

Electronic Supplementary Information

Orderly meso-perforated spherical and apple-shaped 3D carbon microstructures for high-energy supercapacitors and high-capacity Li-ion battery anodes

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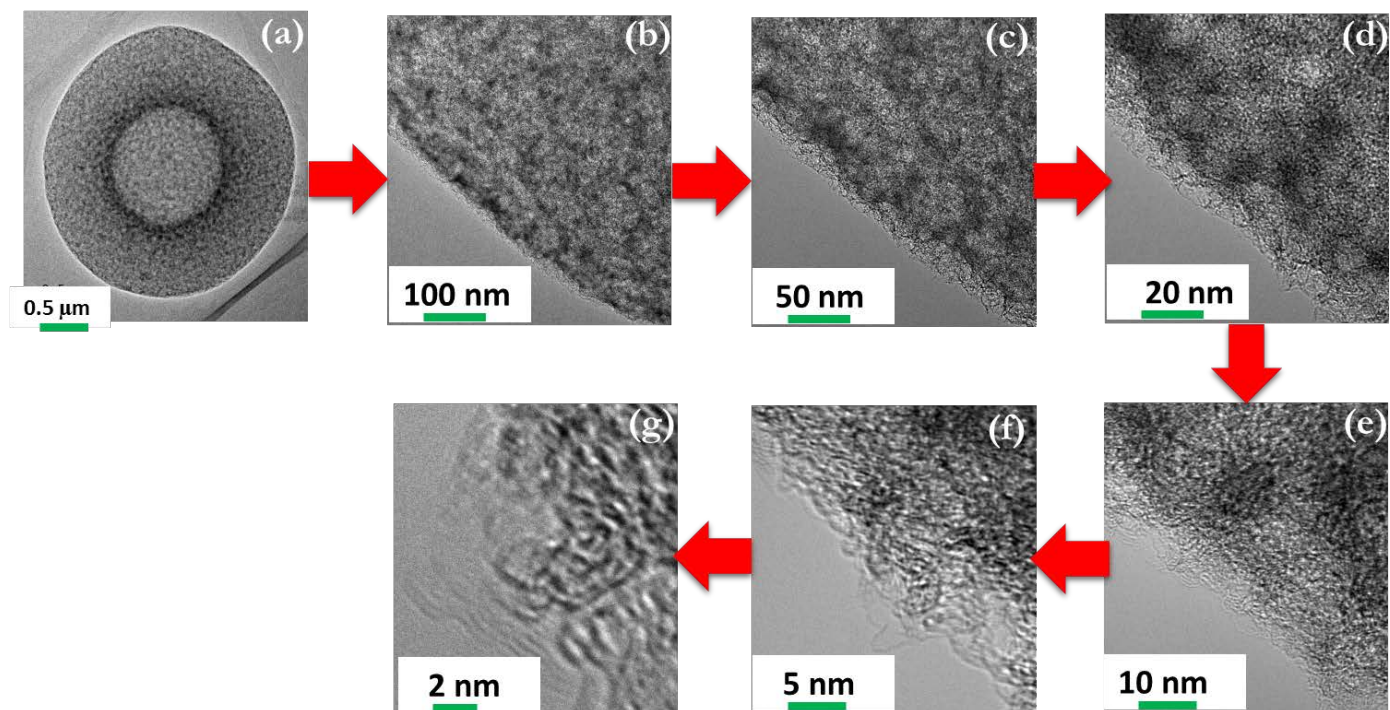


Figure S1 HRTEM image for ASMPC (magnification at edge from figure b to g)

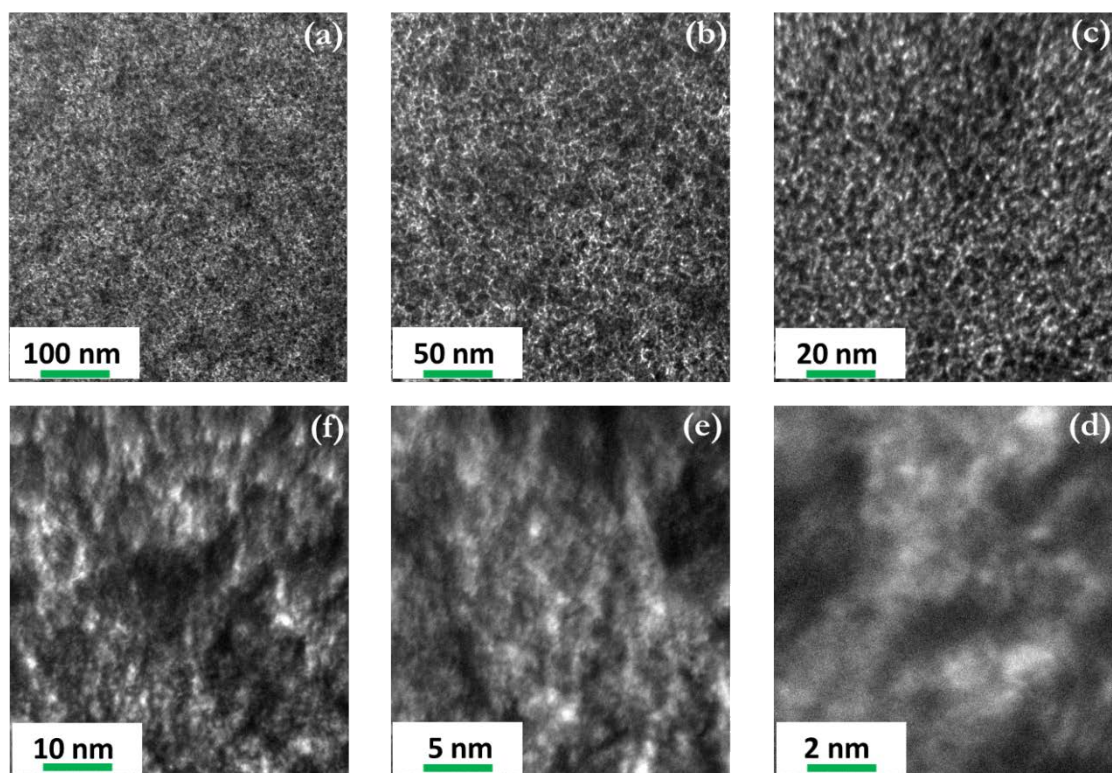


Figure S2 HRTEM image for ASMPC (magnification at the center of apple shape)

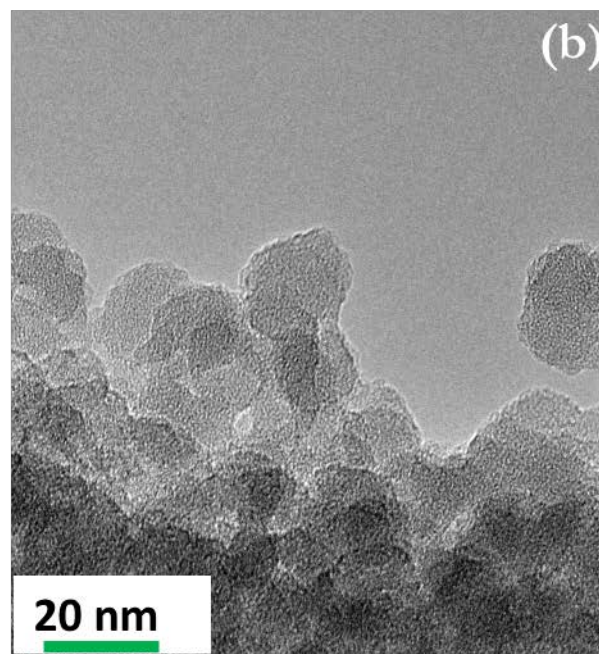
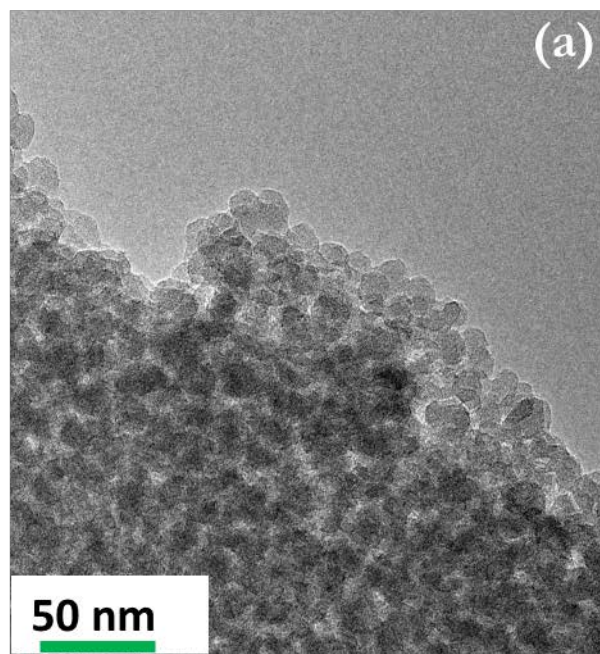


Figure S3 HRTEM image for SiO₂ NPs

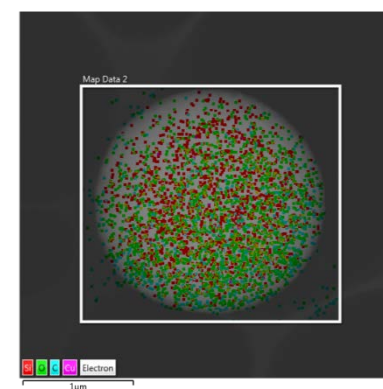


Figure S4 a) Peripheral elemental mapping analysis for SSC-SiO₂ sample

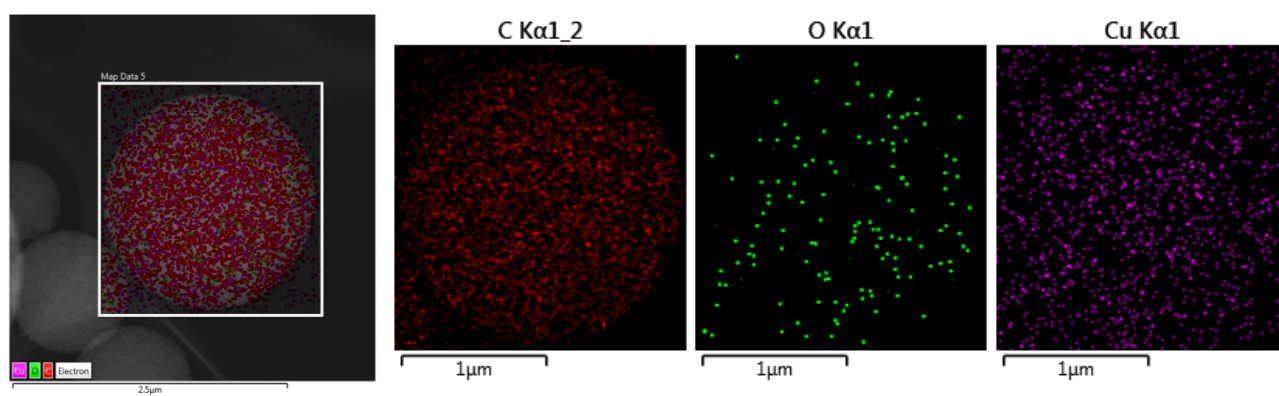
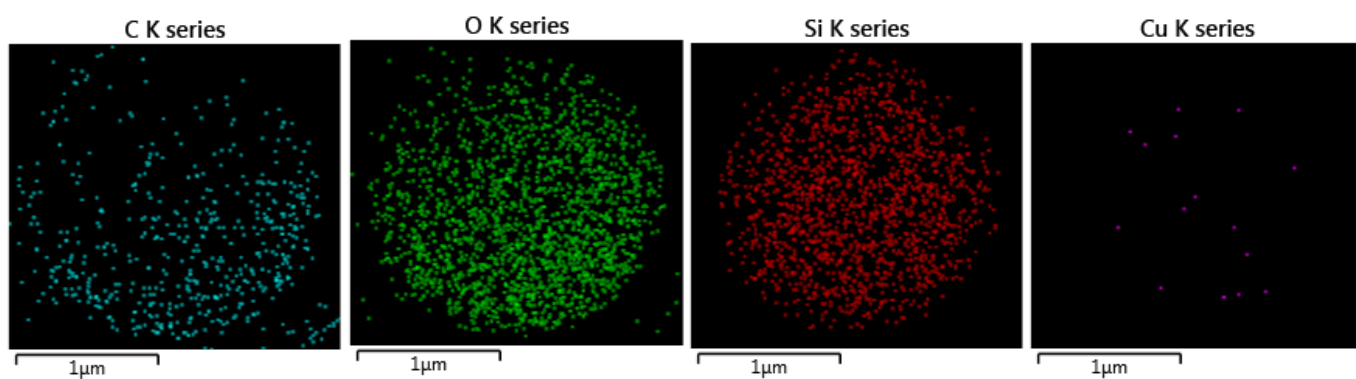


Figure S4 b) Peripheral elemental mapping analysis for SSMPC sample

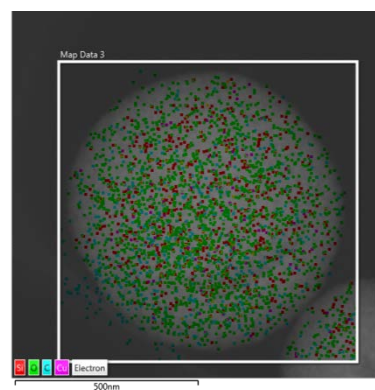


Figure S4 c Peripheral elemental mapping analysis for ASC-SiO₂ sample

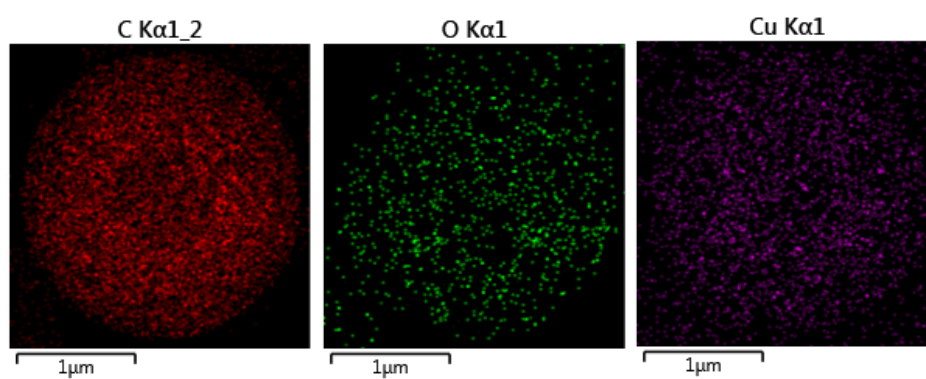
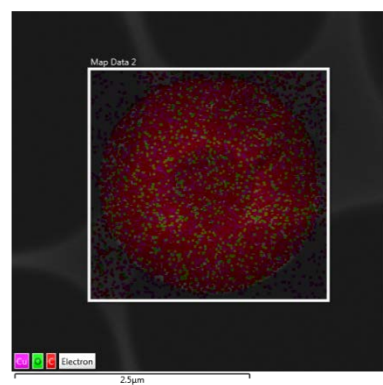
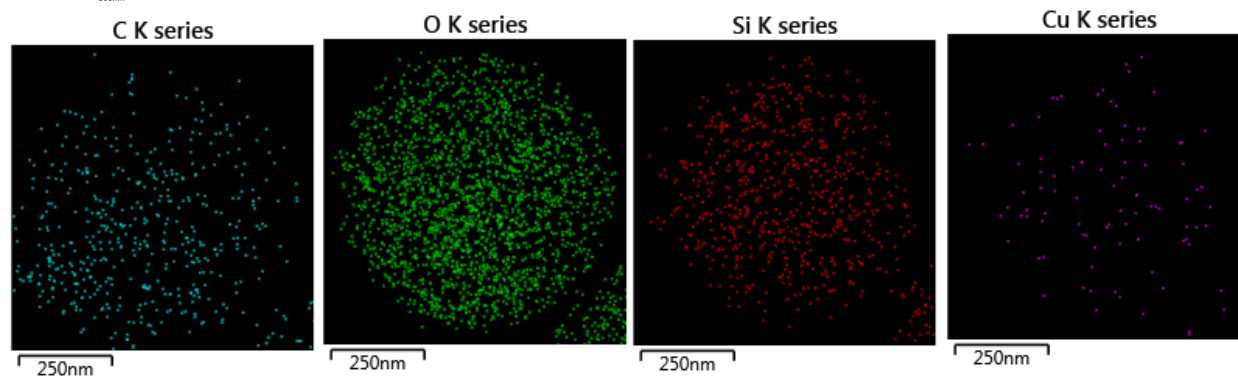


Figure S4 d Peripheral elemental mapping analysis for ASMPc sample

The XRD plots for SSMPC and ASMPc shown in figure S5. In addition to graphitic peak $\sim 23^\circ$ a small reflection is observed near 19° for SSMPC sample. It can be attributed to the presence of traces of SiO_2 NPs deep inside the spherical morphology. Similar observation has been made in one of the recent reports by Choi *et. al.*^[33]

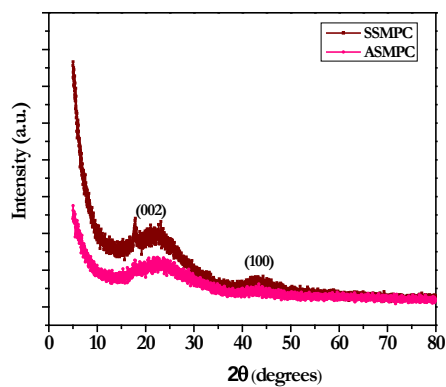


Figure S5 XRD plots for ASMPc and SSMPC

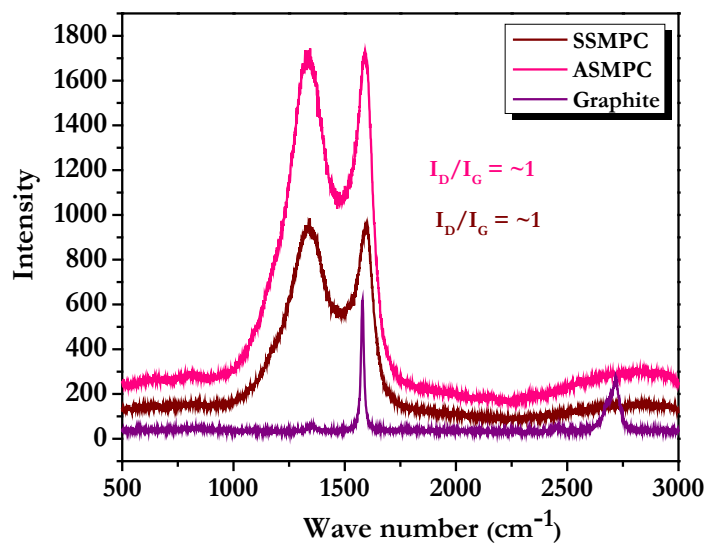


Figure S6 Raman plots for ASMPC and SSMPC and comparison with graphite powder.

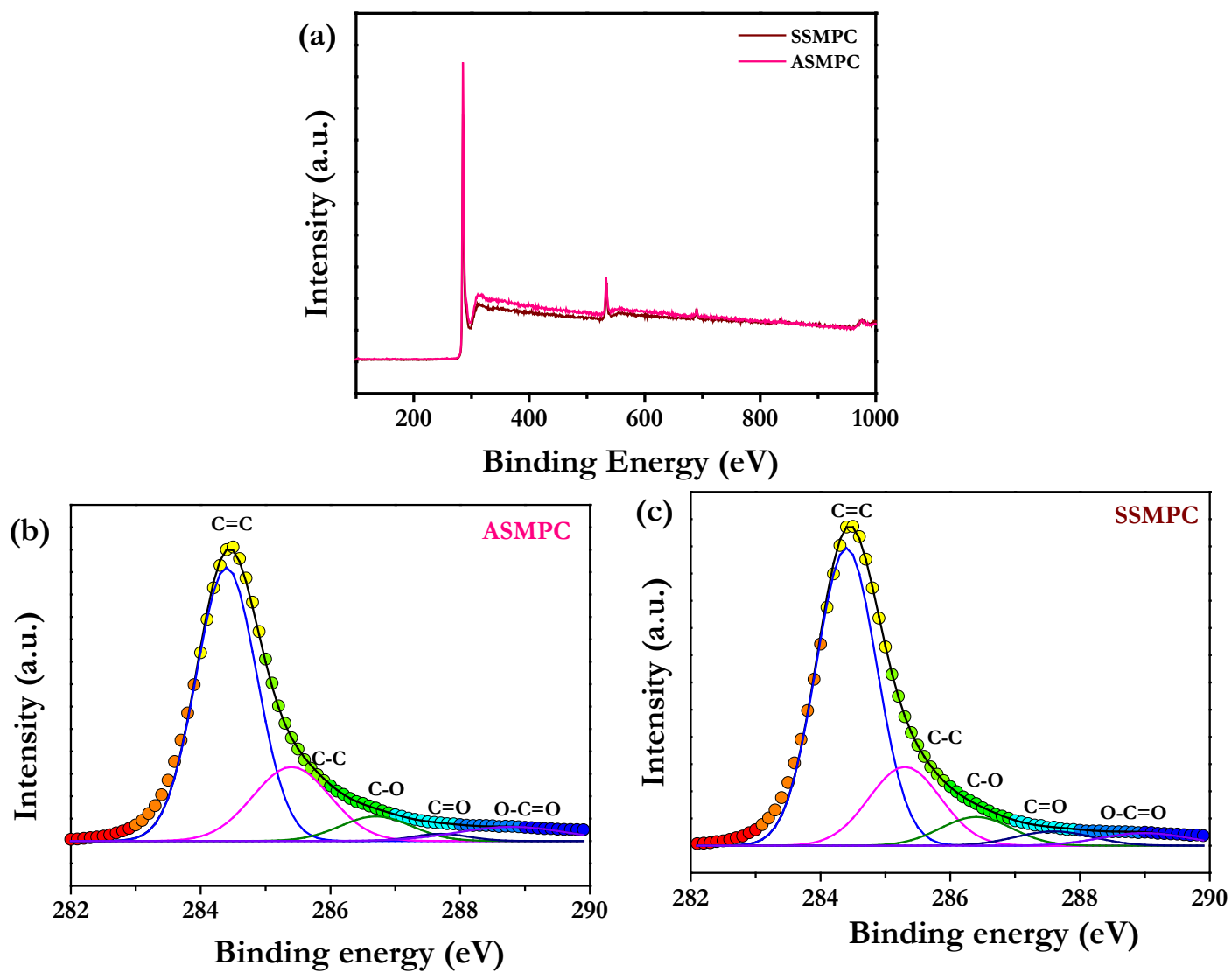


Figure S7 a) The general XPS plots for ASMPC and SSMPC, b) and c) C 1s XPS plots for ASMPC and SSMPC samples.

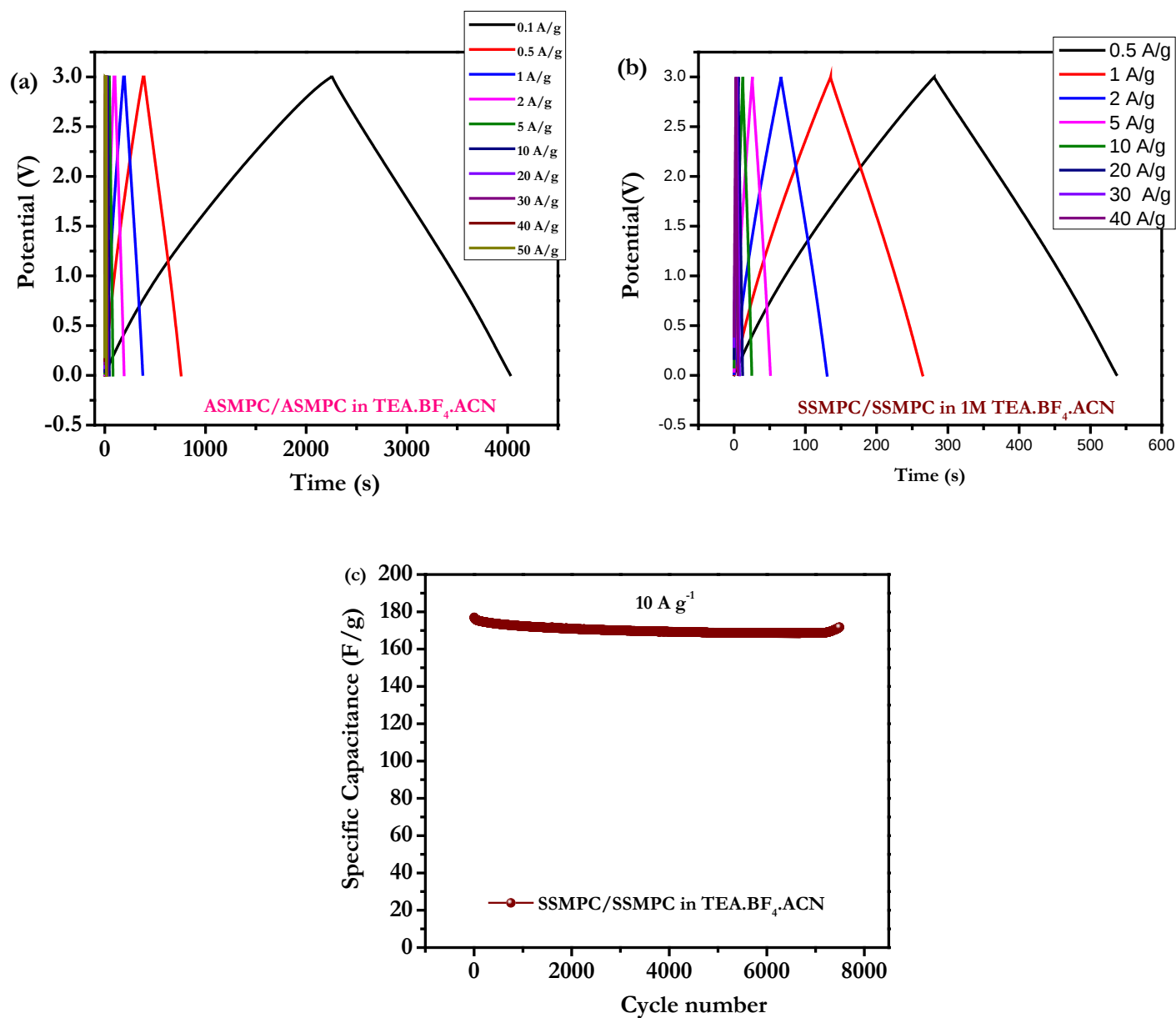


Figure S8 Typical galvanostatic charge-discharge curves of (a) SSMPC/SSMPC, (b) ASMPC/ASMPC based cells in 1M TEABF₄·ACN electrolyte at various current densities (from 0.5-50 A g⁻¹ and between 0 to 3 V). Here the current density is based on the total mass loading of the electrodes and (c) cycle stability plots (Csp vs. cycle number) for SSMPC/SSMPC cell at 10 A g⁻¹.

Table S1 C 1s plot results for SSMPC and ASMPc samples

Sample	C=C/C-C (284.5 eV/285.4eV)	C-O (286.6eV)	C=O (287.6 eV)	O-C=O (288.7 eV)
ASMPc	63.54(C=C) + 21.90 (C-C) = 85.44 %	6.75	1.52	5.40
SSMPc	64.78 (C=C)+20.26(C-C) = 85.04 %	7.38	3.96	3.62

Table S2 Organic electrolyte based comparison of supercapacitor properties of ASMPC and SSMPC electrodes in symmetric configuration with state-of-the-art.

Sr. No.	Material	[Csp F g ⁻¹] (Current Rate A g ⁻¹)	Electrolyte (Voltage window)	Ref
1	ASMPC	~240 (50)	1M TEA.BF ₄ .ACN (0–3V)	This Work
2	i) Reduced graphene oxide (RGO)	118 (50)	 1M TEA.BF ₄ .ACN (0–2.7V) (0–3V)	42
	ii) (N-RGO)	242 (50) 262 (50)		
3	Graphene nanomesh (GNMs)	232 (10)		41
4	Activated Microwave Expanded GO Sphers (asMEG-O)	174 (8.4)	1-ethyl-3-methylimidazolium bis(trifluorosulfonyl)imide, [EMIM][TFSI] (0–3.5V)	43
5	Activated Microwave Expanded GO (a-MEGO)	166 (5.7)	1-butyl-3-methyl-imidazolium tetrafluoroborate (BMIM BF ₄)/AN electrolyte (0–3.5V)	44
6	Activated Benzene Tetra carboxylic acid derived carbon (A-BTCADC)	213 (10)	1M TEA.BF ₄ .ACN (0–3V)	27
7	Interconnected microporous carbon (IMPC)	100 (10)	1M LiPF ₆ (in EC-DMC)	45
8	Holloe Mesoporous Carbon	148 (1)	1.0 M tetraethylammonium tetrafluoroborate (Et ₄ NBF ₄) in acetonitrile (AN) as electrolyte.	46
9	(3-D) ordered mesoporous carbon sphere array	84 (0.1)	1.0 M (C ₂ H ₅) ₄ NBF ₄ in propylene carbonate (PC)	47
10	Mesoporous carbon spheres with hierarchical foam-like pore structures	97 (0.5)	(C ₂ H ₅) ₄ NBF ₄ /propylene carbonate electrolyte	48
11	Mesoporous Carbon Capsules	97 (2)	1M TEA.BF ₄ .ACN (0–2.7V)	49

Table S3 Comparison of ASMPC and SSMPC electrodes half cells (vs. Li) with the state-of-the-art.

Sr. No	Material	Current Rate (A g ⁻¹)	Capacity in mA h g ⁻¹ (cycle)	Reference
1	ASMPc	0.2 1	~1690 (200) 500 (500)	This work
2	SSMPC	0.2 1	~1380 (200) 300 (500)	This work
4	Graphene	0.025	410 (40)	54
5	Carbon Nanospheres	.05	700 (50)	56
6	Mesoporous Carbon	.037	786 (20)	50
7	Mesoporous Carbon	0.1	800 (20)	57
8	Graphene nanosheets	0.1	697 (100)	58
9	Graphene nanosheets	.05	1150 (50)	59
10	Carbon nanosphers (CNSs)		423 (1)	60
11	Hydrogenated carbon nanospheres (HCNSs)	0.05	978 (50)	61
12	Graphene	0.5	480 (100)	62
13	BPPG-1100-A	0.1	717 (300)	53
14	N-doped mesoporous carbon	0.1	1350 (100)	36
15	N-doped graphene B-doped graphene	.05	872 (30) 1227 (30)	63