

Mechanism for formation and growth of carbonaceous spheres from sucrose by hydrothermal carbonization

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Supporting Information

Table S1. Synthesis conditions and statistic results for carbonaceous spheres obtained at 0.333 M in SH and RH routes

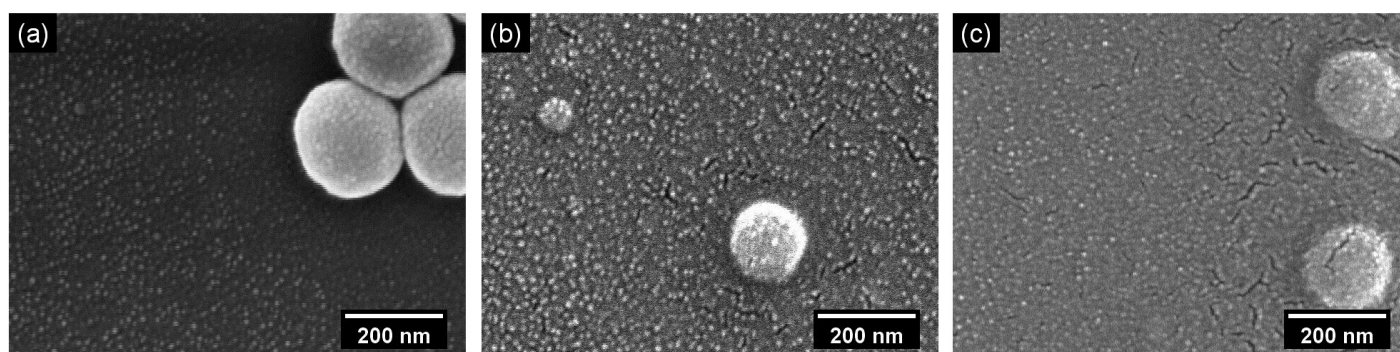
Sample	Synthesis conditions			100% Range		90% Range		50% Range		Standard deviation (nm)
	Heating route	Concentration (M)	Time (h)	Mean diameter (nm)	Range (nm)	Mean diameter (nm)	Range (nm)	Mean diameter (nm)	Range (nm)	
A-1	SH	0.333	2.5	201.84	89.54~410.28	201.20	124.00~279.23	202.03	163.11~237.52	48.62
A-2	SH	0.333	2.75	316.15	163.64~597.96	315.95	199.97~416.16	318.05	266.12~372.13	70.91
A-3	SH	0.333	3	373.96	215.74~480.36	374.46	287.14~443.39	375.20	341.50~415.88	49.05
A-4	SH	0.333	3.5	473.56	266.88~656.03	473.35	328.18~623.31	466.43	407.41~544.45	90.00
A-5	RH	0.333	2.5	206.60	70.68~347.27	207.16	124.21~272.14	210.87	169.74~241.82	47.74
A-6	RH	0.333	2.75	296.88	109.12~398.52	300.17	192.63~357.82	308.33	268.85~332.03	50.51
A-7	RH	0.333	3	383.20	147.07~593.60	386.36	279.28~442.42	392.19	370.74~411.93	47.40
A-8	RH	0.333	3.5	574.32	255.49~854.05	576.34	395.04~733.70	578.71	506.73~646.42	102.71

(Define abbreviations: SH is denoted as Slow Heating, RH for Rapid Heating.)

Table S2. Synthesis conditions and statistic results for carbonaceous spheres obtained from different hydrothermal treatments of sucrose

Sample	Synthesis conditions			100% Range		90% Range		50% Range		Standard deviation (nm)
	Heating route	Concentration (M)	Time (h)	Mean diameter (nm)	Range (nm)	Mean diameter (nm)	Range (nm)	Mean diameter (nm)	Range (nm)	
B-1	SH	0.100	4	229.93	123.35~383.96	229.35	177.62~286.82	229.39	210.79~246.72	33.00
B-2	SH	0.167	4	311.85	170.03~560.88	308.84	223.94~407.43	305.94	273.64~343.37	57.08

B-3	SH	0.233	4	456.83	155.7~756.33	459.22	304.1~594.07	462.09	407.98~511.89	85.61
B-4	SH	0.300	4	554.24	195.76~823.31	557.13	363.39~692.11	566.02	493.12~626.70	100.64
B-5	SH	0.333	4	672.97	273.74~1070.52	674.80	438.71~882.45	680.68	571.68~775.00	134.74
B-6	RH	0.067	4	136.03	51.14~272.95	135.29	101.84~179.03	134.30	121.13~148.52	23.65
B-7	RH	0.100	4	192.81	74.61~400.05	190.59	145.48~259.40	186.49	169.86~210.33	38.70
B-8	RH	0.167	4	304.63	102.45~889.46	302.79	199.54~406.01	303.16	265.19~338.62	68.33
B-9	RH	0.233	4	614.98	201.74~902.86	618.85	432.88~768.70	621.09	558.76~680.97	102.46
B-10	RH	0.300	4	683.84	230.64~1054.78	687.15	478.68~852.57	691.84	617.86~758.49	110.53
B-11	RH	0.333	4	827.12	322.54~1788.68	823.99	505.53~1088.79	839.08	678.80~974.77	191.57
B-12	RH	0.100	3	162.22	47.49~408.66	159.16	96.42~244.06	156.14	125.35~190.25	50.32
B-13	RH	0.100	3.5	189.78	93.3~475.86	188.22	140.42~249.86	185.66	166.88~209.85	35.38
B-14	RH	0.100	3.75	138.43	75.11~251.97	137.57	104.82~182.05	136.77	123.59~149.71	22.82



B-15	RH	0.100	4.5	192.38	89.07~329.50	191.51	142.56~250.70	191.29	173.05~209.27	31.58
B-16	RH	0.100	5	208.28	81.34~378.08	207.01	154.13~277.26	203.48	183.09~228.32	37.99
B-17	RH	0.100	5.5	288.08	139.47~499.13	287.41	211.60~366.45	287.99	260.08~314.43	46.09
B-18	RH	0.067	3	112.44	37.79~218.58	110.04	67.64~168.18	110.08	92.90~125.38	30.59
B-19	RH	0.067	3.5	151.82	68.53~251.55	151.28	108.51~200.24	150.79	134.92~166.72	27.73
B-20	RH	0.067	3.75	137.05	63.39~205.97	136.34	106.15~179.12	134.66	121.30~149.60	21.84
B-21	RH	0.067	4.5	125.64	71.66~214.79	125.31	95.91~155.72	125.45	112.57~137.20	18.71
B-22	RH	0.067	5	123.85	62.26~286.22	123.27	92.07~156.84	123.42	110.43~135.90	20.86
B-23	RH	0.067	5.5	162.96	97.97~488.02	159.08	126.00~217.72	155.71	141.53~173.98	38.47

(Define abbreviations: SH is denoted as Slow Heating, RH for Rapid Heating.)

Fig. S1. FESEM images of primary particles deposited on substrates from (a) 0.100 M solution reacted for 3.5, h, 0.067 M solutions reacted for (b) 3 h and (c) 3.5 h in RH route respectively.

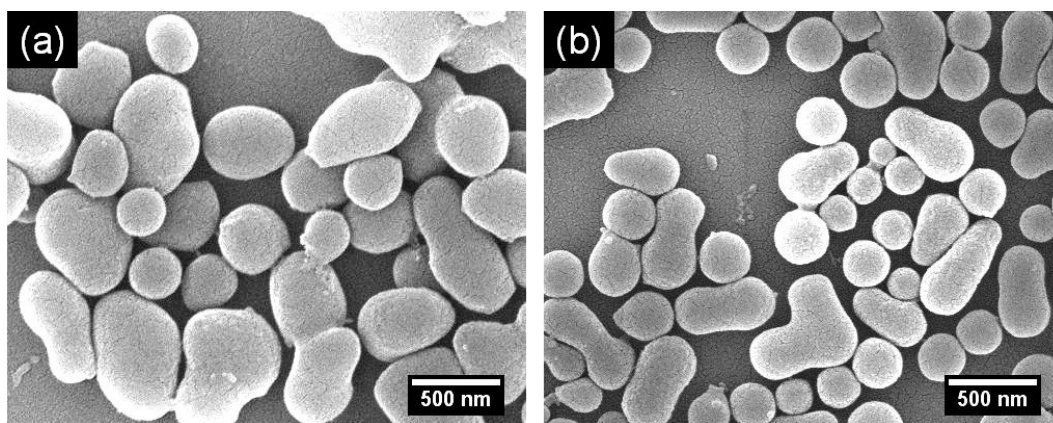


Fig. S2. FESEM images of carbonaceous spheres reacted at (a) 0.050 M for 6 h, (b) 0.033 M for 10 h in RH route.