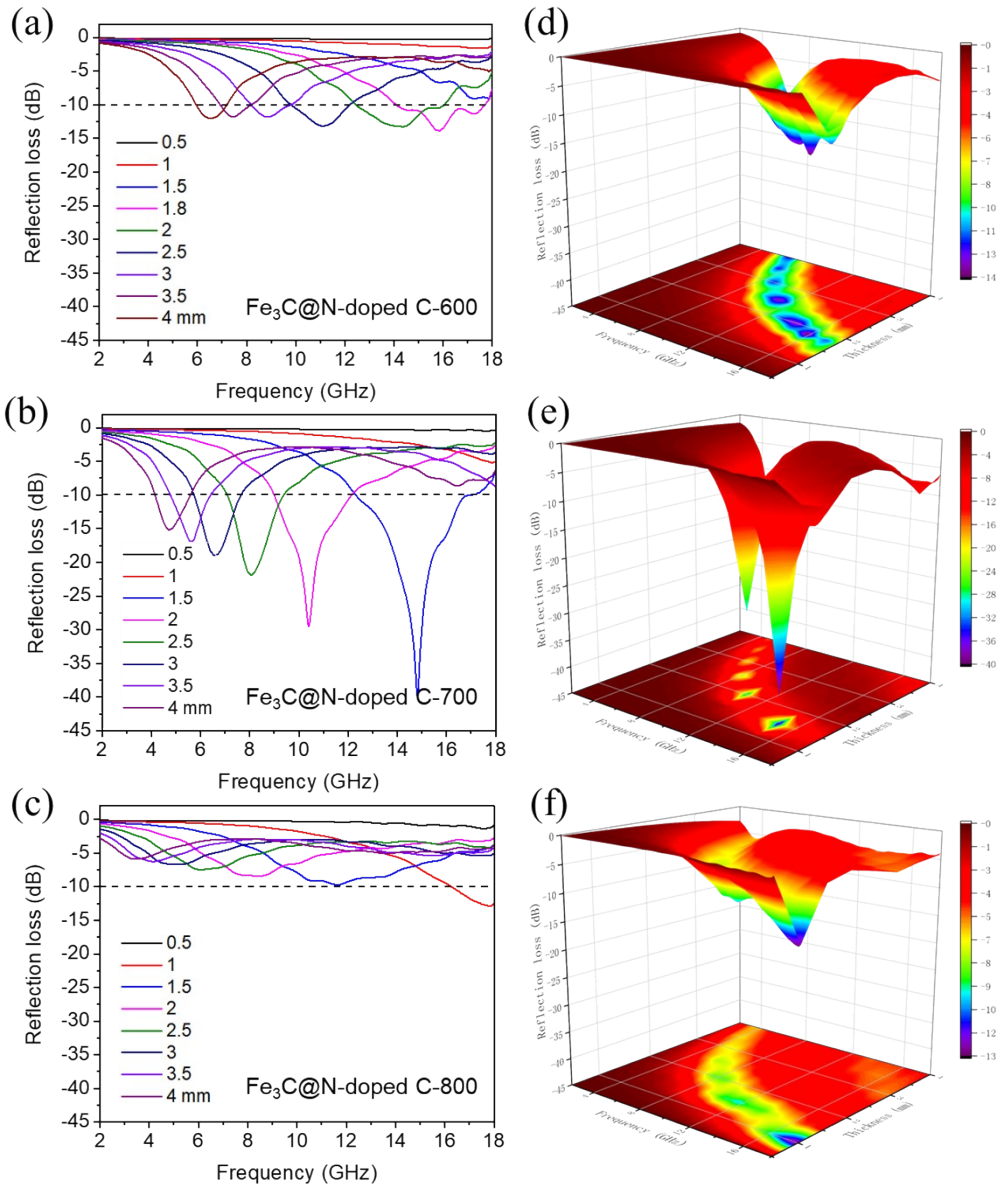

Figure S7. (a-c) The 2D microwave reflection loss (RL) curves of Fe_3C@N-doped C at different carbonization temperatures; (d-f) The 3D contour map of RL values corresponds to the 2D plot on the left.

Sample	Carbide production rate (%)	Acid production rate (%)	Total yield (%)
Fe_3C@N-doped C-600	38.20%	75.47%	28.83%
Fe_3C@N-doped C-700	37.64%	64.28%	24.19%
Fe_3C@N-doped C-800	33.95%	55.60%	18.88%

Table S1. The yields of samples after carbonization and pickling to remove iron.

Sample	EDS (wt%)				XPS (wt%)				EA (wt%)		
	C	**N**	**O**	**Fe**	**C**	**N**	**O**	**Fe**	**C**	**H**	**N**
1	67.79	**7.55**	6.47	18.12	76.72	**7.62**	9.37	6.29	60.34	1.76	**6.10**
2	73.07	**4.86**	5.16	12.90	84.55	**5.34**	6.18	3.93	69.86	1.31	**3.41**
3	77.49	**3.60**	6.24	12.78	87.96	**3.97**	4.81	3.26	88.74	0.83	**1.38**
Sample	**EDS (at%)**				**XPS (at%)**				**EA (at%)**		
	C	**N**	**O**	**Fe**	**C**	**N**	**O**	**Fe**	**C**	**H**	**N**
1	81.4	**7.8**	5.8	4.7	83.73	**7.13**	7.67	1.47	69.61	24.36	**6.03**
2	86.0	**4.9**	4.6	4.3	89.37	**4.84**	4.90	0.89	78.94	17.76	**3.30**
3	87.9	**3.5**	5.3	3.2	91.94	**3.56**	3.77	0.73	88.84	9.97	**1.18**

Note: Sample 1- Fe_3C@N-doped C-600, Sample 2- Fe_3C@N-doped C-700, Sample 3- Fe_3C@N-doped C-800.

Table S2. Atomic percent (at%) result of Fe_3C@N-doped C at different carbonization temperatures with EDS and XPS methods, mass percent (wt%) result of Fe_3C@N-doped C at different carbonization temperatures with EDS and EA methods, and interconversion of atomic percent results to mass percent results.