Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information's:

Germanosilicate zeolite ITQ-44 with extra-large 18-rings synthesized by using commercial quaternary ammonium as structure-directing agent

Kun Qian,*[ab] Yilin Wang,[b] Zhiqiang Liang,[b] Jiyang Li*[b]

[a] Liaoning Medical University, Jinzhou 121001, P. R. China.
[b] State Key Laboratory of Inorganic Synthesis and Preparative Chemistry, College of Chemistry, Jilin University, Changchun 130012, P. R. China.

Table S1 The products obtained in the reaction gel with molar composition of $mSiO_2$: $nGeO_2$: 0.25SDAOH: $y NH_4F$: (0.25-y) NH_4Cl: xH_2O (x =1-3; y=0-0.25; m+n=1 and n/m=0.5-1.0) at 170 °C for 1 day.

F^-/T	Ge/Si=0.5		Ge/Si=1.0	
	H_2O/T=1	H_2O/T=2	H_2O/T=1	H_2O/T=2
0.25	ITQ-44	ITQ-44	ITQ-44	ITQ-44
0.20	ITQ-44	ITQ-44	ITQ-44	ITQ-44
0.10	ITQ-44	ITQ-44	ITQ-44	ITQ-44
0.05	ITQ-44	ITQ-44	ITQ-44	ITQ-44
0	ITQ-44+GeO_2	ITQ-44+GeO_2	ITQ-44+GeO_2	ITQ-44+GeO_2

Table S2 Products obtained in the reaction gel with molar composition of $mSiO_2$: $nGeO_2$: 0.25SDAOH: 0.25NH_4F: xH_2O (x=1-2; m+n=1, n/m=0.1-1.0) at 170 °C for 1-10 day.

Ge/Si	Time (days)			
	1	5	7	10
0.1	Amorphous	Amorphous	Amorphous	Amorphous
0.5	ITQ-44	ITQ-44	ITQ-44	ITQ-44
1.0	ITQ-44	ITQ-44	ITQ-44+ITQ-17	ITQ-44+ITQ-17

Table S3 Products obtained in the reaction gel with molar composition of $mSiO_2$: $nGeO_2$: 0.25SDAOH: 0.25NH_4F: xH_2O (x=1-2; m+n=1, n/m=0.1-1.0) at 140-200 °C for 1 day.

Ge/Si	Temperature (°C)				
	140	150	160	170	200
0.1	Amorphous	Amorphous	Amorphous	Amorphous	Amorphous
0.5	Amorphous	ITQ-44	ITQ-44	ITQ-44	ITQ-44
1.0	Amorphous	ITQ-44	ITQ-44	ITQ-44	ITQ-44

Table S4 ICP analysis of the M-ITQ-37 obtained from the reaction system of $0.5SiO_2$: $0.5GeO_2$: zM_2O_3: 0.25OSDAOH: $0.20NH_4F$: $0.05NH_4Cl$: $5H_2O$ at 170 °C for 24 hours.

M source	M/（Si+Ge）		
	0.01	0.05	0.10
$Al(OH)_3$	0.01	0.04	0.07
Fresh $Al(OH)_3$	0.01	0.04	0.09
B_2O_3	0.01	—	—
Ga_2O_3	0.01	—	—

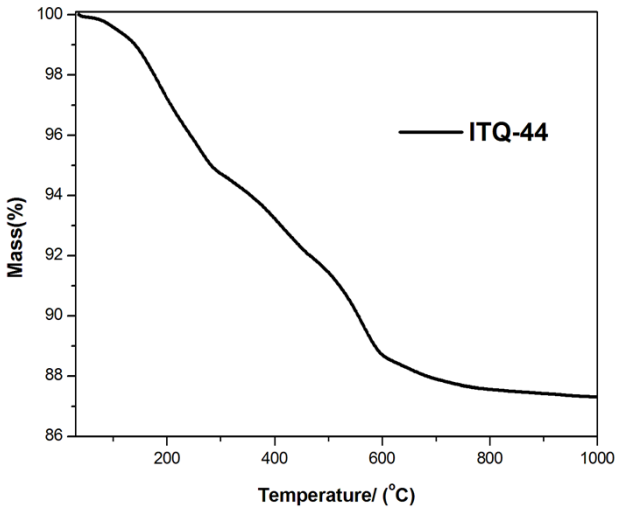

Fig. S1 The TG curve of as-synthesized ITQ-44.

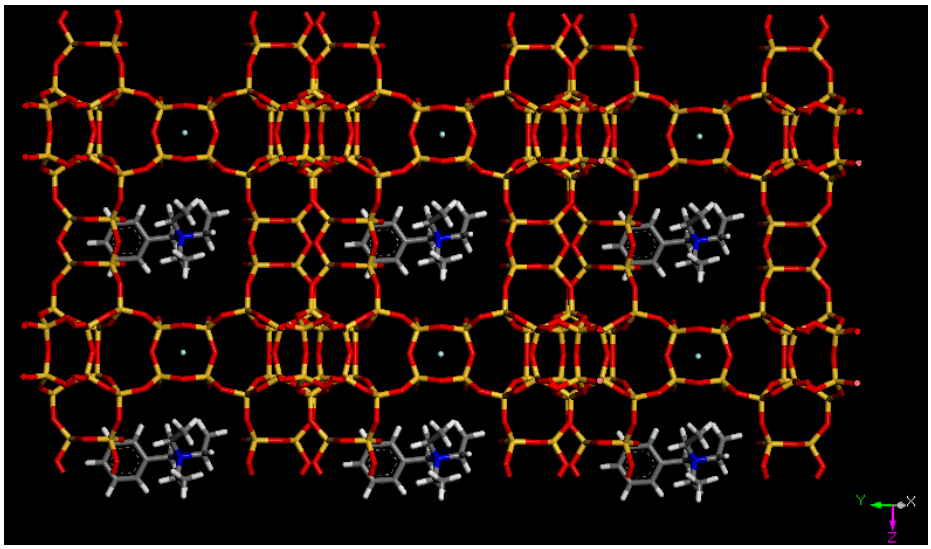

Fig. S2 The positions of SDA-1 cations in ITQ-44.

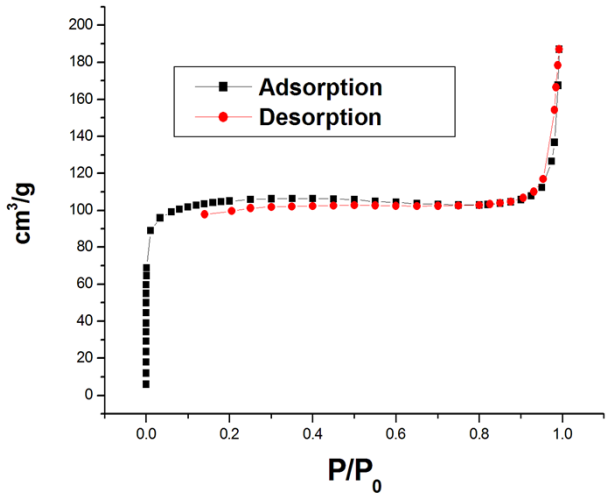

Fig. S3 The N_2 adsorption and desorption isotherms of calcined ITQ-44.

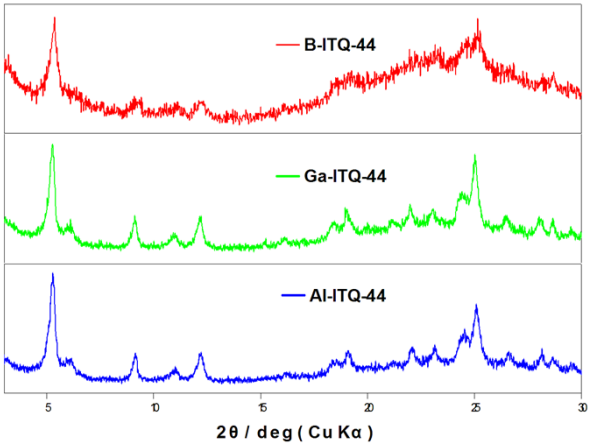

Fig. S4 The XRD patterns of as-synthesized M-ITQ-44.