Electronic Supplementary Material (ESI) for RSC Advances

The effects of surface acidity on CO_2 adsorption over amine functionalized protonated titanate nanotubes

Yue Liu,[a] Jie Liu,[a] Weiyuan Yao,[a] Wanglai Cen,[a] Haiqiang Wang,[a] Xiaole Weng[a] and Zhongbiao Wu*[a,b]

[a] *Department of Environmental Engineering, Zhejiang University, Yuhangtang Road 866, Hangzhou 310058, P.R. China. Fax: +86 0571 87953088; Tel: +86 571 88982863; E-mail: zbwu@zju.edu.cn*

[b] *Zhejiang Provincial Engineering Research Center of Industrial Boiler & Furnace Flue Gas Pollution Control, Hangzhou 310058, P.R. China. Fax:+86 571 87953088; Tel: +86 571 88982863; Emai: zbwu@zju.edu.cn*

*Corresponding auther: zbwu@zju.edu.cn

Table S1 Textural properties of as-synthesized PTNTs and MCM-41[a]

sample	S_{BET}[b] (m^2/g)	V_t[c] (cm^3/g)	Inner pore diameter[d] (nm)	Average pore width[e] (nm)
As-synthesized PTNTs	320.4	1.07	4~6	13.3
MCM-41	661.2	0.91		3.9

[a] The characterization of nitrogen adsorption-desorption isotherms was obtained at 77 K under relative pressures ranging from 0.005 to 0.99 using Tristar Ⅱ 3020 (V1.03) surface area and porosity measurement system (Micromeritics Inc. USA).

[b] Specific surface area were calculated using the Brunauer-Emmett-Teller (BET) method based on the linear part of the BET surface area plot (P/P_0-0.06-0.20);

[c] V_t was determined by the single point liquid nitrogen adsorption capacity at a relative pressure of P/P_0=0.974;

[d] Inner pore diameter was determined by TEM images;

[e] Adsorption average pore width (4V/A by BET).

Table S2 The adsorption characteristics of PEI functionalized PTNTs with different loading

Samples	amine capacity (wt%)	CO_2 adsorption amount (mmol/g)	Adsorption heat (KJ/mol)
PEI-PTNTs	5	0.15	38.45
	10	0.34	40.35
	20	0.96	48.54
	30	1.69	61.50
	50	2.97	66.99

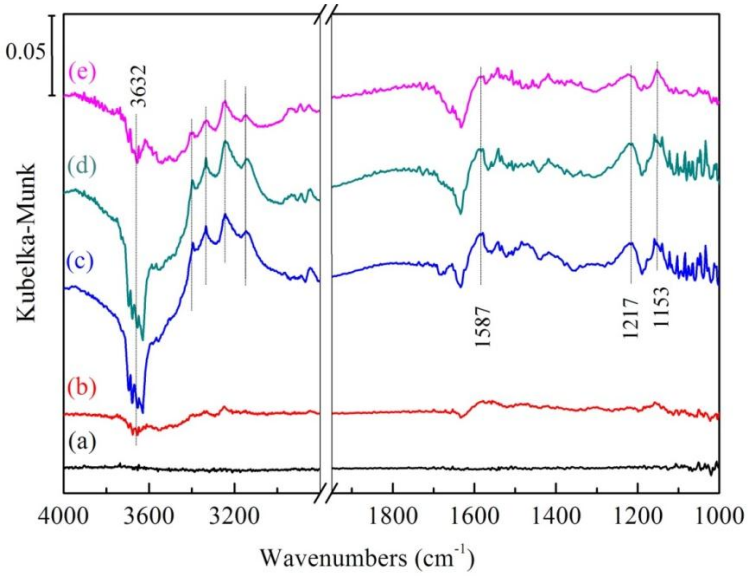

Figure S1. DRIFT spectra of NH_3 adsorption P25: (a): 0 min, (b) 1 min, (c) 5 min, (d) 30 min, (e) after purge for 60 min at 100 ºC.

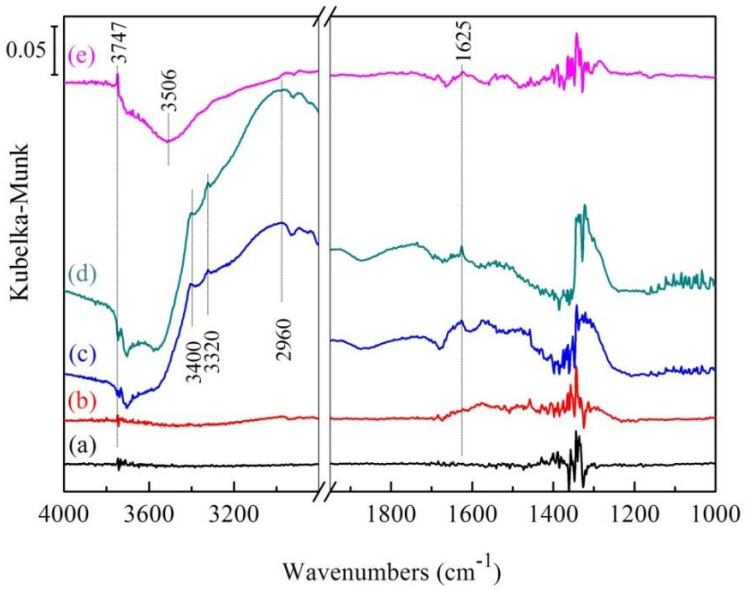

Figure S2. DRIFT spectra of NH_3 adsorption on MCM-41: (a): 0 min, (b) 1 min, (c) 5 min, (d) 30 min, (e) after purge for 60 min at 100 ºC.

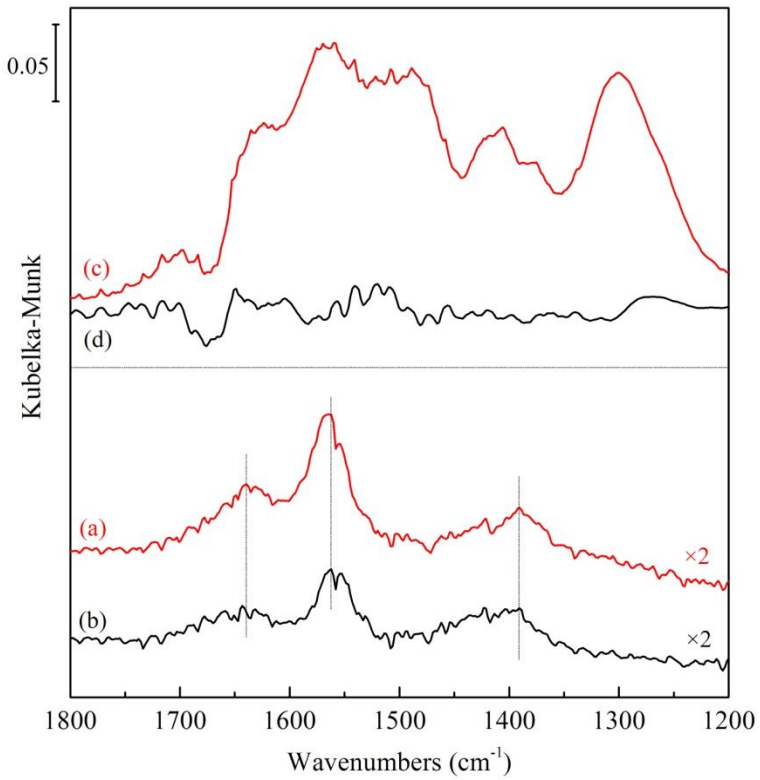

Figure S3. DRIFT spectra of the as-synthesized PTNTs (bottom) and PEI-PTNTs-30 (upper) when they exposed to CO_2 until adsorption equilibrium at 100 ºC (red) and after purge in helium for 60 min (black): (a, b) PTNTs; (c, d) PEI-PTNTs-30.

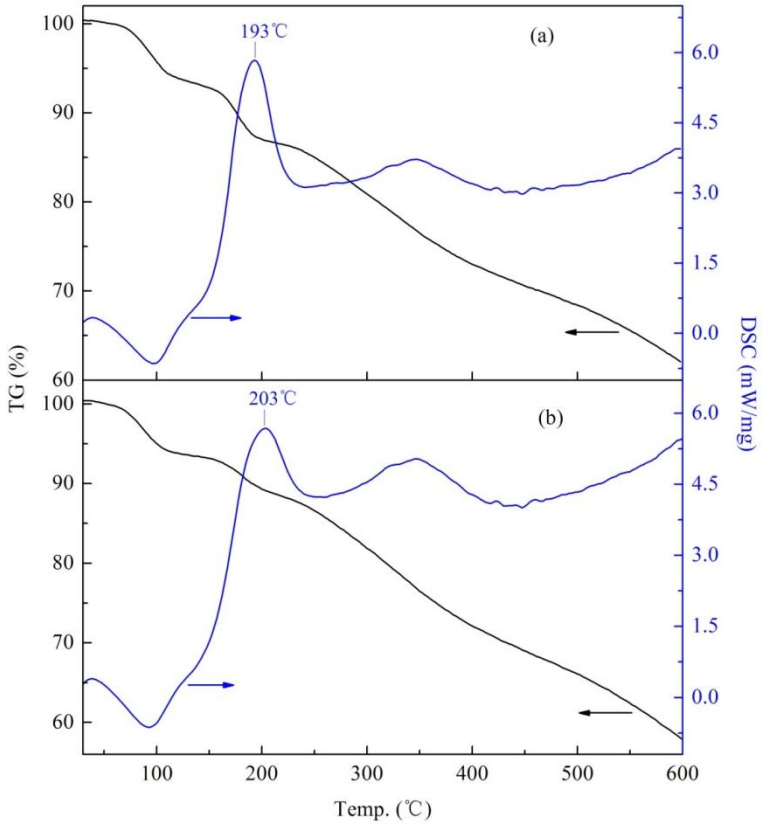

Figure S4. TG-DSC plots of (a) TEPA-MCM-41-43 and (b) PEI (1800)-MCM-41-43.