Supporting Information

for

Cross-Linked Polymers of Diethynylbenzene and Phenylacetylene as New Polymer Precursors for High-Yield Synthesis of High-Performance Nanoporous Activated Carbons for Supercapacitors, Hydrogen Storage, and CO_2 Capture

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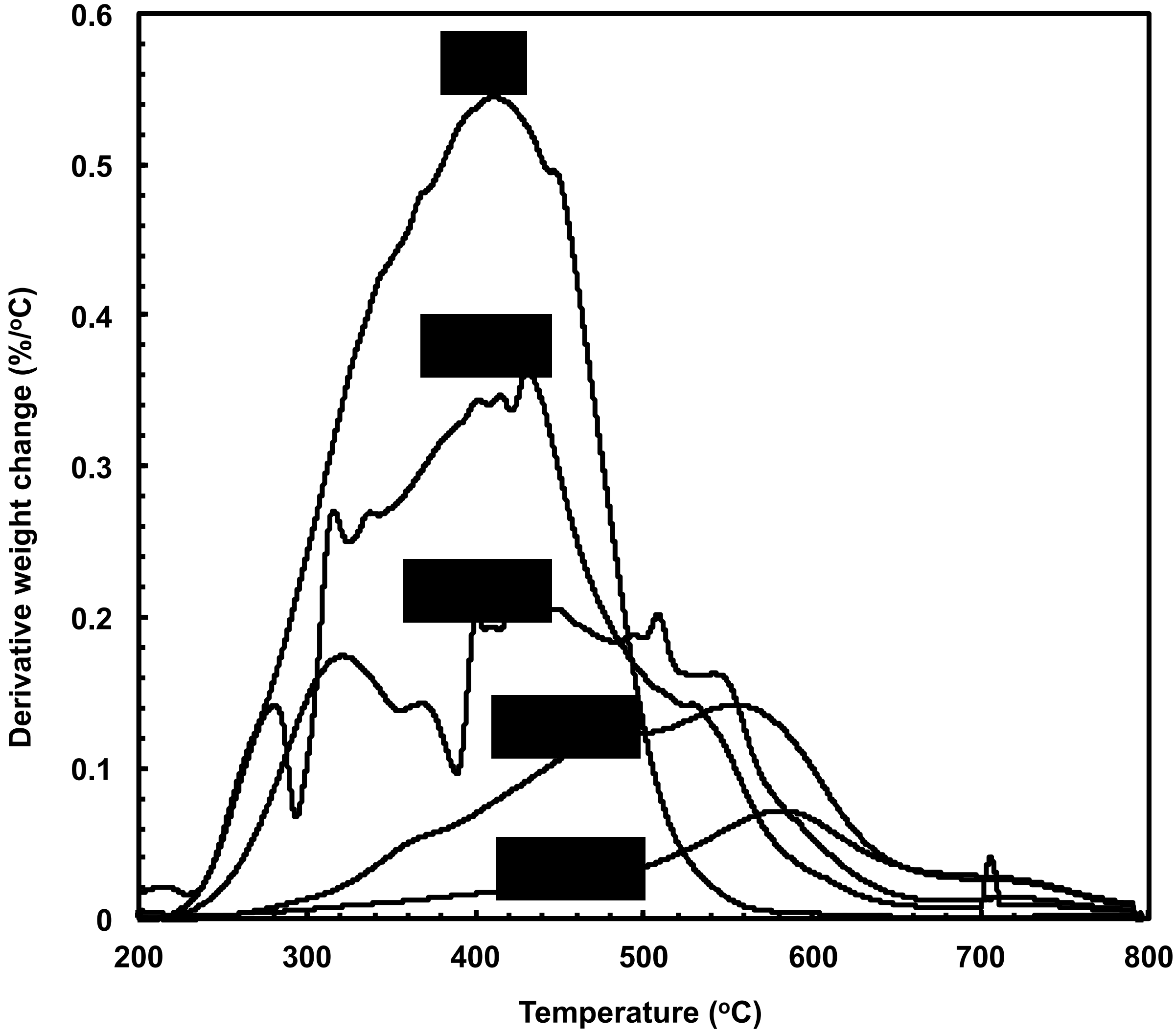

Figure S1. First-order derivative TGA curves of representative polymers (corresponding to the TGA curves in Figure 1).

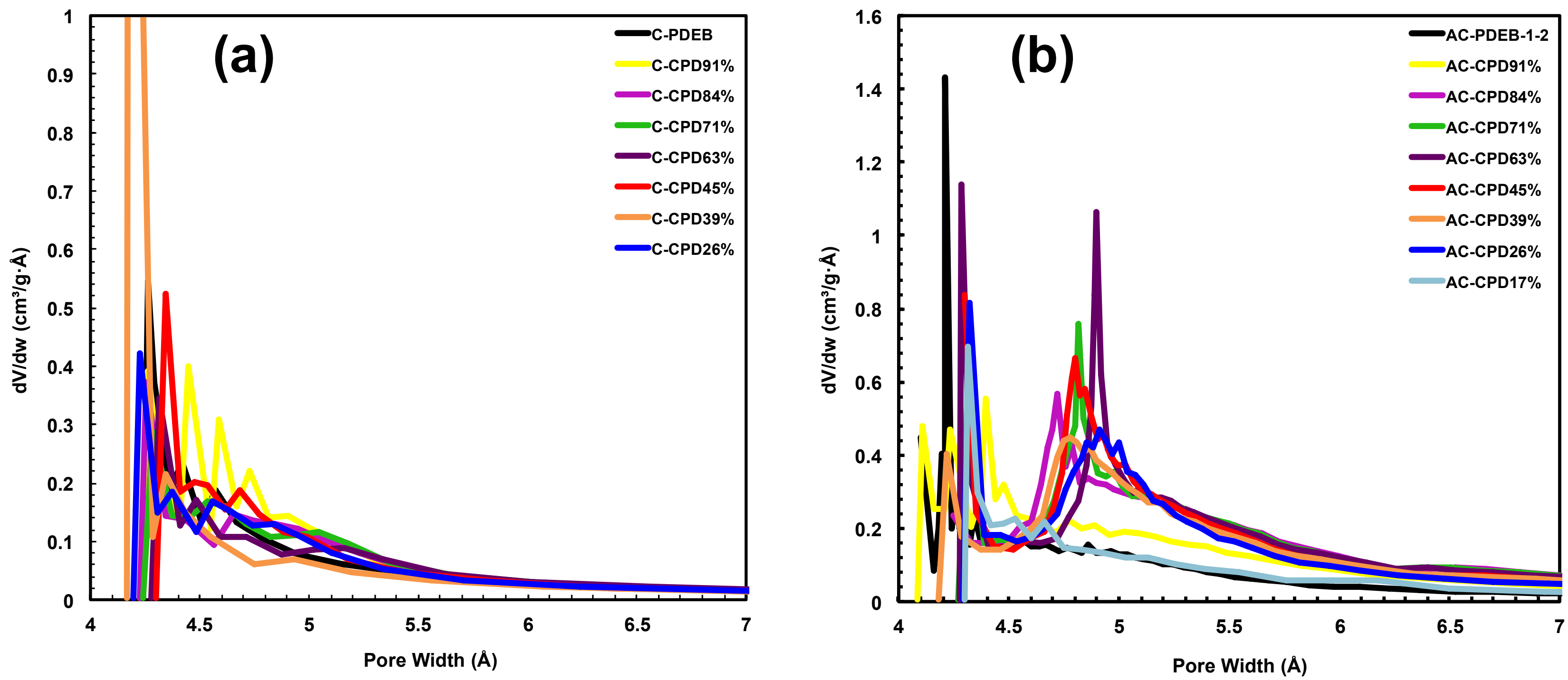

Figure S2. Micropore size distribution curves of (a) the nonactivated carbons and (b) activated carbons determined from N_2 sorption isotherm ($P/P_o < 0.02$) with the HK model.

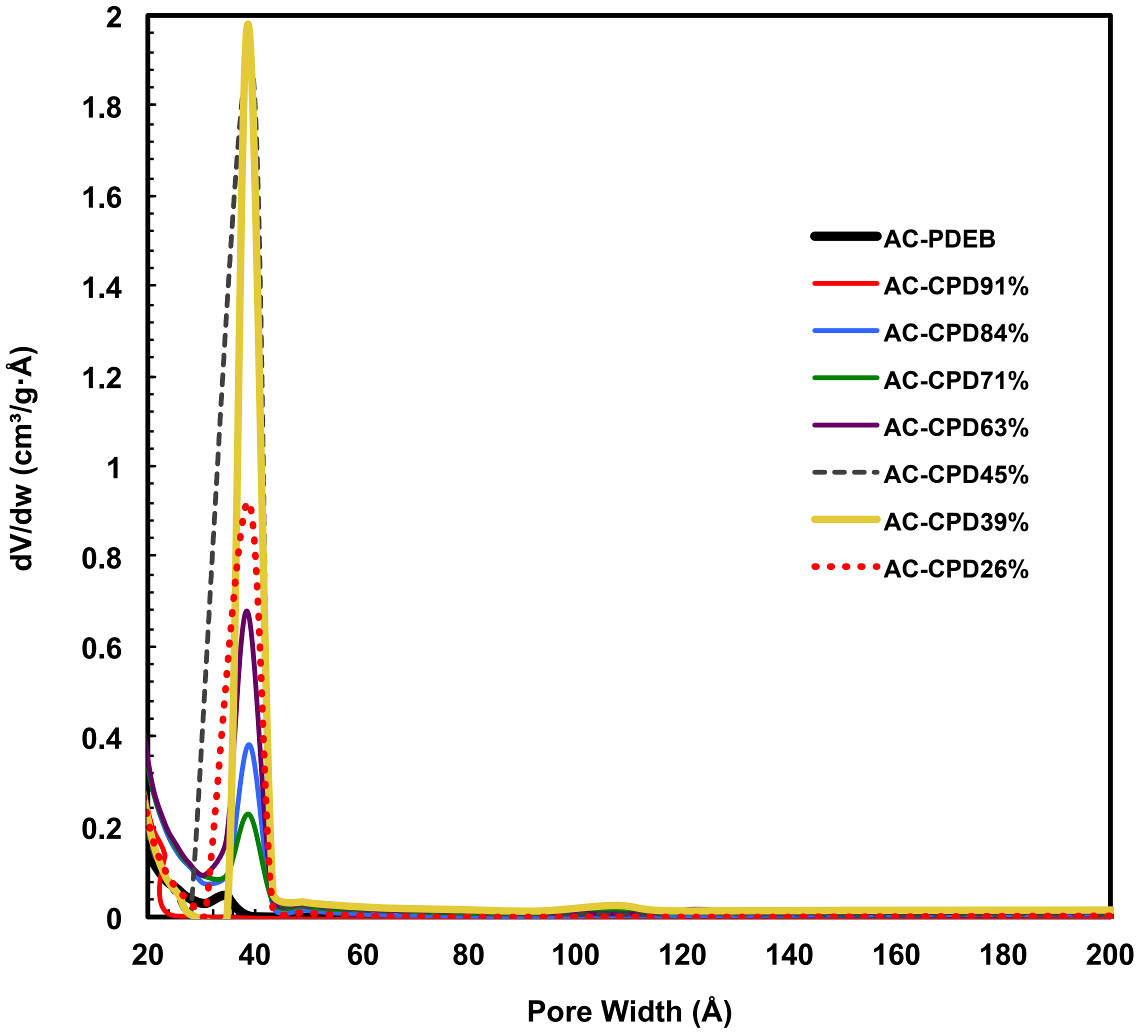

Figure S3. Mesopore size distribution of the activated carbons determined from N_2 desorption data with BJH model.

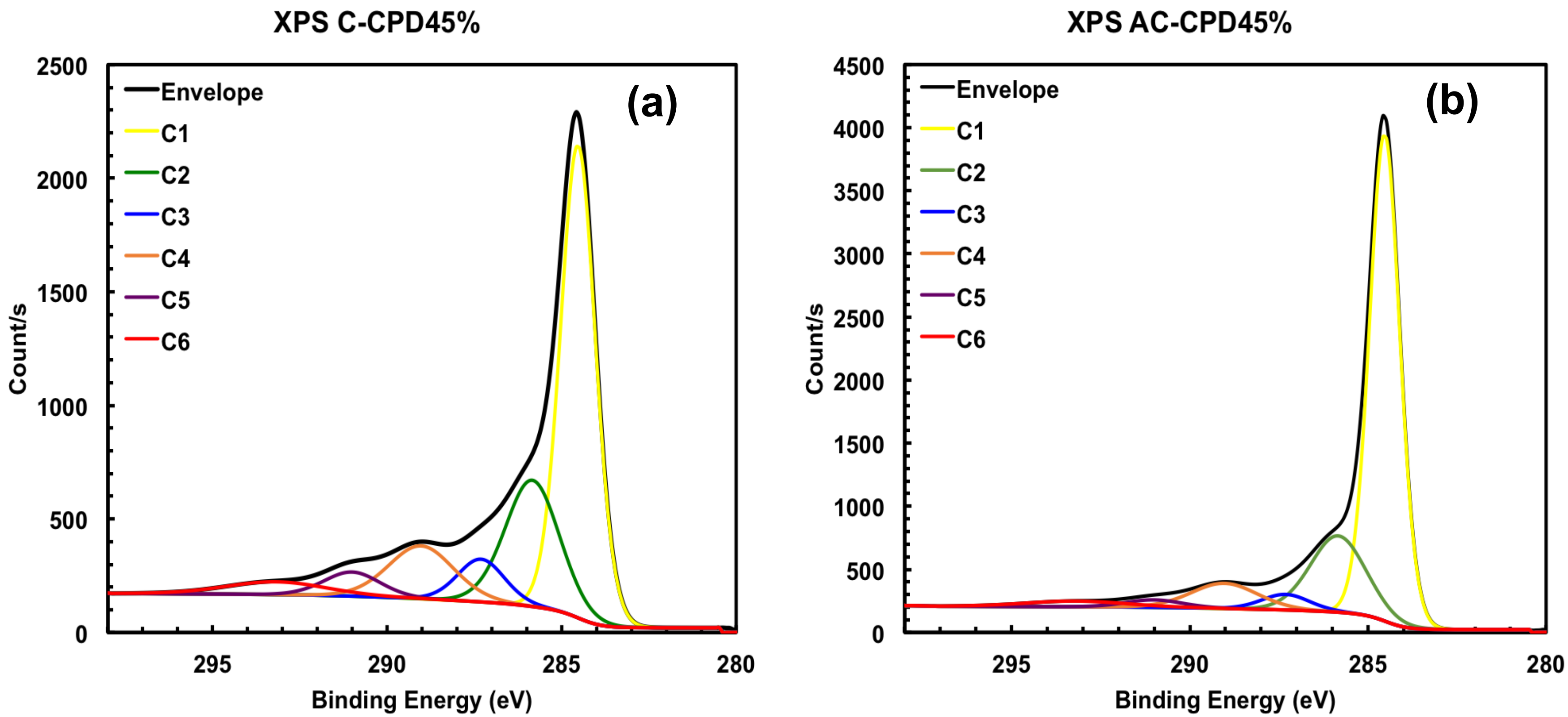

Figure S4. C 1s XPS spectra of (a) C-CPD45% and (b) AC-CPD45%. Peaks labeled as C1–C4 (binding energy at 284.53, 285.84, 287.31, 289.03 eV, respectively) arise, respectively, from the sp3 C–C and sp2 C=C, C–OH, C=O, O–C=O functional groups. Peaks C5 (291.01 eV) and C6 (293.19 eV) are satellite peaks resulting from π-π* electronic transition (see Ref. 13 and 15d in the article). The atomic content of C1–C6 in C-CPD45% is 65.8%, 18.8%, 3.3%, 7.5%, 1.9%, and 2.6%, respectively; and the corresponding content in AC-CPD45% is 52.4%, 21.8%, 6.4%, 11.0%, 4.3%, and 4.1%, respectively.

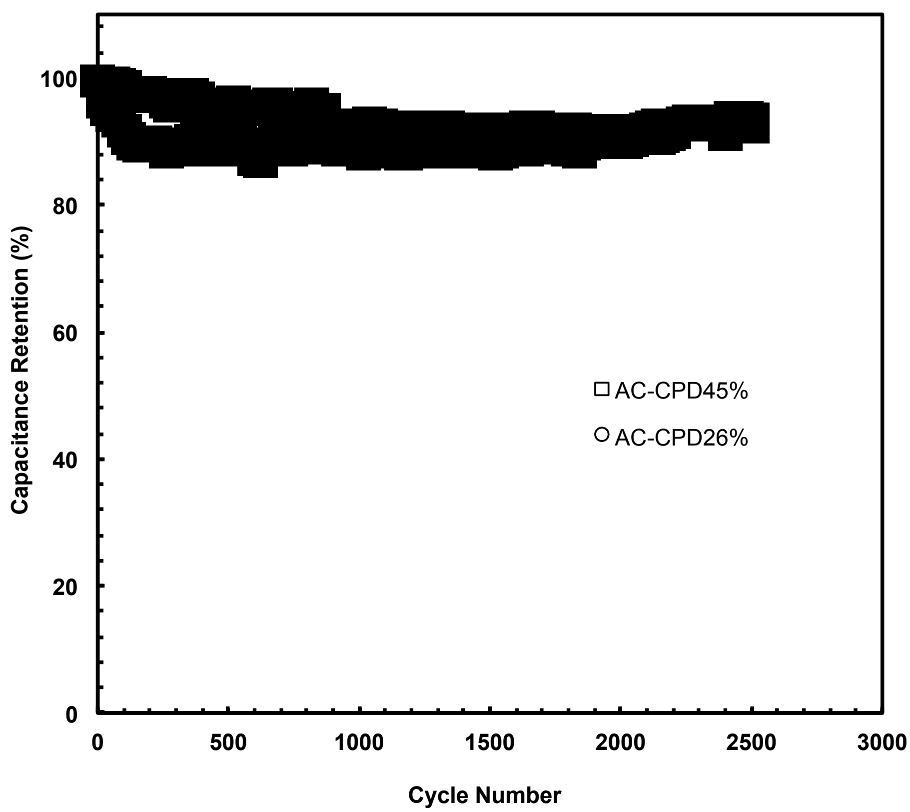

Figure S5. Cyclic stability of electrodes made with AC-CPD45% and AC-CPD26%, respectively, at the current density of 1 A/g over 2500 charge-discharge cycles. The tests were performed on three-electrode cells in 1 M H_2SO_4 solution.

Table S1. Specific capacitance results reported in the literature for representative carbon-based materials in 3-electrode cells.

Name	Electrolyte	Potential Range	CV Measurement		GCD Measurement		Gas Sorption Measurement					Reference
			Scan rate *mV/s*	**Specific Capacitance** *F/g*	**Current Density** *A/g*	**Specific Capacitance** *F/g*	**BET Surface Area** *m^2/g*	**Pore Volume** V_{total} (V_{mic}) *cm^3/g*	**Pore Size** d_{micro} (d_{meso}) *nm*	**CO_2 Adsorption** *mmol/g (cm^3/g)*	**Hydrogen adsorption** *wt%*	
Carbon Microspheres												
USP-C2	1M H_2SO_4	0 to 0.9 V (Ag/AgCl)	5	360 ± 11	--	--	698	--	0.82	--	--	S1
Activated Carbon												
PIR-4	6M KOH	-0.9 to 0 V (Ag/AgCl)	5	258	--	--	2350	0.88(0.44)	(2.25)	--	--	S2
AKN	1M H_2SO_4	0 to 0.75 V (Ag/AgCl)	0.5	358	0.125(1)	355(329)	2062	1.99(0.95)	1.4	(0.37)	--	S3
AK	1M H_2SO_4	0 to 0.75 V (Ag/AgCl)	0.5	321	0.125(1)	325(291)	2132	2.18(0.96)	1.4	(0.44)	--	S3
N22AC	1M H_2SO_4	0 to 1 V (Ag/AgCl)	10	426	--	--	2204	1.17(0.69)	(2.12)	--	--	S4
RAC	1M H_2SO_4	0 to 1 V (Ag/AgCl)	10	241	--	--	1913	0.86(0.51)	1.79	--	--	S4
CobK3	0.5M H_2SO_4	-0.1 to 0.9 V (Ag/AgCl)	25	127	--	--	~2000graph	~1.1(~0.95)	--	--	--	S5
CNSs-6	6M NaOH	-0.8 to 0.2 V (Hg/HgO)	5	328	--	--	~1700calc	~0.86	2.00	--	--	S6
KOH-500	1M $NaNO_3$	−1.0 to 0.3 V (MSE).	5	226	--	--	--	1.375	--	--	--	S7
Carbide-derived Carbon												
Nano-CDC	1M H_2SO_4	0.4 to 0.9 V (Ag/AgCl)	--	--	0.0025 mA	132	952	0.90	0.85	--	--	S8
CCDC–KOH	6M KOH	-1 to 0 V (Hg/HgO)	1	280.1	--	--	1100	1.74(0.17)	(8.83)	--	--	S9
ACA-K2CO3	6M KOH	-1 to 0 V (Ag/AgCl)	--	--	1	152	1166	1.71	--	--	--	S10
PCNFW	6M KOH	-1 to 0 V (Hg/HgO)	5	171	--	--	416	0.19(0.18)	--	--	--	S11
N-CNFs-900	6M KOH	-1 to 0 V (Hg/HgO)	--	--	1	202	563	0.51	(3.64)	--	--	S12
CNT in Activated Carbon												
tube-in-AC	6M KOH	0 to 1 V (SCE)	1	378	--	--	1626	~1 – 2	--	--	--	S13
CO2-Derived Boron Doped Porous Carbon												
K-BPC	1M Na_2SO_4	-0.4 to 0.6 (Ag/AgCl)	20	139	--	--	--	--	--	--	--	S14
Graphene												
NGS	6M KOH	-1.1 to -0.1 V (SCE)	--	--	0.2	326	593	0.092	3	--	--	S15
Graphene in Activated Carbon												
GSNCs-1%	1M H_2SO_4	-0.2 to 0.8 V (Ag/AgCl)	--	--	0.3	324.6	1256		(2-50)	--	--	S16
RG3	2M H_2SO_4	-0.2 to 0.8 V (Ag/AgCl)	--	--	1	316	1652	0.94(0.39)	(2.28)	--	--	S17
RG3	6M KOH	-0.2 to 0.8 V (Ag/AgCl)	--	--	1	397	1652	0.94(0.39)	(2.28)	--	--	S17
P-F-GO-E	1M H_2SO_4	0 to 1 (Ag/AgCl)	--	--	1	327	181.6	0.74	(<5)	--	--	S18
Hiearchically Porous Carbon												
THPC	6M KOH	-1 to 0 (Hg/HgO)	--	--	0.5	318.2	2870	2.19	(2.73)	--	--	S19
Mesoporous Carbon by Soft-templating Approach												
COU-2	1M H_2SO_4	-0.2 to 0.8 V (Ag/Ag/Cl)	2	184	--	--	694	0.66(0.16)	(5.5)	--	--	S20
K-COU-2	1M H_2SO_4	-0.2 to 0.8 V (Ag/AgCl)	2(20)	244(187)	--	--	1685	1.25(0.47)	(5.5)	--	--	S20

AMC-6	0.1M NaCl	-0.4 to 0.6 V (Ag/AgCl)	1(10)	188(32)	--	--	1940	1.57(0.62)	(10)	--	--	S21
BP-800	1M H_2SO_4	-0.6 to 0.4 (Hg/HgO)	20	192	--	--	1578	1.092	<2	--	--	S22
BP-800	6M KOH	-1.2 to 0 V (Hg/HgO)	20	237	--	--	1578	1.092	<2	--	--	S22
MOF-derived Carbon												
NPC-800	0.5M H_2SO_4	0 to 0.8 V (Ag/Ag/Cl)	20	238	--	--	943	0.84	0.8(2-4)	--	--	S23
CZIF69a	0.5M H_2SO_4	-0.241 to 0.759	20	156	--	--	2264	--	<1.3	4.76	2.16	S24
C-S700	6M KOH	-1 to 0 V (Ag/AgCl)	2(20)	182(163)	--	--	817	0.85	0.8(2.7-10.6)	--	--	S25
Z-900	0.5M H_2SO_4	-0.2 to 1 V (Ag/AgCl)	5	214	--	--	1075	0.57(0.38)	(10.2)	--	--	S26
Z-900	0.5M H_2SO_4	-0.2 to 1 V (Ag/Ag/Cl)	5(20)	214(158)	--	--	1075	0.57(0.38)	(10.2)	--	--	S26
Carbon-700	6M KOH	-1 to 0 V (SCE)	10	218	--	--	672	0.38(0.34)	(2.3)	--	--	S27
MAC-A	6M KOH	-1 to 0 V (Ag/AgCl)	2	271	--	--	2222	1.14(1.01)	0.68	--	--	S28
MC-A	6M KOH	-1 to 0 V (Ag/AgCl)	2	208	--	--	1673	1.33(0.68)	0.9	--	--	S28
MPC-A	6M KOH	-1 to 0 V (Ag/AgCl)	2	196	--	--	1271	1.92(0.59)	0.9	--	--	S28
OMC-derived Carbon												
KF1– 90	6M KOH	-0.8 to 0 V (Hg/HgO)	--	--	0.5	200	1410	0.73(0.38)	1.5-4	--	--	S29
KNOMC-850	2M KOH	-1 to 0 V (SCE)	--	--	1	320	693	0.75(0.69)	(3.27)	--	--	S30
Surface Treated Carbon Black												
BP2	1M H_2SO_4	-0.4 to 0.75 V (Ag/AgCl)	2	250	--	--	270	--	1-2, 2-4	--	--	S31
Templated Porous Carbon by Hard and Soft Templating												
MHCS	2M H_2SO_4	0 to 1 V (Ag/AgCl)	--	--	0.25	404	935	2.14(0.45)	(6.67)	--	--	S32
Templated Porous Carbon by Nanocasting												
carbon hollow spheres	6M KOH	-1 to 0 V (Hg/HgO)	--	--	1(0.5)	266(269)	658	1.07	<1, 1-2, (>50)	--	--	S33
MPM-2	6M KOH	0 to -0.9 V (Hg/HgO)	--	--	0.1	224	349	0.339(0.051)	(3.88)	--	--	S34
ARP-CTs-30	6M KOH	-1 to 0 V (Hg/HgO)	50	230	--	--	2415.68	1.55	--	--	--	S35
BMC-I	1M H_2SO_4	0 to 0.8 V (Hg/HgO)	2	112	--	--	660	0.54	(4.9)	--	--	S36
BMC-II	1M H_2SO_4	0 to 0.8 V (Hg/HgO)	2	99	--	--	470	0.49	(6.8)	--	--	S36

Table S2. Specific capacitance results reported in the literature for representative carbon-based materials in 2-electrode cells.

			CV Measurement		GCD Measurement		Gas Sorption Measurement					
Name	Electrolyte	Potential Range	Scan rate *mV/s*	Specific Capacitance *F/g*	Current Density *A/g*	Specific Capacitance *F/g*	BET Surface Area m^2/g	Pore Volume V_{total} (V_{mic}) cm^3/g	Pore Size micropore (mesopore) *nm*	CO_2 Adsorption $mmol/g(cm^3/g)$	Hydrogen adsorption *wt%*	Reference
Activated Carbon												
PAN-A	1M H_2SO_4	0 to 0.8 V	1(5)	201(176)	0.1(0.5)	176(157)	807	--	--	--	--	S37
aMP	2M H_2SO_4	-1 to 1 V	--	--	0.125	295	3160	1.58	0.6-2, 2-4	--	--	S38
KOH-A	1M H_2SO_4	0 to 1 V	--	--	0.1	176±9	2570	3	--	--	--	S39
KOH-A	6M KOH	0 to 1 V	--	--	0.1	173±7	2570	3	--	--	--	S39
H-CMN	1M H_2SO_4	0 to 1 V	--	--	0.1	264	2557.3	--	<4	--	--	S40
SCC-750-1	1M H_2SO_4	0 to 1 V	--	--	0.25	300	1452	0.81(0.48)	<2	(0.27)	--	S41
CGC	1M H_2SO_4	0 to 1 V	--	--	0.05	368	1019	0.48(0.21)	<1, (2-4)	(~0.275)	--	S42
AK3P-0.30	30wt% KOH	0 to 0.8 V	--	--	0.12	218	1759	0.93(0.61)	(3.5-4.5)	--	--	S43
NC-700-3	30wt% KOH	0 to 1 V	--	--	0.125	311	2509	1.34(1.12)	(2.1)	--	--	S44
Carbide-derived Carbon												
TiC-CDC	1M H_2SO_4	-0.5 to 0.5 V	5	190	--	--	600-2000	--	0.7-1.85	--	--	S45
Carbon Aerogel												
ACA	6M KOH	-1 to 0 V	--	--	1	136	1447	--	(3.4)	--	--	S46
Carbon Fiber-based Material												
ACF4	6M KOH	0 to 1 V	1	371	--	--	3291	2.162(0.721)	~1.5, (~3)	--	--	S47
Activated Carbon Containing Graphene or CNT												
CNAGs/SMF-Ni-5	5M KOH	-1 to 0 V	1(5)	359(321)	--	--	155	0.138(0.05)	(3.6)	--	--	S48
hGO	6M KOH	0 to 1 V	10	110	--	--	--	--	--	--	--	S49
GAC	KOH	0 to 1.2 V	--	--	0.1	122	798	--	2	--	--	S50
Hiearchically Porous Carbon												
HPCs-3	6M KOH	0 to 1 V	1	272	--	--	689	0.61(0.19)	(3.84)	--	--	S51
MOF-derived Carbon												
C1000	1M H_2SO_4	-0.5 to 0.5 V	5	161	--	--	3405	2.58(1.54)	--	--	2.77	S52
C800	1M H_2SO_4	-0.5 to 0.5 V	5	188	--	--	2169	1.5(0.9)	--	--	2.23	S52
NPC	1M H_2SO_4	-0.5 to 0.5 V	5	204	--	--	2872	2.06	--	--	2.6	S53
NPC650	1M H_2SO_4	-0.5 to 0.5 V	5	167	--	--	1521	1.48(0.06)	(3.9)	--	--	S54
Templated Porous Carbon by Nanocasting												
OMC-M-6	30wt% KOH	-1 to -0.2 V	5	205.3	--	--	868.5	1.75(0.18)	(8.5)	--	--	S55
CNC700	1M H_2SO_4	0 to 1 V	10	251	--	--	1854	--	(5-8)	--	--	S56
HPC-242	1M H_2SO_4	-0.2 to 0.8 V	--	--	0.1	165	940	1.2(0.33)	242*	--	--	S57
Y-Ac	1M H_2SO_4	0 to 1 V	2	240	--	--	1814	1.03(0.508)	<0.7, 1.7	--	--	S58
Y-AN	1M H_2SO_4	0 to 1 V	2	340	--	--	1680	0.86(0.51)	<0.7, 1.7	--	--	S58

*macroporous

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