

Supporting information

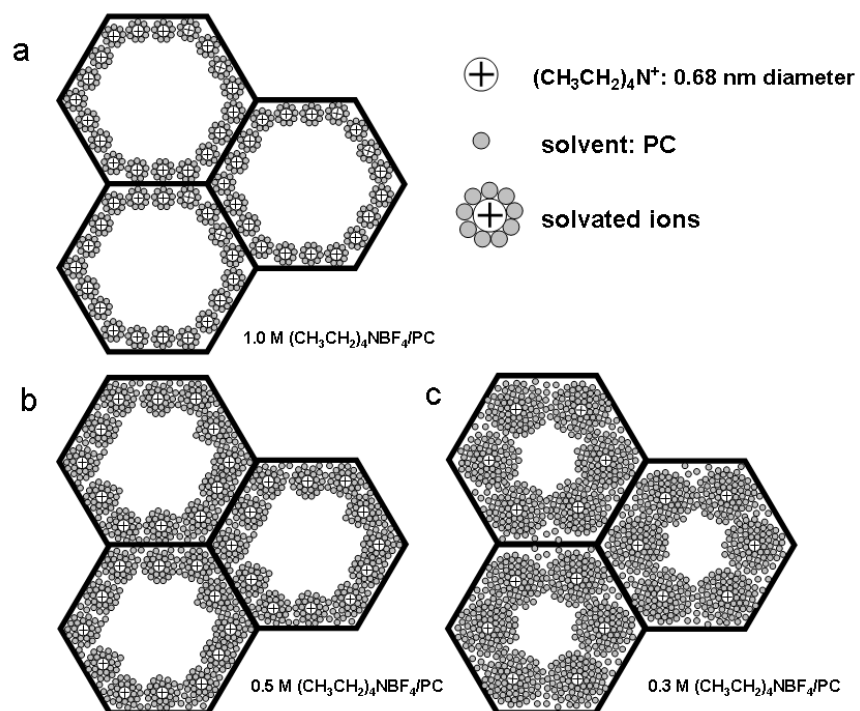


Fig. S1. Schematic presentation of electrochemical reaction path on the surface of the mesopore in MCSA by the influence of different concentration of $(\text{C}_2\text{H}_5)_4\text{NBF}_4$ in PC solvent. a) 1 M $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte; b) 0.5 M $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte; c) 0.3 M $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte.

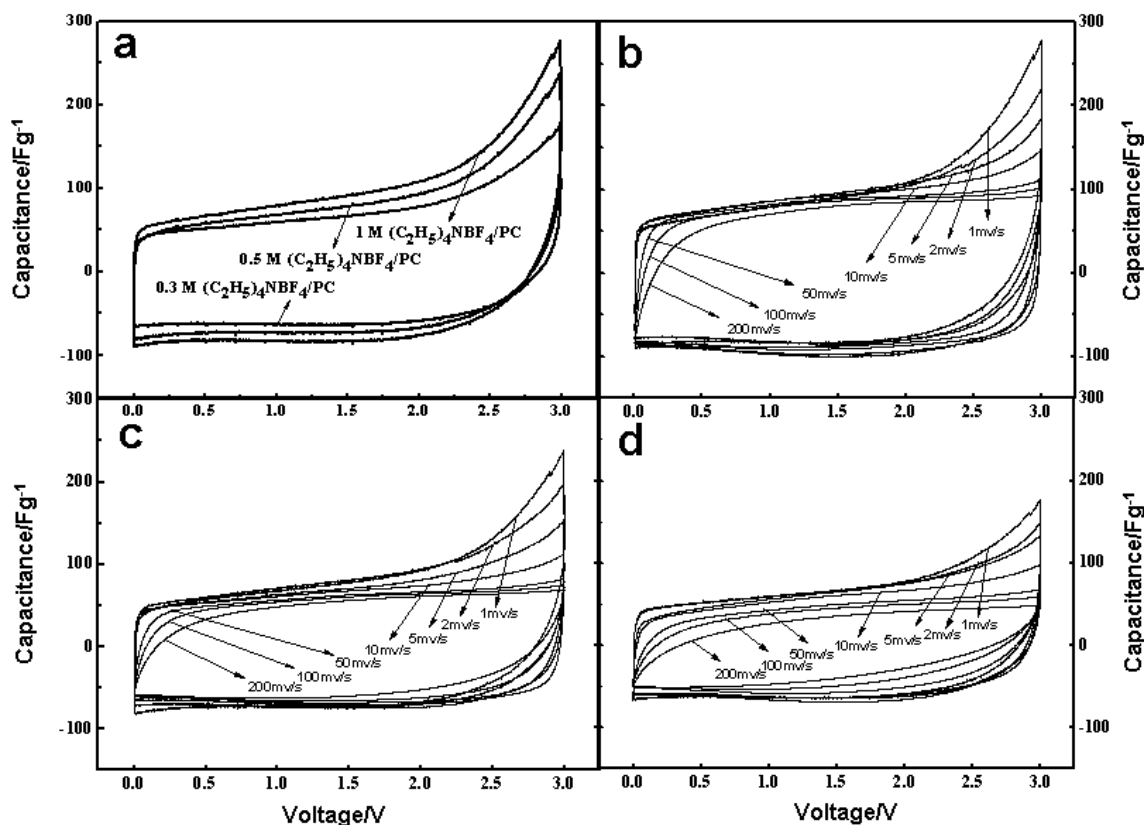


Fig. S2. CV curves of MCSA capacitor by using the two-electrode quasi-capacitor, the capacitance is based on the weight of active material in one electrode. a) at the scan rate of 1 mV/s in different concentration $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte; b) at different scan rates in 1 M $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte; c) at different scan rates in 0.5 M $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte; d) at different scan rates in 0.3 M $(\text{C}_2\text{H}_5)_4\text{NBF}_4/\text{PC}$ electrolyte.

The solvated ions may have a direct influence on the electrochemical performance of the MCSA/MCSA capacitor, with a contribution to capacitance from compact layers of ions residing on mesoporous walls. $(\text{C}_2\text{H}_5)_4\text{N}^+$ ion with the diameter of 0.68 nm,⁵ encompassed by the solvent molecule (PC) during the electrochemical reaction process on the surface of mesopores of MCSA. With the concentration of $(\text{C}_2\text{H}_5)_4\text{NBF}_4$ in PC decreasing, the solvating degree improved with the size of solvated ions enlarging, and the amount of $(\text{C}_2\text{H}_5)_4\text{N}^+$ ions adsorbed on the same surface area of the mesopores which are usable for double-layer formation may reduce (Fig. S1 a to c), as a result, the capacitance of

the capacitor may decrease. In Fig. S2 a, at the same scan rate of 1mv/s, the capacitance in 1 M $(C_2H_5)_4NBF_4/PC$ electrolyte is 87 F/g, 76 F/g in 0.5 M $(C_2H_5)_4NBF_4/PC$ electrolyte, and drops to 65 F/g in 0.3 M $(C_2H_5)_4NBF_4/PC$ electrolyte. So we can conclude that, with the concentration decreasing, larger solvated ions with more PC molecule have larger resistance during the ions transferring between the carbon surface and the electrolyte solution. And also, with the size of solvated ions enlarging, the distribution of ions should make farther approach of the ion center to the carbon electrode surface, which by Equation $C = \epsilon A/d$ (where A is the electrode surface area accessible to electrolyte ions, ϵ is the electrolyte dielectric constant, and d is the distance between electrolyte ions and carbon surface), so it leads to the capacitance decrease. Comparing the capacitances of different concentration electrolyte at increasing scan rates (Fig. S2 b, c, d), the faster of the scan rate, the more gravely capacitance decreases, and the more obviously the rectangular-shape of CV curves distort. The capacitance in 0.3 M $(C_2H_5)_4NBF_4/PC$ electrolyte decreases faster than the capacitance in 0.5 M $(C_2H_5)_4NBF_4/PC$ electrolyte and 1 M $(C_2H_5)_4NBF_4/PC$ electrolyte.