Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary Data

Physical and chemical activation mechanisms of carbon materials based on the microdomain model

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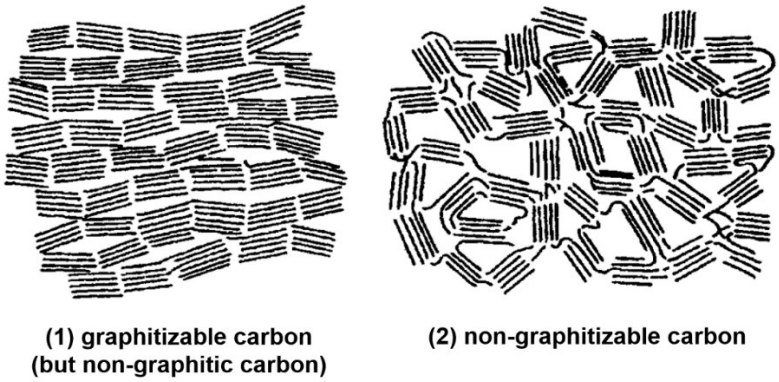

Figure S1. Franklin's structural models of graphitizable carbon and non-graphitizable carbon.[1]

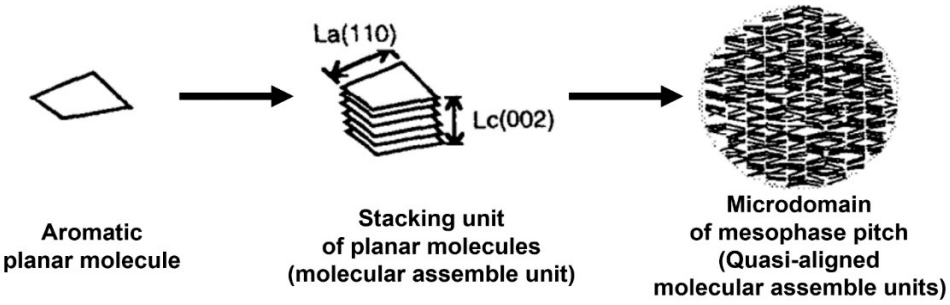

Figure S2. Formation of the molecular stacking and microdomain unit from aromatic planar molecules in liquid crystal mesophase pitch.[2]

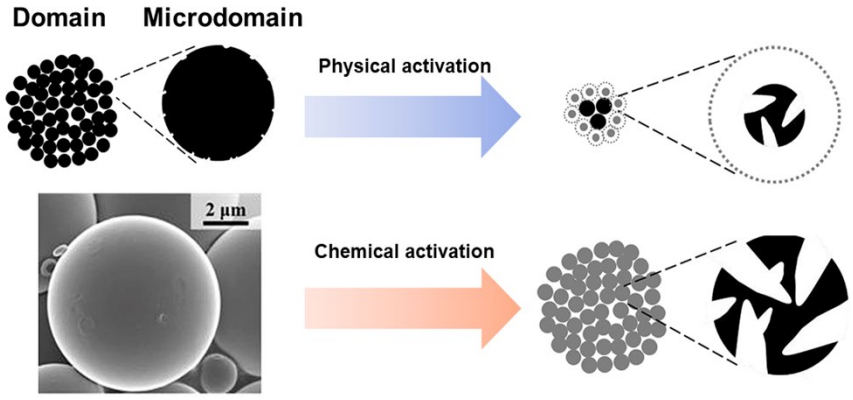

Figure S3. The activation mechanisms proposed by Yoon's group.[3]

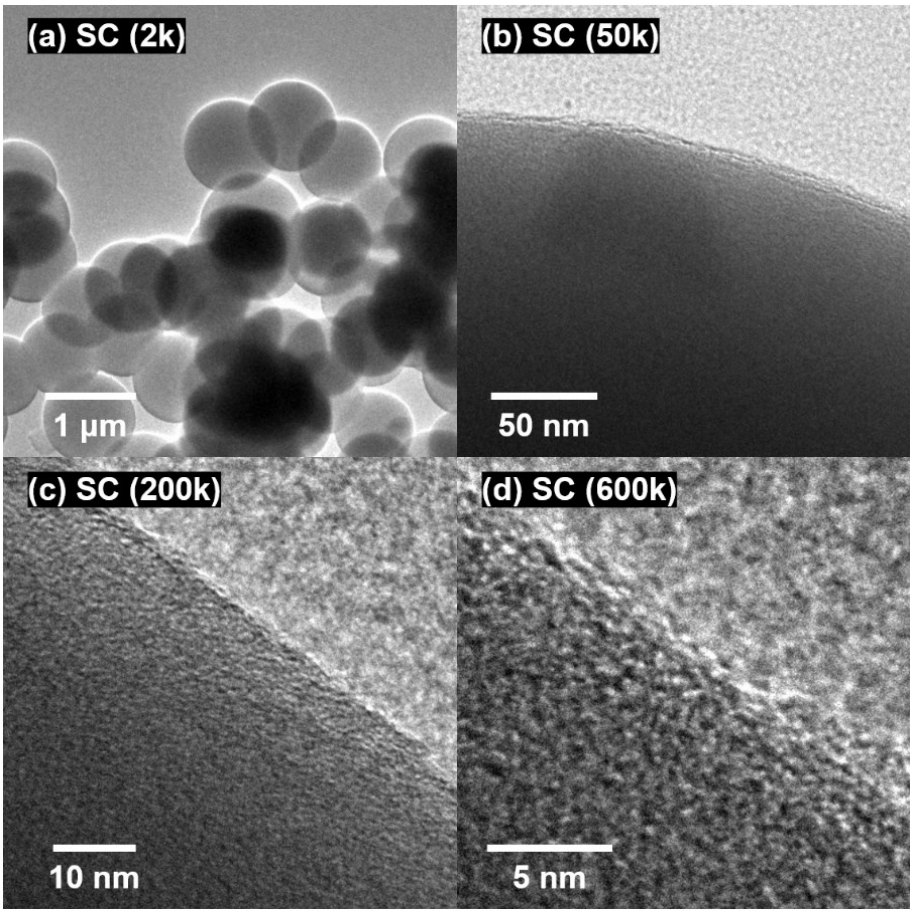

Figure S4. TEM images of SC in various scales.

Table S1. Activating conditions for preparation of ASCXYs.

Sample	Activating agent	Activation temperature [^{o}C]	Activation time [h]
ASCC600	CO_2	600	2
ASCC700	CO_2	700	2
ASCC800	CO_2	800	2
ASCC900	CO_2	900	2
ASCC1000	CO_2	1000	2
ASCK600	KOH	600	2
ASCK700	KOH	700	2
ASCK800	KOH	800	2
ASCK900	KOH	900	2
ASCK1000	KOH	1000	2

Table S2. Loading mass and electrode thickness of the prepared electrodes.

Active material	Loading mass [mg cm^{-2}]	Thickness of electrode [a] [μm]
SC	2.9	40
ASCC600	2.8	40
ASCC700	2.8	40
ASCC800	2.6	40
ASCC900	2.5	40
ASCC1000	1.4	39
ASCK600	2.1	40
ASCK700	1.8	40
ASCK800	1.3	38
ASCK900	1.4	40
ASCK1000	1.7	39

[a] Thickness of electrodes are included thickness of current collector (20 μm).

Table S3. Physical properties of SC, ASCC, and ASCK samples.

Sample	S_{BET} [a]	D_{avg} [b]	V_{micro} [c]	V_{total} [d]	Burn-off
	[m^2 g^{-1}]	[nm]	[cm^3 g^{-1}]	[cm^3 g^{-1}]	[%]
SC	503.2	1.7	0.22	0.22	0.00
ASCC600	575.2	1.7	0.24	0.24	3.39
ASCC700	583.6	1.7	0.25	0.25	4.97
ASCC800	647.2	1.8	0.27	0.27	29.27
ASCC900	1014.5	1.7	0.41	0.40	63.06
ASCC1000	2991.1	2.4	1.33	1.81	85.74
ASCK600	1985.0	1.9	0.92	0.93	37.33
ASCK700	2587.2	2.5	1.35	1.16	47.79
ASCK800	3414.5	2.5	1.78	2.13	52.51
ASCK900	2648.3	3.2	1.68	2.12	56.17
ASCK1000	1512.3	4.6	0.53	1.72	83.05

[a] Specific surface area; [b] Average pore diameter; [c] Micropore volume; [d] Total pore volume

Table S4. Specific capacitances and retention ratios of the fabricated electric double-layer capacitors.

	Gravimetric capacitance [F g^{-1}]						Volumetric capacitance [F cm^{-3}]						R_{ret} [a]
Current density [A g^{-1}]	0.1	0.5	1	3	5	7	0.1	0.5	1	3	5	7	[%]
SC	2.3	0.8	0.6	0.6	0.4	0.1	3.1	1.8	1.1	0.9	0.6	0.2	19.5
ASCC600	2.9	1.3	0.8	0.6	0.3	0.1	4.1	1.8	1.1	0.9	0.5	0.2	17.9
ASCC700	3.4	1.6	1.4	0.7	0.4	0.2	4.7	2.2	2.0	1.0	0.5	0.2	13.1
ASCC800	4.8	3.2	1.8	1.4	0.9	0.2	6.3	4.2	2.3	1.8	1.2	0.3	12.7
ASCC900	13.1	8.3	5.3	2.1	1.1	0.7	16.3	10.3	6.6	2.6	1.3	0.9	13.9
ASCC1000	26.8	22.1	17.9	14.0	8.1	4.6	20.0	16.5	13.3	10.4	6.3	3.5	25.9
ASCK600	20.6	10.2	5.2	0.9	0.2	0.1	21.9	10.8	5.5	1.0	0.2	0.1	2.6
ASCK700	23.4	17.2	12.4	3.3	3.1	2.1	19.6	14.4	10.4	2.8	2.6	1.7	16.7
ASCK800	31.2	27.4	23.1	12.5	7.6	5.0	21.8	19.2	16.1	8.7	5.3	3.5	21.5
ASCK900	20.8	19.8	18.5	14.2	11.0	9.1	14.9	14.2	13.3	10.2	7.9	6.5	49.0
ASCK1000	18.2	16.0	14.8	11.1	8.6	7.9	16.2	14.3	13.1	9.9	7.7	7.0	53.5

[a] Retention ratio with increasing current density: calculated from the ratio of specific capacitance at 0.1 A g^{-1} and 7 A g^{-1}.

References

1 R. E. Franklin, *Acta. Crystallogr.*, 1951, **4**, 253; R. E. Franklin, *Proc. Roy. Soc. Lond. A*, 1951, **209**, 196.

2 S. H. Yoon, Y. Korai and I. Mochida, *Carbon*, 1996, **34**, 83.

3 D. -W. Kim, H. -S. Kil, K. Nakabayashi, S. -H. Yoon and J. Miyawaki, *Carbon*, 2017, **114**, 98.