Supporting Information

for

Impregnation of Polyethylenimine in Mesoporous Multilamellar Silica Vesicles for CO_2 Capture: A Kinetic Study

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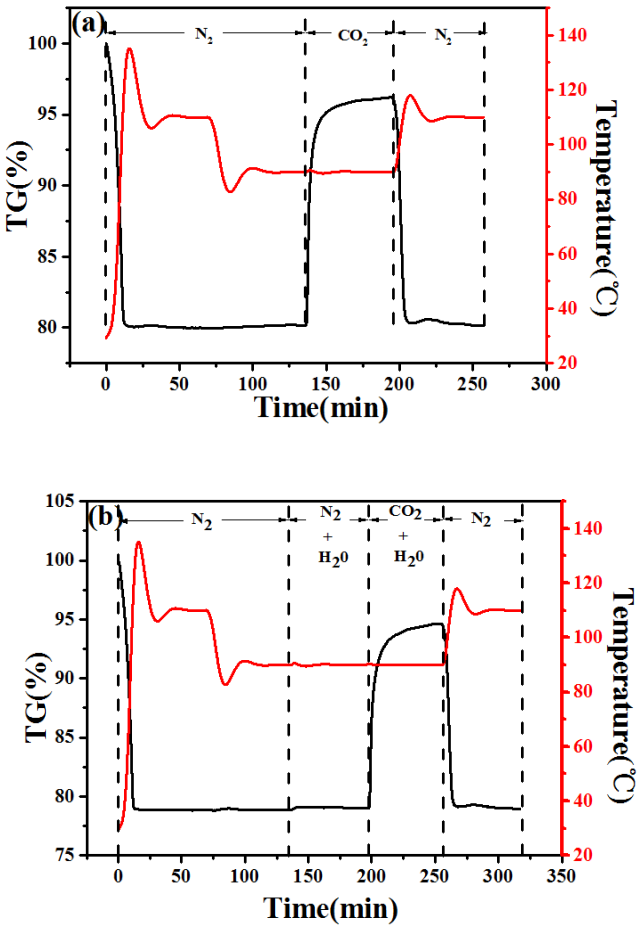

Figure S1 (a) TG profile (MMSV(a)-PEI-60%) for dry CO_2 adsorption and desorption at 90 °C and (b) TG profile (MMSV(a)-PEI-60%) for humid CO_2 (30%RH) adsorption and desorption at 90 °C

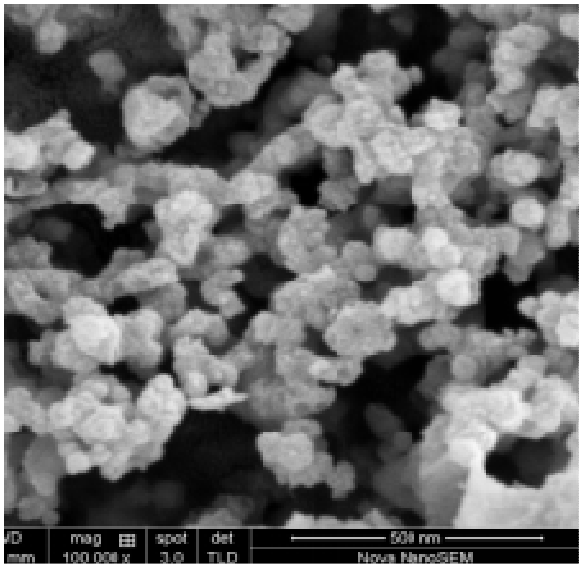

Figure S2 SEM image of MMSV(c)

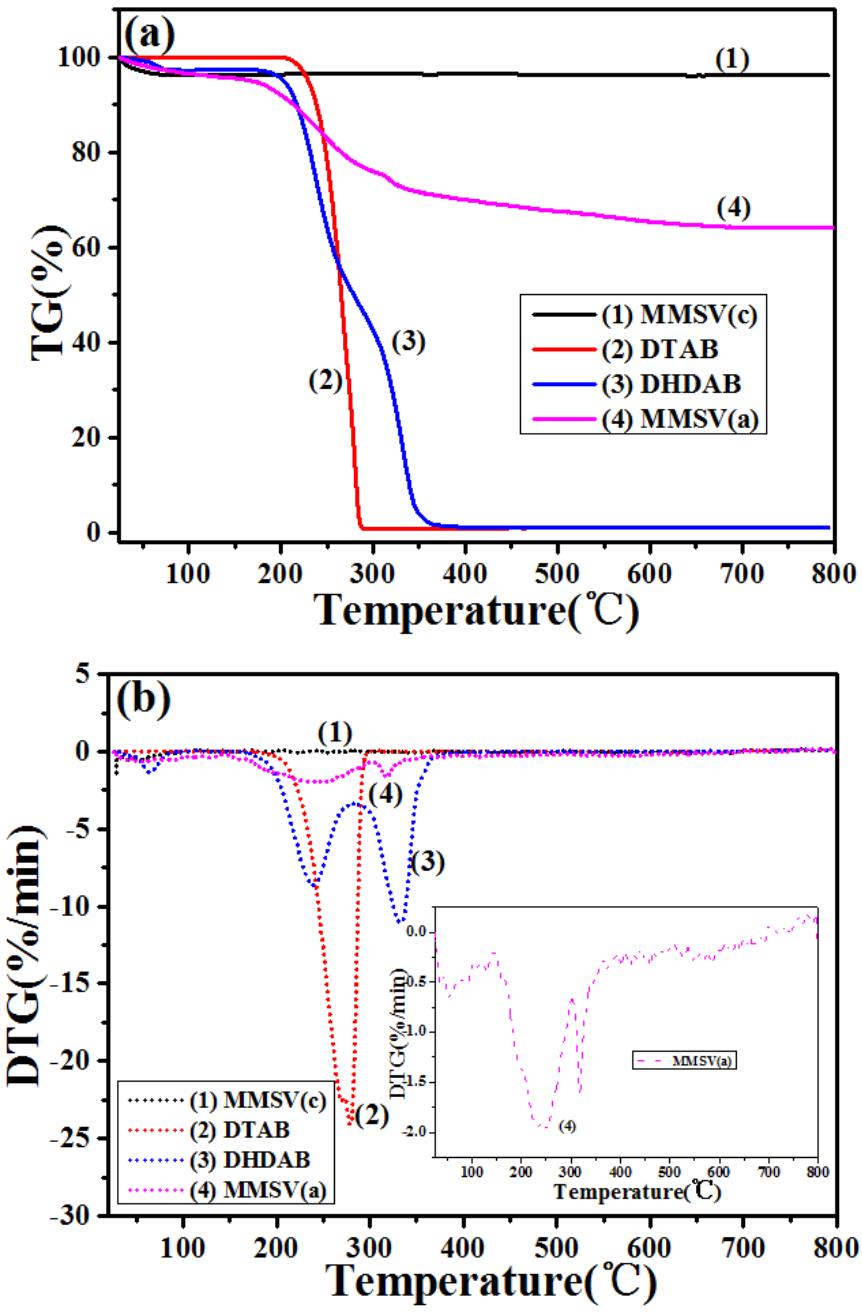

Figure S3 (a) TG and (b) DTG curves for MMSV(a), DTAB, DHDAB and MMSV(c) with a temperature ramp of 10 °C/min in pure N_2

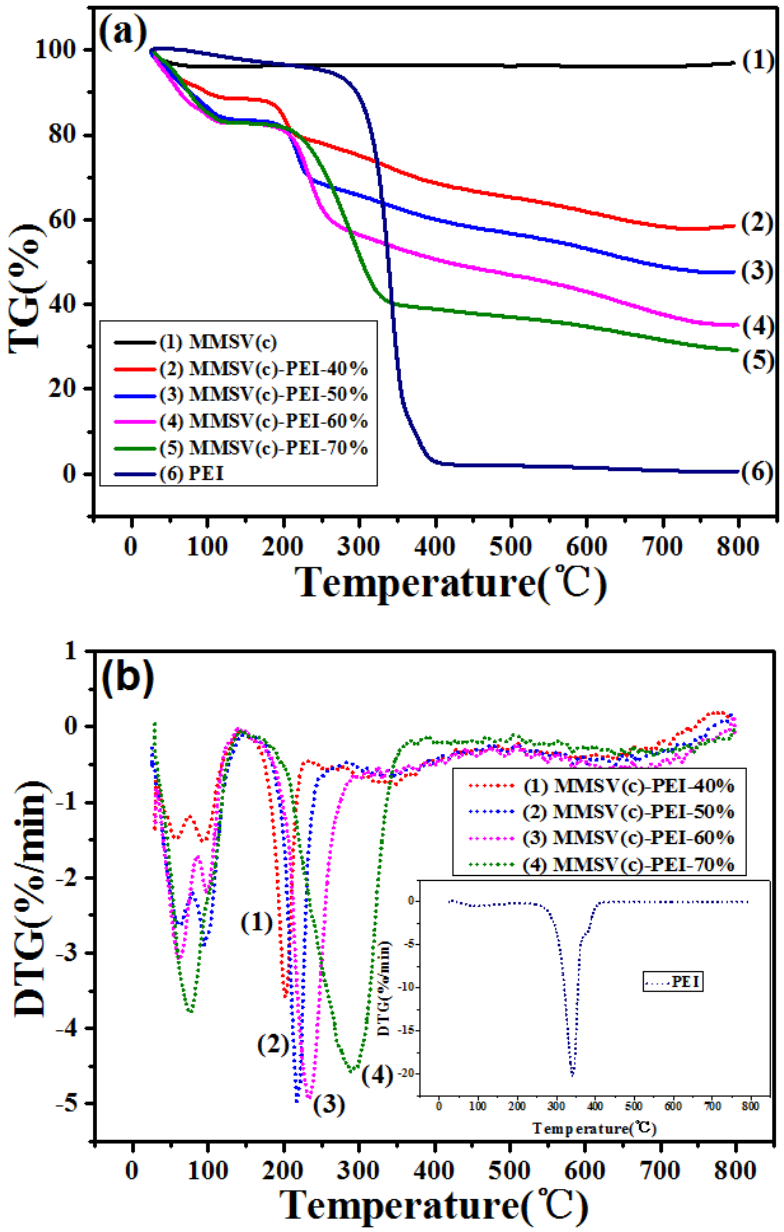

Figure S4 TG (a) and DTG (b) curves for MMSV(c)/PEIs with a temperature ramp of 10 °C/min in pure N_2

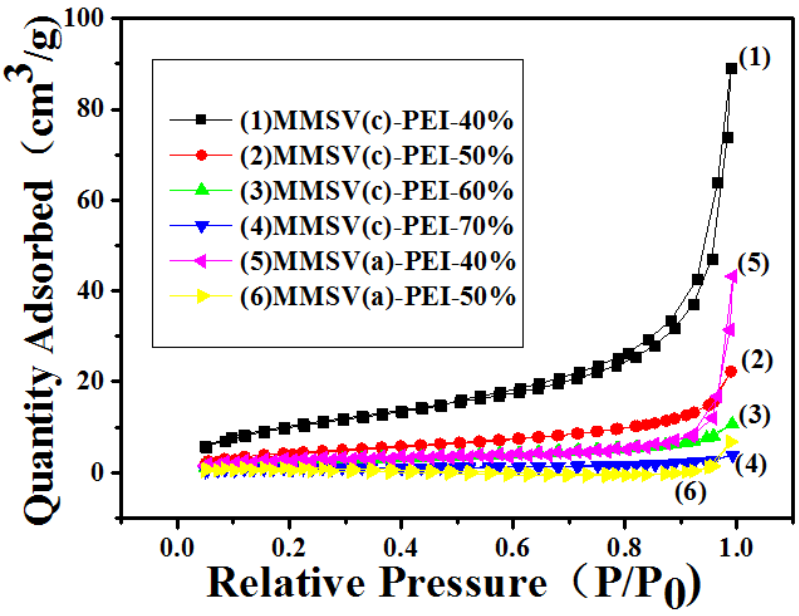

Figure S5 Nitrogen adsorption/desorption isotherms of MMSV-PEIs

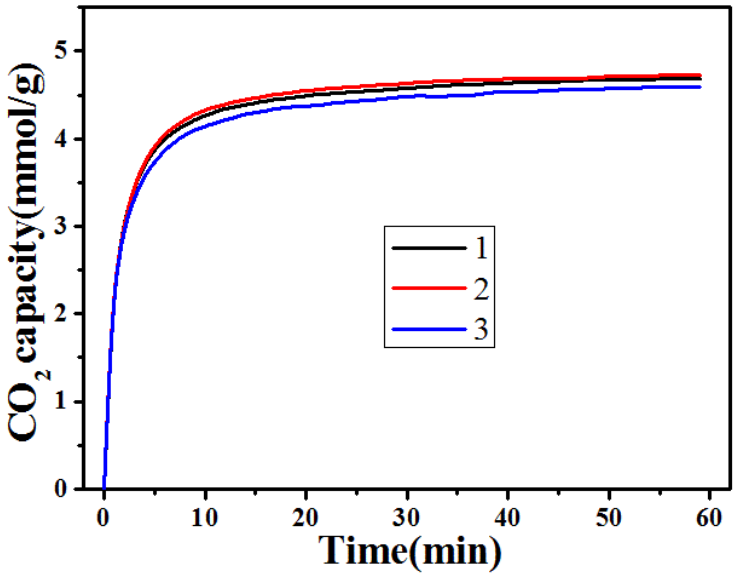

Figure S6 Repeating demonstrations of CO_2 dynamic adsorption on MMSV(a)-PEI-60%

The CO_2 capacities are 4.68, 4.73, and 4.59 mmol/g, respectively, and the standard deviation is calculated as ±0.058.

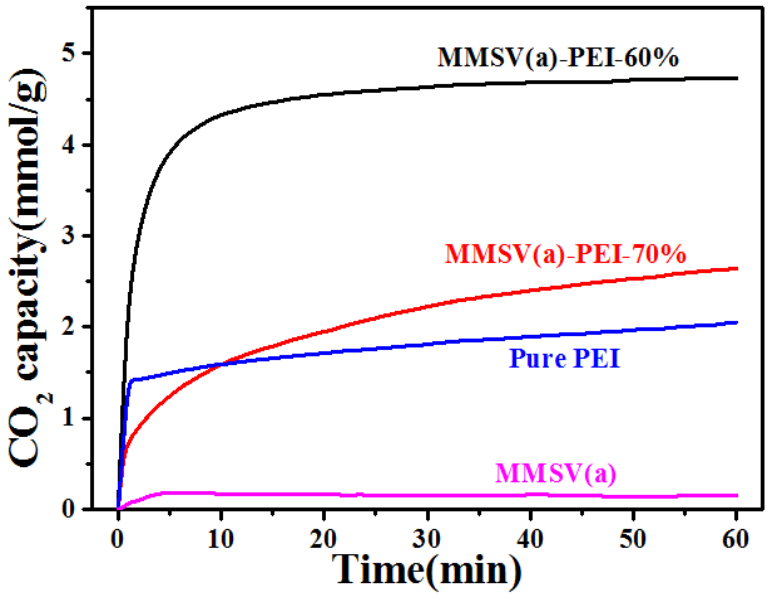

Figure S7 CO_2 adsorption capacity of MMSV(a)/PEIs with different amine loadings, Pure PEI and MMSV(a) at 90 °C under 20 mL/min flow rate of pure CO_2 in TGA

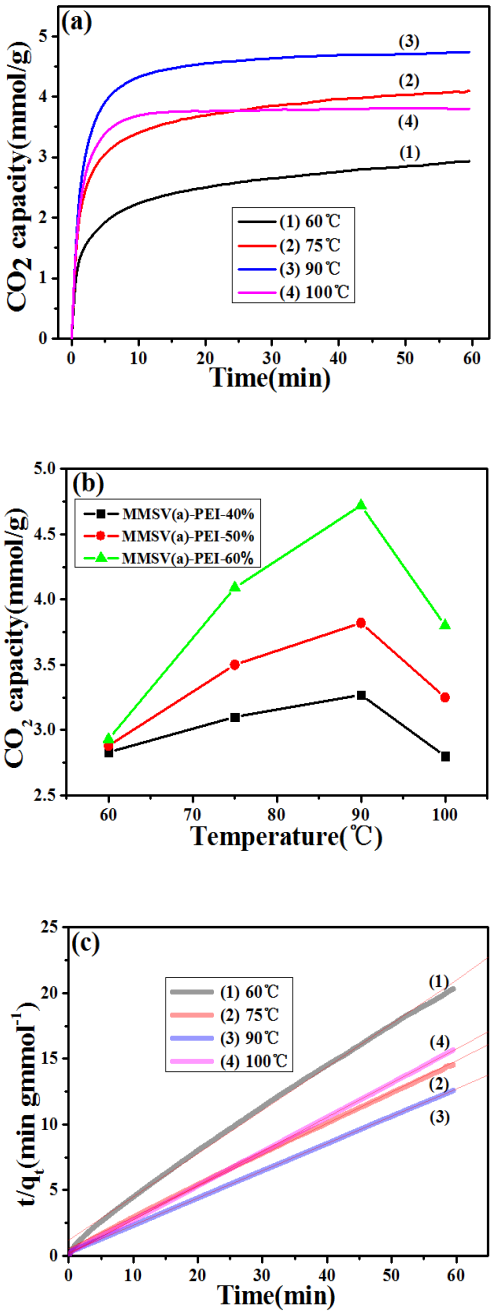

Figure S8 (a) Comparison of dynamic CO_2 adsorption in isothermal conditions for MMSV-PEI-60% at adsorption temperatures of 60, 75, 90 and 100 °C under 20 mL/min flow rate of pure CO_2 in TGA, (b) CO_2 adsorption capacity of MMSV(a)/PEIs with different amine loadings at adsorption temperatures of 60, 75, 90 and 100 °C under 20 mL/min flow rate of pure CO_2 in TGA and (c) Fitting plots of t/q_t against t as predicted by the second-order rate law

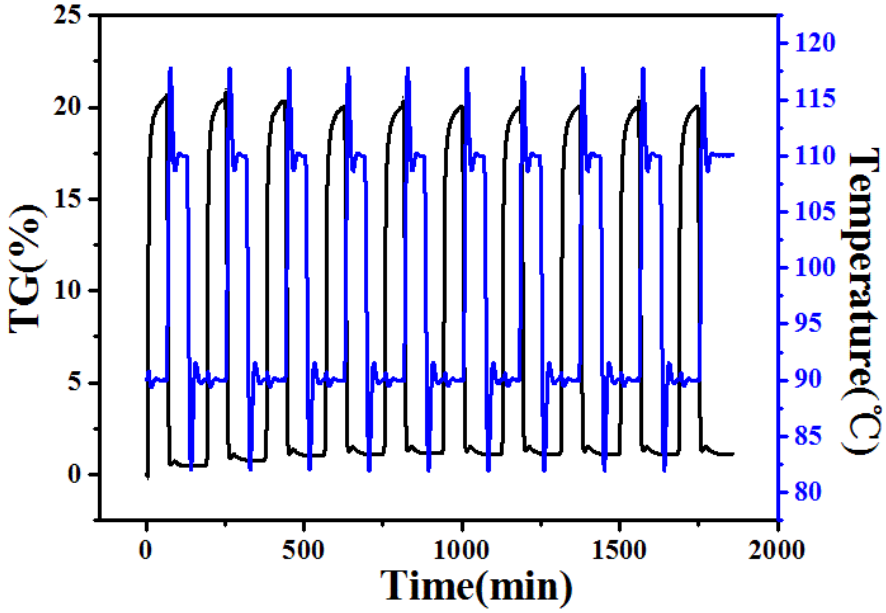

Figure S9 Cyclic adsorption/desorption of MMSV(a)-PEI-60% under dry pure CO_2 at 90 °C

Table S1 Pore properties of MMSV-PEIs

Samples	$S_{BET}(m^2/g)$	Volume(cm^3/g)
MSMV(c)	797.7	0.857
MSMV(c)-PEI-40%	39.7	0.13
MSMV(c)-PEI-50%	16.9	0.034
MSMV(c)-PEI-60%	9.5	0.016
MSMV(c)-PEI-70%	3.4	0.005
MSMV(a)	43.9	0.192
MSMV(a)-PEI-40%	10.9	0.049
MSMV(a)-PEI-50%	2.37	0.001
MSMV(a)-PEI-60%	0.09	---

Table S2 CO_2 adsorption capacity and amine efficiency of various sorbents of porous silica with PEI impregnated

Materials	CO_2 capacity (mmol/g)	Amine efficiency* (%)	Refs.
MCM-41/75%PEI	3.02	37.1	[1]
MCM-48/50%PEI	2.70	46.4	[2]
SBA-15/55%PEI	3.93	61.4	[3]
SBA-16/50%PEI	2.93	50.4	[2]
KIT-6/50%PEI	3.07	52.8	[2]
HMS/60%PEI	4.18	59.9	[4]
PE-MS/70%PEI	4.95	60.8	[5]
MCF/50%PEI	4.09	70.4	[6]
Monolith/65%PEI	4.77	63.1	[7]
Mesoporous capsules/83%PEI	5.70	59.1	[8]
Silica foam/83%PEI	5.80	60.1	[9]
Spherical silica foams/56.5%	4.27	65.0	[10]
MMSV(a)-PEI-60%	4.73	67.8	This work

* The amine efficiency was defined as the ratio of mol CO_2 captured per 2 mol of amino groups in the sorbent and expressed as a % of the maximum adsorption capacity

Table S3 CO_2 capacity of MMSV(a)/PEIs at the simulated flue gas (with 15:85 v/v CO_2/N_2 and dry) at 90 °C

Sample	CO_2 capacity (mmol/g)	Amine efficiency (%)
MMSV(a)-PEI-40%	2.57	55.3
MMSV(a)-PEI-50%	3.14	54.6
MMSV(a)-PEI-60%	3.85	55.1
MMSV(a)-PEI-70%	1.95	23.8

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