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

Enhanced Li-S Battery Performance Based on Solution-Impregnation-Assisted Sulfur/Mesoporous Carbon Cathodes and a Carbon-Coated Separator

Changil Oh, Naeun Yoon, Jaeho Choi, Yeseul Choi, Seonghyeon Ahn, and Jung Kyoo Lee*

[a]*Department of Chemical Engineering, Dong-A University, Busan 49315, Republic of Korea*

Supporting Information

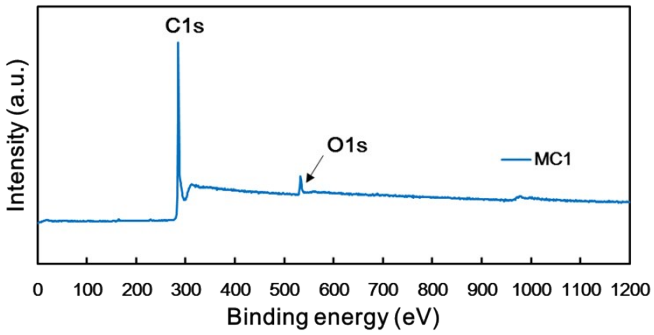

Figure S1. XPS survey spectrum of MC1.

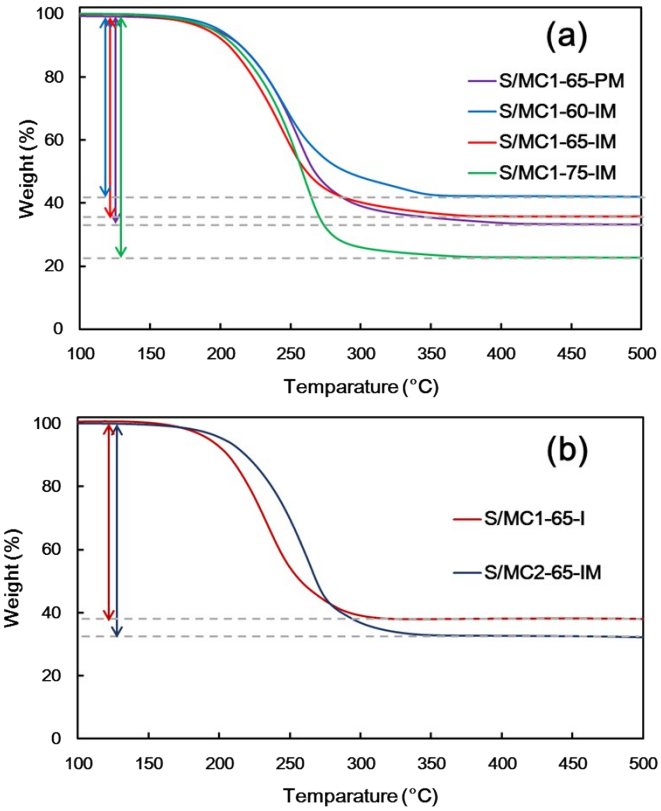

Figure S2. TGA profiles of (a) S/MC1s and (b) S/MC1-65-I (by impregnation only) and S/MC2-65-IM.

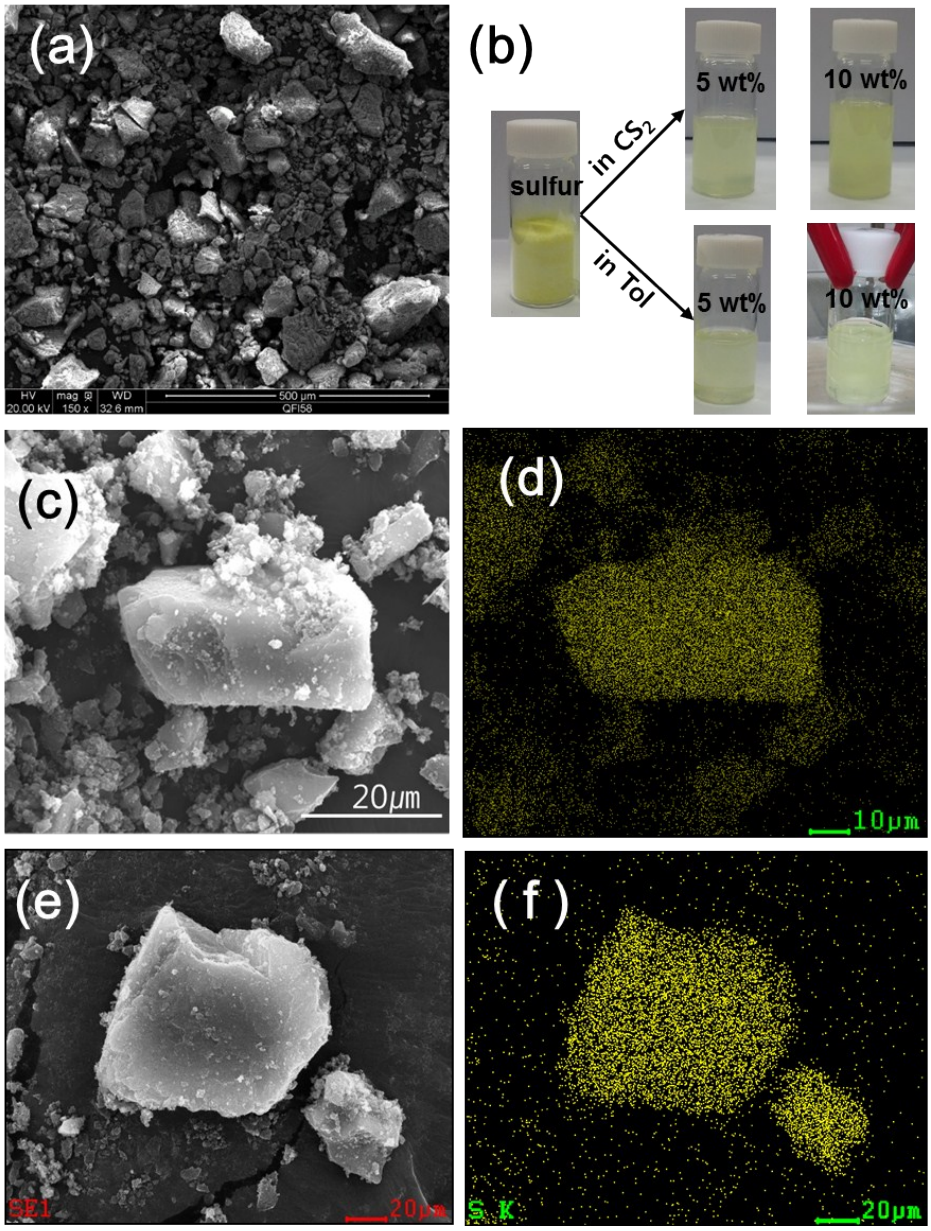

Figure S3. (a) SEM image of elemental sulfur powder, (b) photographs of elemental sulfur powder and sulfur dissolved in CS_2 at 5 wt% and 10 wt% at room temperature, and sulfur dissolved in toluene at 5 wt% and 10 wt% at 80 °C, (c) SEM image of S/MC1-65-PM and (d) EDS sulfur mapping of the image in (c), (e) SEM image of S/MC1-65-IM and (f) EDS sulfur mapping of image in (e).

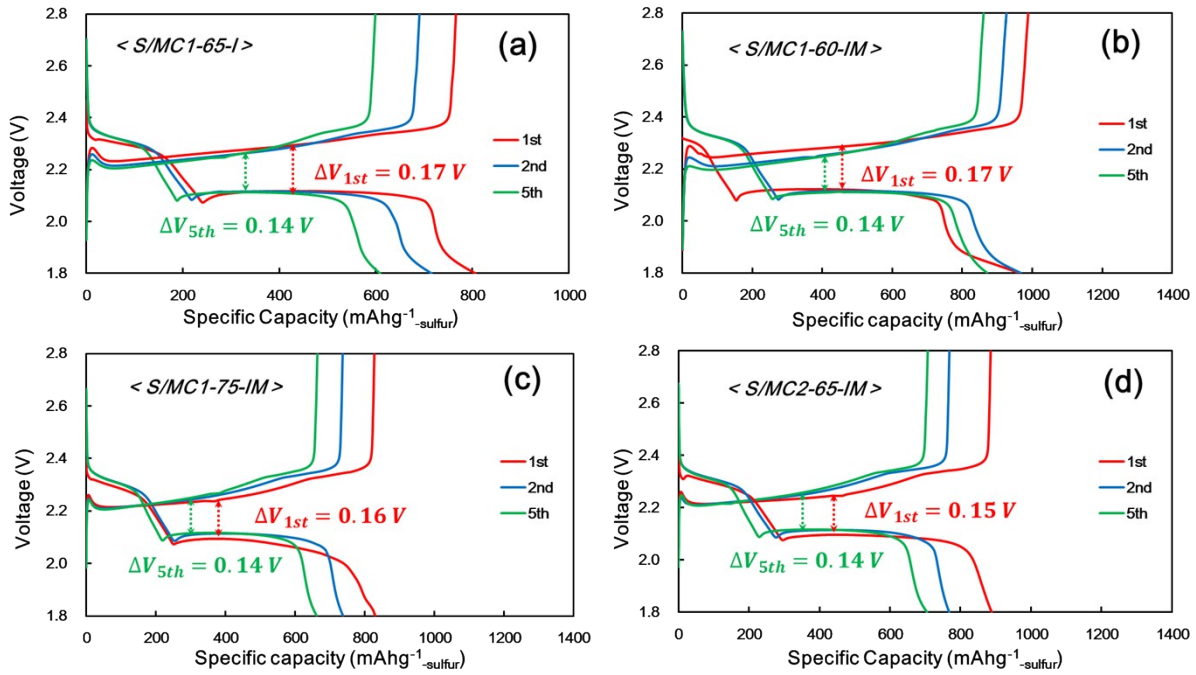

Figure S4. Voltage profiles of (a) S/MC1-65-I, (b) S/MC1-60-IM, (c) S/MC1-75-IM, and (d) S/MC2-65-IM.

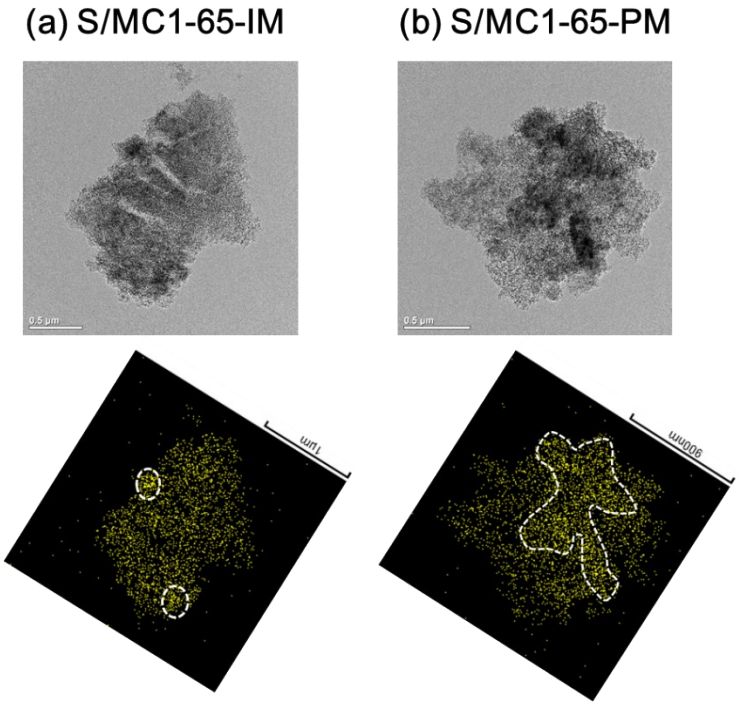

Figure S5. FE-TEM and sulfur mapping images of (a) S/MC1-65-IM and (b) S/MC1-65-PM showing the difference in internal sulfur dispersion on the samples. Dark-grey area in the FE-TEM image corresponds to the bright-yellow area of sulfur mapping image marked with dotted-white lines where local sulfur concentration is high, indicating that sulfur dispersion is much better in S/MC1-65-IM than in S/MC1-65-PM.

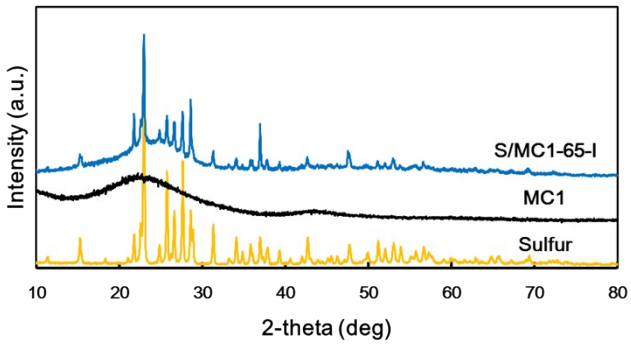

Figure S6. XRD patterns of S/MC1-65-I, MC1 and elemental sulfur.

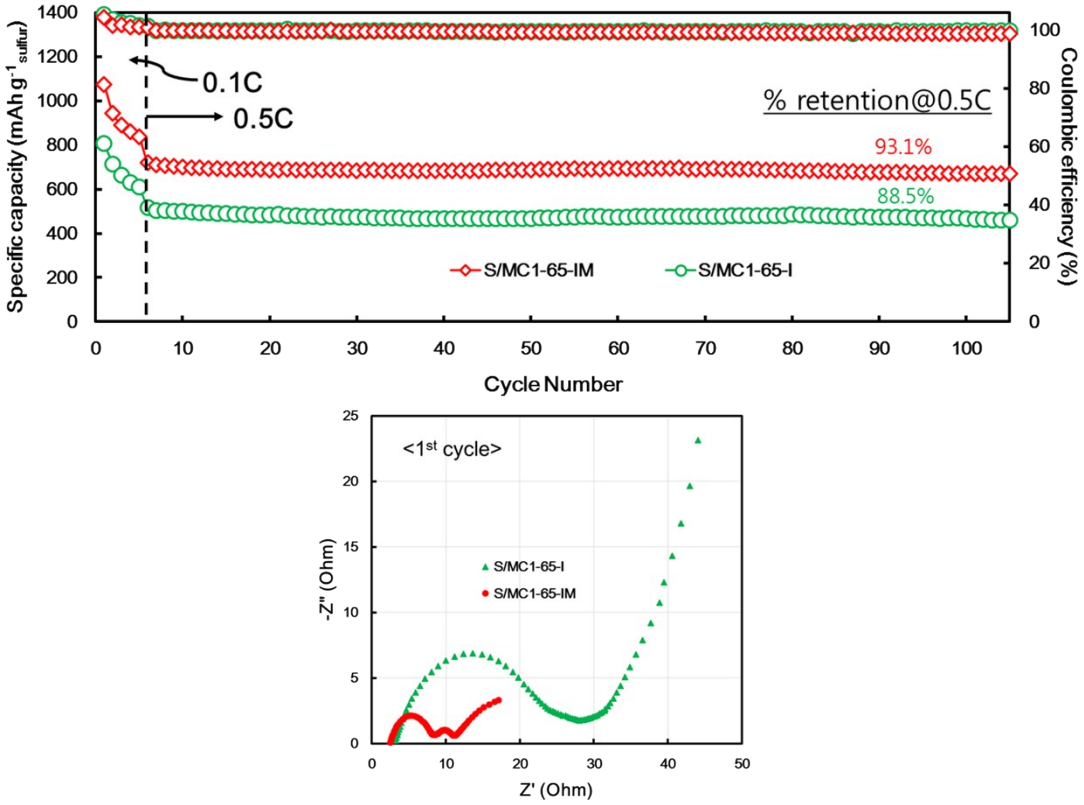

Figure S7. Cycling performances (top) and Nyquist plots (bottom, after 1st cycle) of S/MC1-65-I and S/MC1-65-IM cells.

Table S1. Comparison of electrochemical performances of various approaches for S/C cathode system.

Approach	First discharge capacity	Current density[a)]	Sulfur loading		Sulfur Utilization	Cycle number	Retention	Ref.
	mAh g^{-1}	mA g^{-1}	Wt. %	mg cm^{-2}	%		%	
S/MC1-60-IM	**970 (0.1 C)**	**0.5 C**	**59.2**	**1.3**	**57.9 (44.5)[b]**	**300**	**88.4**	**This study**
S/MC1-65-IM	**1075 (0.1 C)**	**0.5 C**	**65.3**	**1.3**	**64.2 (43.0)**	**300**	**81.5**	**This study**
S/MC1-65-IM (CCS)	**1280 (0.1 C)**	**0.5 C**	**65.3**	**1.3**	**76.4 (55.2)**	**300**	**81.0**	**This study**
S/MC1-65-IM (CCS)	**1172 (0.1 C)**	**0.5 C**	**65.3**	**2.9**	**70.0 (55.4)**	**100**	**91.1**	**This study**
Ordered mesoporous carbon	1070	1.0 C	70	n. a.	63.9	100	65.4	[1]
Ordered mesoporous carbon	1050	1.0 C	50	0.7~0.8	62.7	100	57.3	[2]
Meso-/micro-porous carbon	1037	0.5 C	60.6	1	61.9	200	80.7	[3]
Hollow carbon sphere	835	1.0 C	61	n. a.	49.9	500	75.4	[4]
Hollow carbon sphere	1040	0.5C	61	n. a.	62.1	100	89.8	[4]
Porous hollow carbon	1071	0.5 C	70	n. a.	63.9	100	90.9	[5]
Porous hollow carbon	920	0.5 C	70	2.0~2.5	54.9	100	89.4	[6]
Hierarchical Vine-Tree-Like Carbon Nanotube	844	1.0 C	60	1.0~1.5	50.4	450	62.8	[7]
Double-layer templated graphene	1084	1.0 C	64	0.8~1.1	64.7	200	73.8	[8]
Carbon coated separator	970	0.1 C	60	1.5~2.0	57.9	200	62.9	[9]
Carbon layer	1337	0.014 C	45	8.5	79.8	20	82.3	[10]
Carbon layer	1050	0.33 C	55	13.9	62.7	100	70.6	[11]

Note; 1.0 C = 1675 mA g^{-1}, [a)] Current density for the measurement of capacity retention, [b)] Sulfur utilization at 0.5 C.

References for Table S1.

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