Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Multi-template synthesis of hierarchical porous carbon spheres with potential application in supercapacitors

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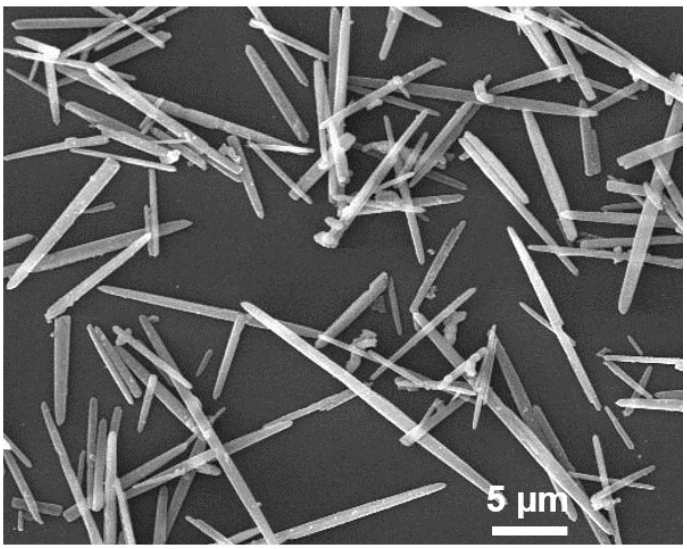

Fig. S1 SEM images of pristine $CaCO_3$ rods.

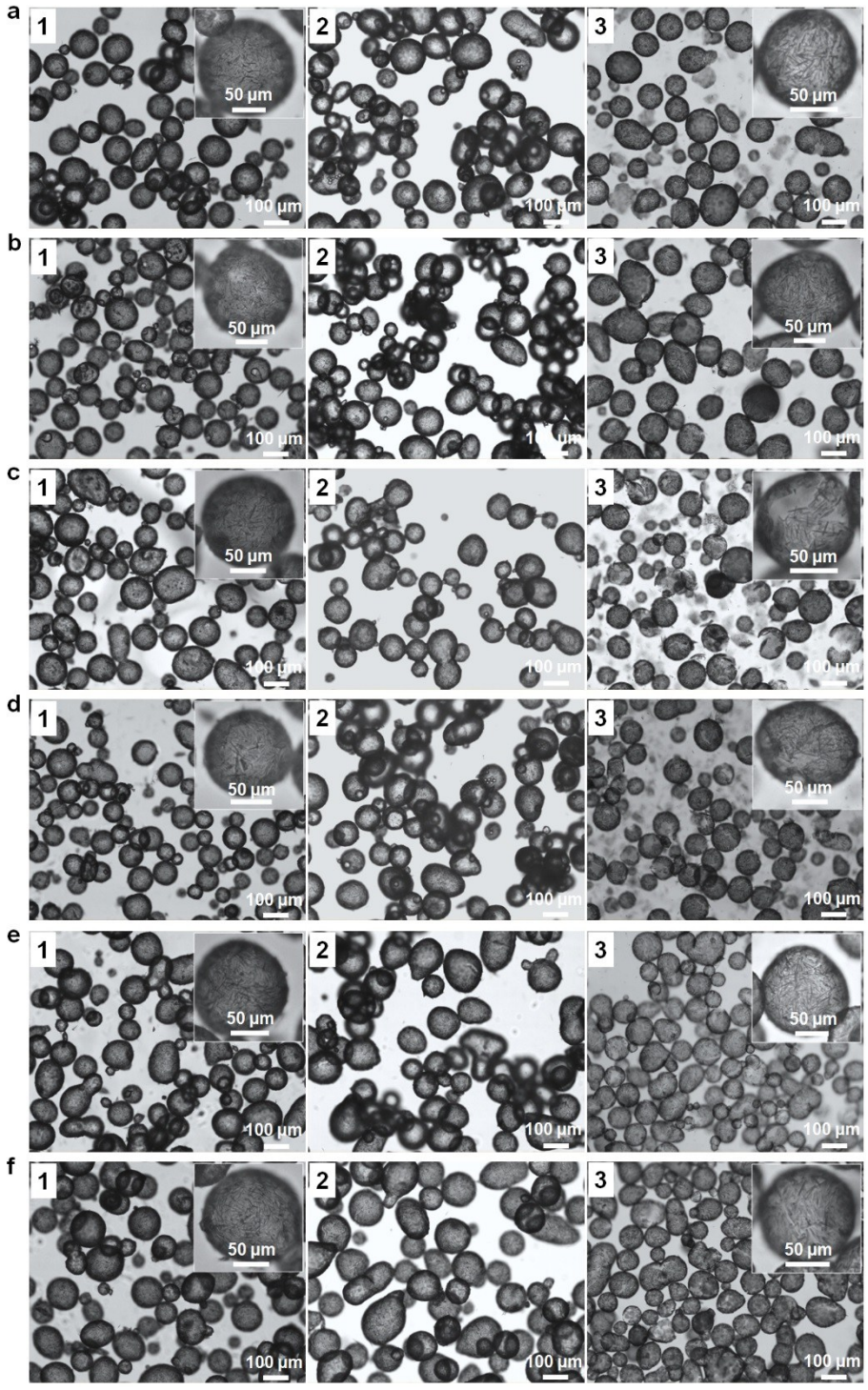

Fig. S2 Optical micrographs of $CaCO_3$-rod stabilised w/o emulsions and $CaCO_3$/silica composite capsules prepared with different APTES contents. a) 0.04 mL APTES, $CaCO_3$-rod stabilised emulsions (a1), the emulsion aged at 60 ºC for 20 h (a2), and $CaCO_3$/silica composite capsules (a3). b) 0.10 mL APTES. c) 0.20 mL APTES. d) 0.40 mL APTES. e) 0.80 mL APTES. f) 1.20 mL APTES. The inset graph of each shows a single emulsion droplet or capsule.

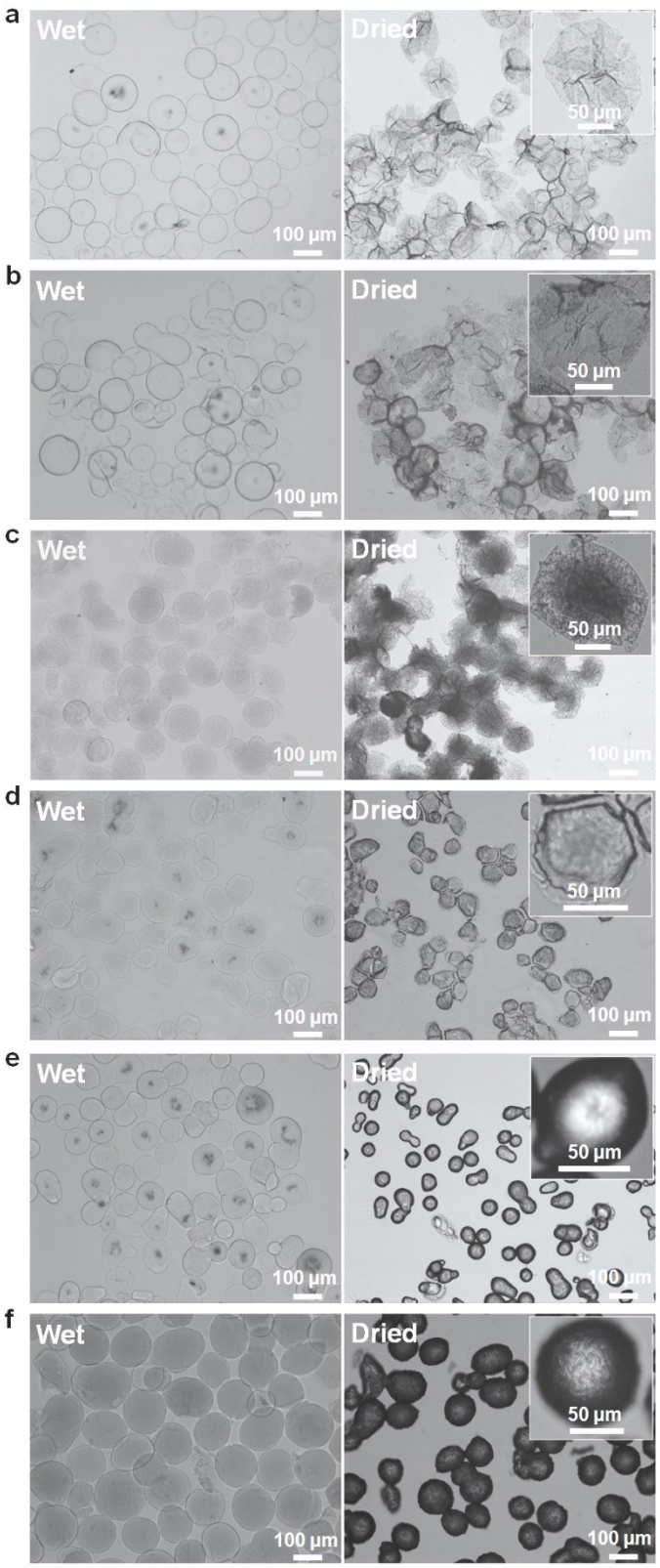

Fig. S3 Optical micrographs of silica capsules prepared with different APTES contents. a) 0.04 mL APTES, wet and dried silica capsules. b) 0.10 mL APTES. c) 0.20 mL APTES. d) 0.40 mL APTES. e) 0.80 mL APTES. f) 1.20 mL APTES. The inset graph of each shows a single silica capsule.

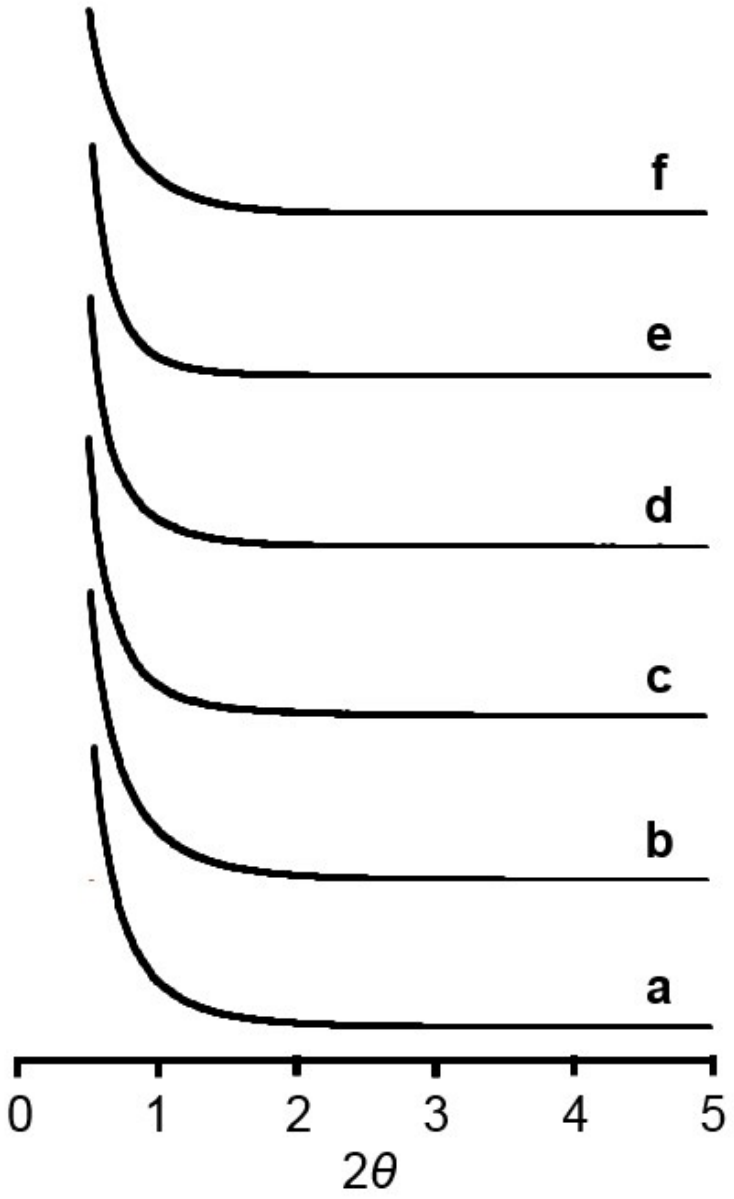

Fig. S4 Small angle X-ray diffraction (XRD) patterns of silica capsules prepared with different APTES contents. a) 0.04 mL APTES. b) 0.10 mL APTES. c) 0.20 mL APTES. d) 0.40 mL APTES. e) 0.80 mL APTES. f) 1.20 mL APTES.

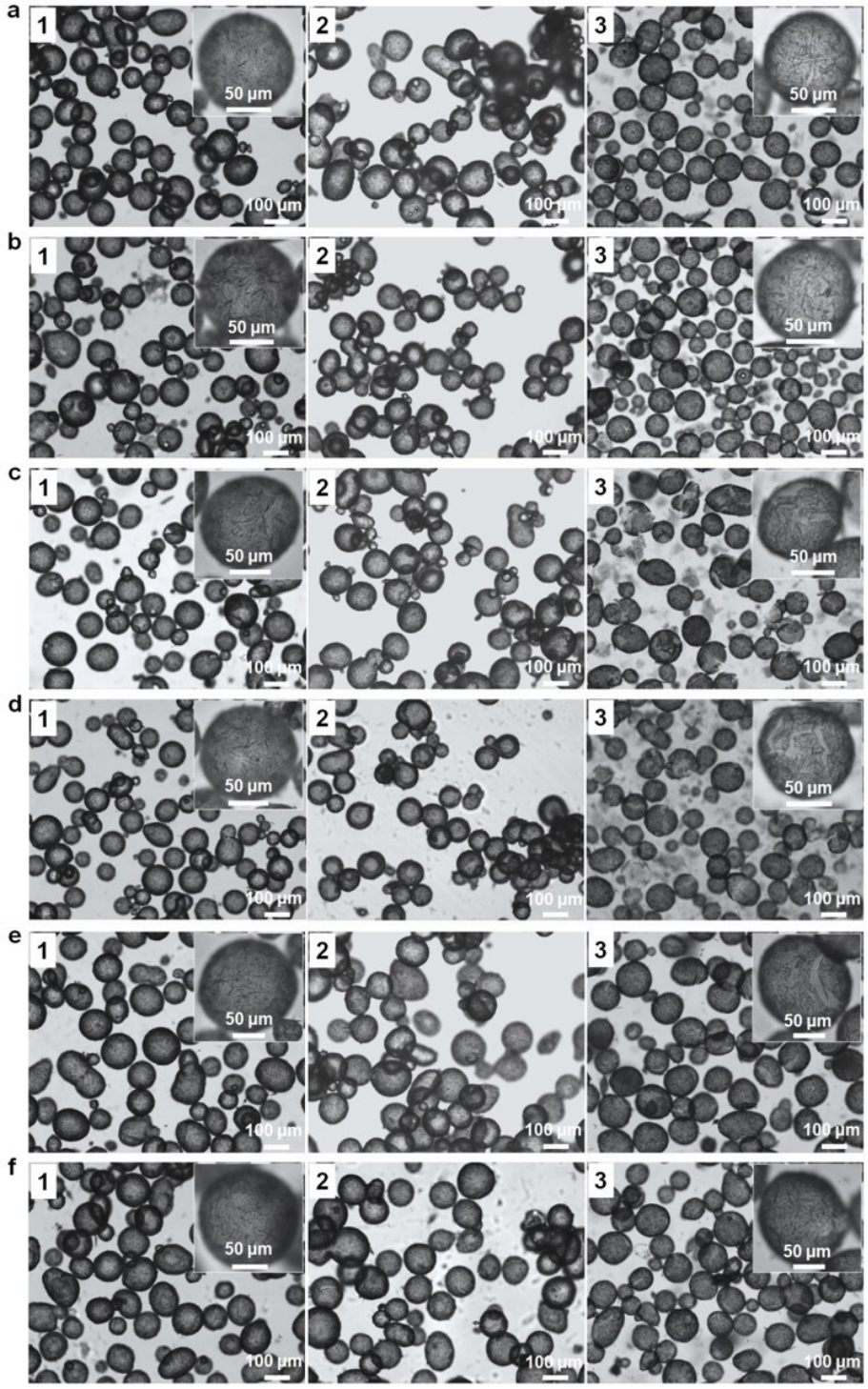

Fig. S5 Influence of no addition of polyvinyl pyrrolidone (PVP): Deionized water was used to replace 2.5 wt% PVP aqueous solution as the inner phase of $CaCO_3$-rod stabilised w/o emulsions. Optical micrographs of $CaCO_3$-rod stabilised w/o emulsions and $CaCO_3$/silica composite capsules prepared with different APTES contents. a) 0.04 mL APTES, $CaCO_3$-rod stabilised emulsions (a1), the emulsion aged at 60 ºC for 20 h (a2), and $CaCO_3$/silica composite capsules (a3). b) 0.10 mL APTES. c) 0.20 mL APTES. d) 0.40 mL APTES. e) 0.80 mL APTES. f) 1.20 mL APTES. The inset graph of each shows a single emulsion droplet or capsule.

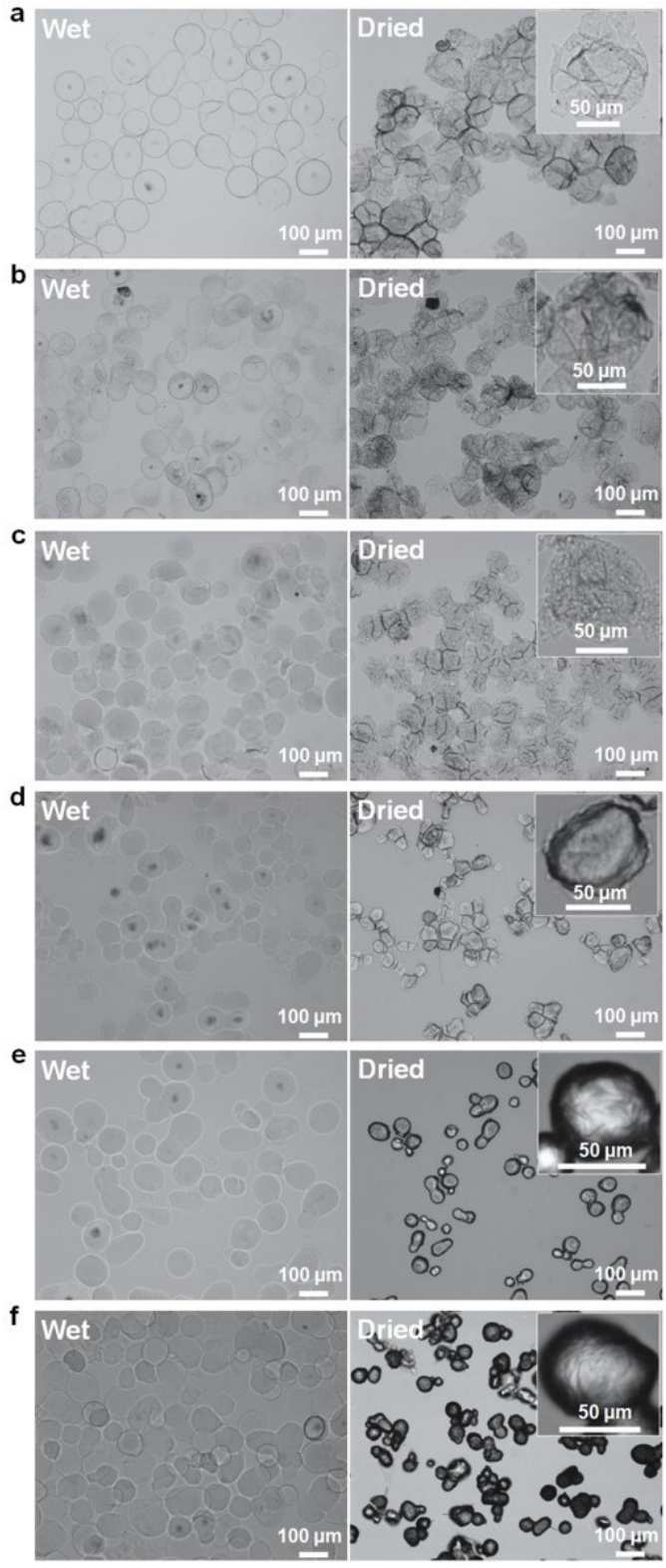

Fig. S6 Influence of no addition of polyvinyl pyrrolidone (PVP): Deionized water was used to replace 2.5 wt% PVP aqueous solution as the inner phase of $CaCO_3$-rod stabilised w/o emulsions. Optical micrographs of silica capsules prepared with different APTES contents. a) 0.04 mL APTES, wet and dried silica capsules. b) 0.10 mL APTES. c) 0.20 mL APTES. d) 0.40 mL APTES. e) 0.80 mL APTES. f) 1.20 mL APTES. The inset graph of each shows a single silica capsule.

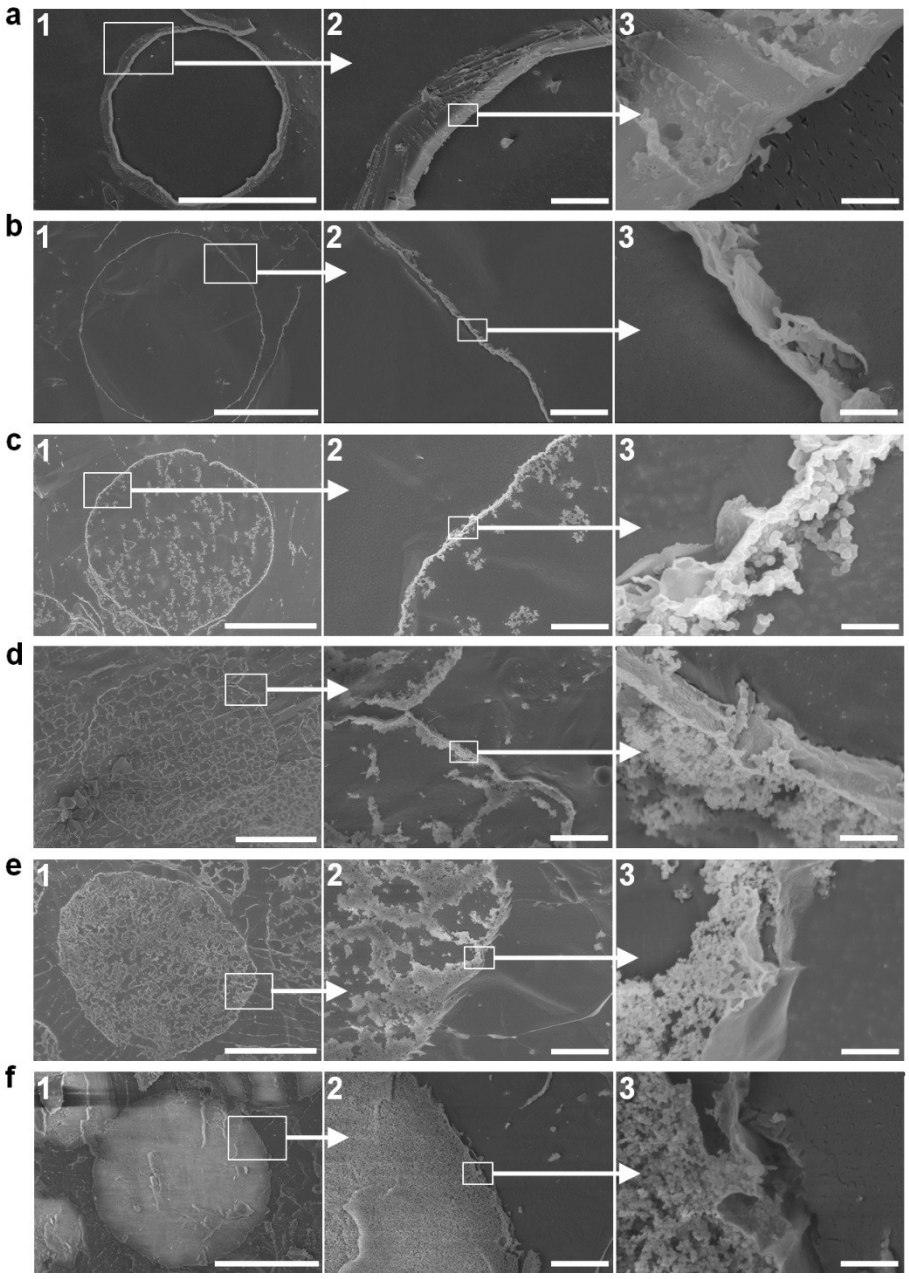

Fig. S7 Influence of no addition of polyvinyl pyrrolidone (PVP): Deionized water was used to replace 2.5 wt% PVP aqueous solution as the inner phase of $CaCO_3$-rod stabilised w/o emulsions. Microstructure evolution of hierarchical silica capsules with the increase of APTES content in the oil phase, observed by Cryo-SEM. a) 0.04 mL APTES. b) 0.10 mL APTES. c) 0.20 mL APTES. d) 0.40 mL APTES. e) 0.80 mL APTES. f) 1.20 mL APTES. Scale bars, 50 μm for a1, b1, c1, d1, e1 and f1; 5 μm for a2, b2, c2, d2, e2 and f2; 0.5 μm for a3, b3, c3, d3, e3 and f3.

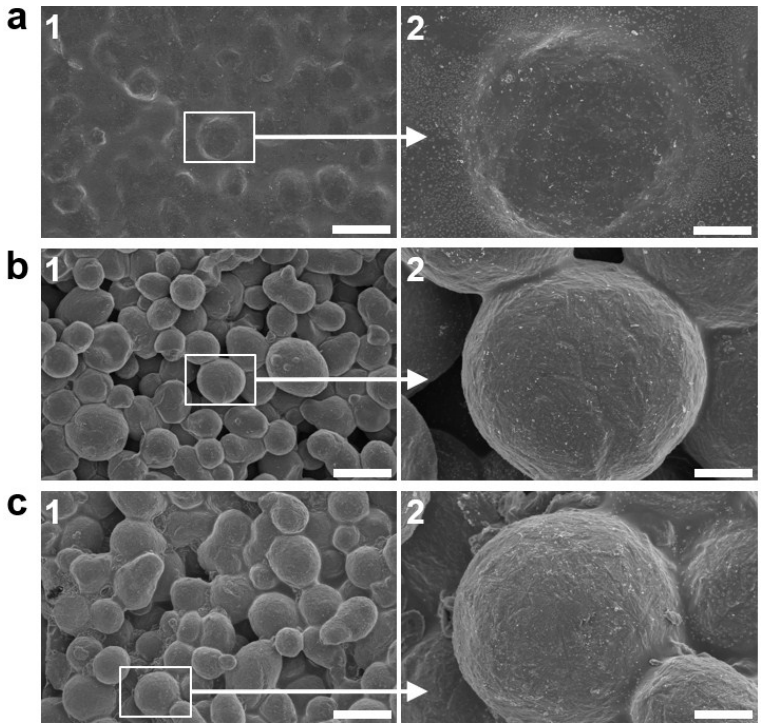

Fig. S8 SEM images of hierarchical porous carbon (HPC) spheres. a) HPC1 prepared from the hierarchical silica based on the system with 0.40 mL APTES. b) HPC2 prepared from the hierarchical silica based on the system with 0.80 mL APTES. c) HPC3 prepared from the hierarchical silica based on the system with 1.20 mL APTES. Scale bars, 100 μm for a1, b1 and c1; 20 μm for a2, b2 and c2.

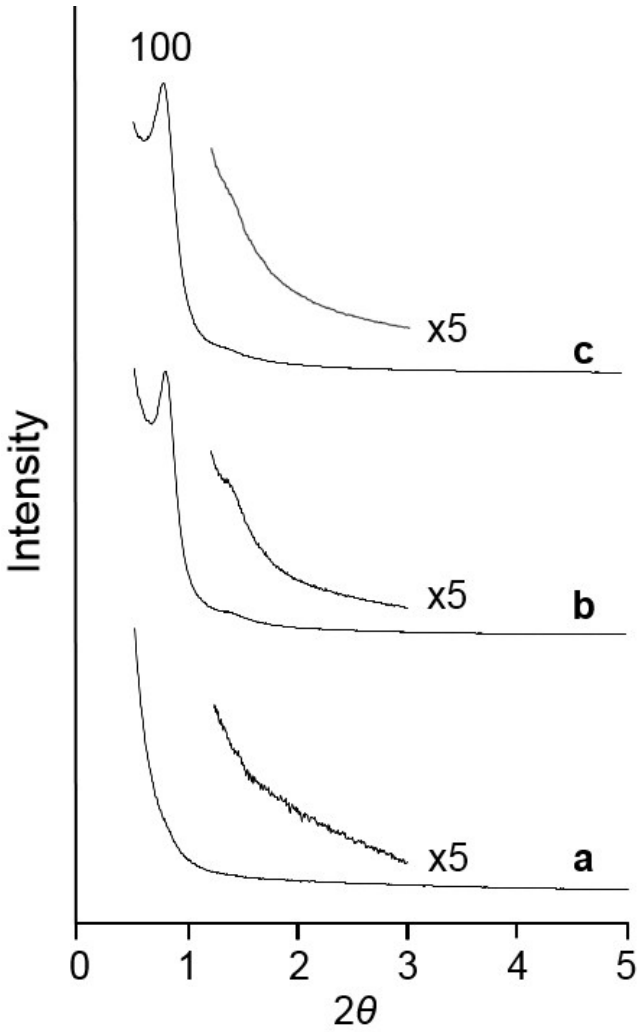

Fig. S9 Small angle XRD patterns of hierarchical porous carbon (HPC) spheres. a) HPC1 prepared from the hierarchical silica based on the system with 0.40 mL APTES. b) HPC2 prepared from the hierarchical silica based on the system with 0.80 mL APTES. c) HPC3 prepared from the hierarchical silica based on the system with 1.20 mL APTES.

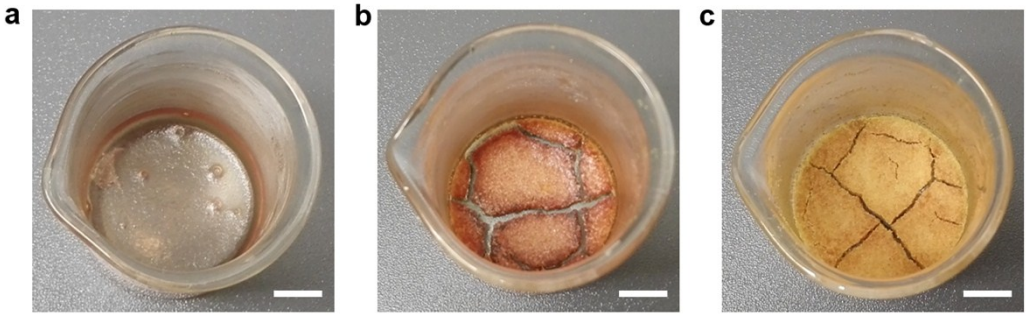

Fig. S10 Digital photos of ordered mesoporous polymer composites (OMPC). a) OMPC1 prepared from the original system with 0.40 mL APTES. b) OMPC2 prepared from the original system with 0.80 mL APTES. c) OMPC3 prepared from the original system with 1.20 mL APTES. Scale bars, 1.0 cm for a, b and c.

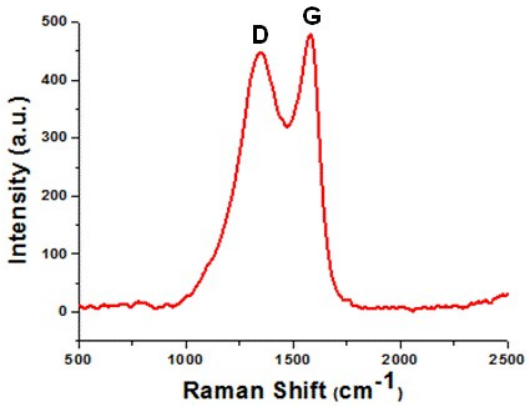

Fig. S11 A typical Raman spectrum of HPCs (using that of HPC2 as an example).

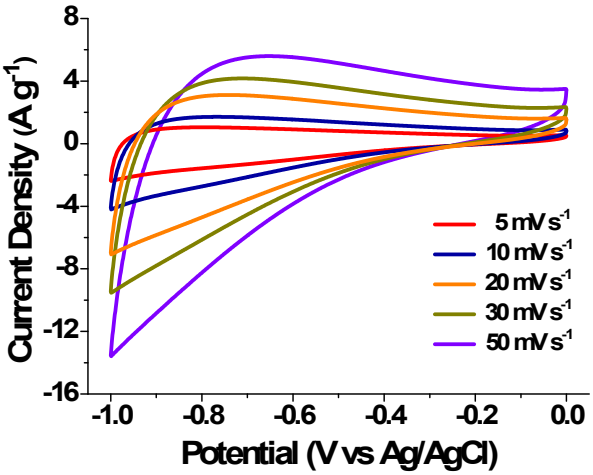

Fig. S12 CV curves of HPC2 at different scan rates.

Tables

Table S1 BET surface area (S_{bet}), Micropore area (S_m) and Eternal surface area (S_e) of Silica capsules prepared from the systems with different APTES contents

	S_{bet} [m^2g^{-1}]	S_m [m^2g^{-1}]	S_e [m^2g^{-1}]
Silica capsule 1, 0.04 mL APTES	**287**	**67**	**220**
Silica capsule 2, 0.10 mL APTES	**250**	**55**	**195**
Silica capsule 3,0.20 mL APTES	**129**	**61**	**68**
Silica capsule 4, 0.40 mL APTES	**162**	**42**	**120**
Silica capsule 5, 0.80 mL APTES	**206**	**0**	**206**
Silica capsule 6, 1.20 mL APTES	**422**	**0**	**422**

Table S2 BET surface area (S_{bet}) and Total pore volume (V_t) of hierarchical porous carbons (HPCs) prepared from hierarchical silica based on the systems with different APTES contents

	S_{bet} [m^2g^{-1}] [a]	V_t [m^3g^{-1}] [b]
HPC1, 0.40 mL APTES	408	0.28
HPC2, 0.80 mL APTES	628	0.46
HPC3, 1.20 mL APTES	759	0.56