Supplementary Information for

Polyethyleneimine Intercalated into Alkyl Layer for Superhydrophobic Interface: Low-Energy and O_2 & H_2O-resistant CO_2 Sorbent

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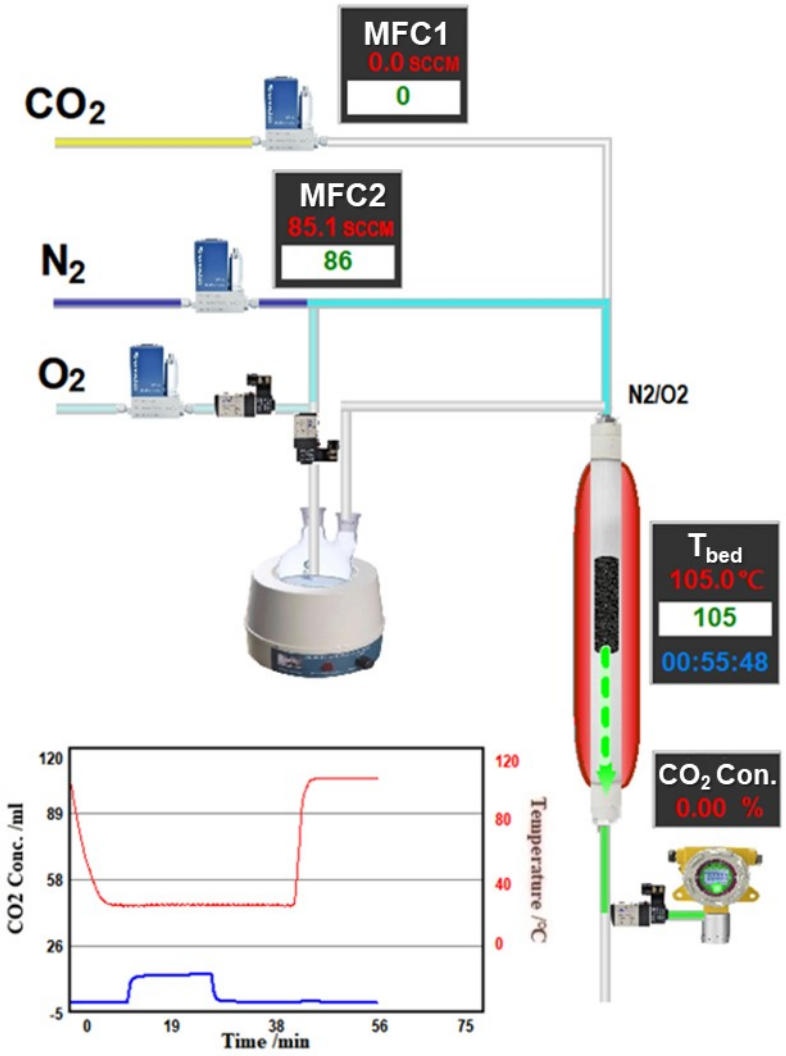


Figure S1. The cyclic stability evaluation apparatus of the adsorbent (including CO_2 adsorption performance, water resistance, and oxidation resistance)

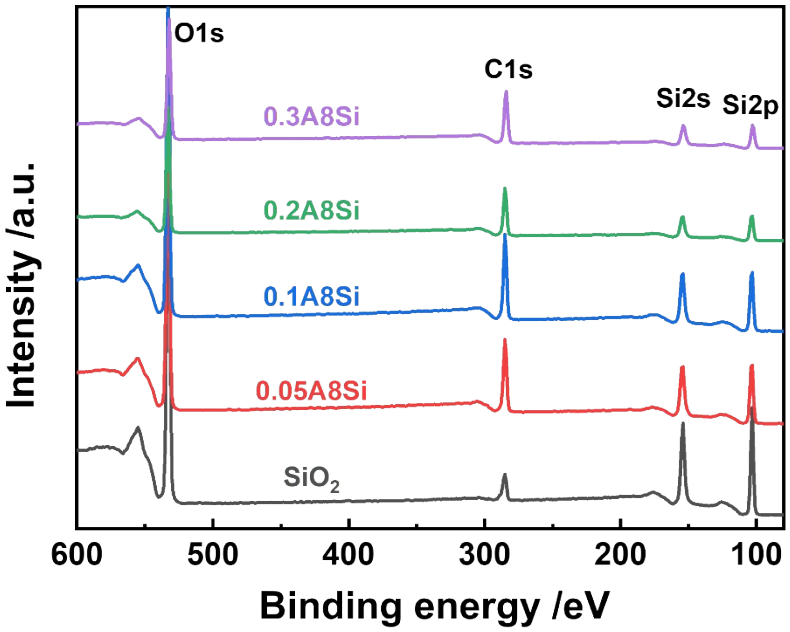


Figure S2. The XPS spectra of SiO_2 and alkyl-SiO_2 samples

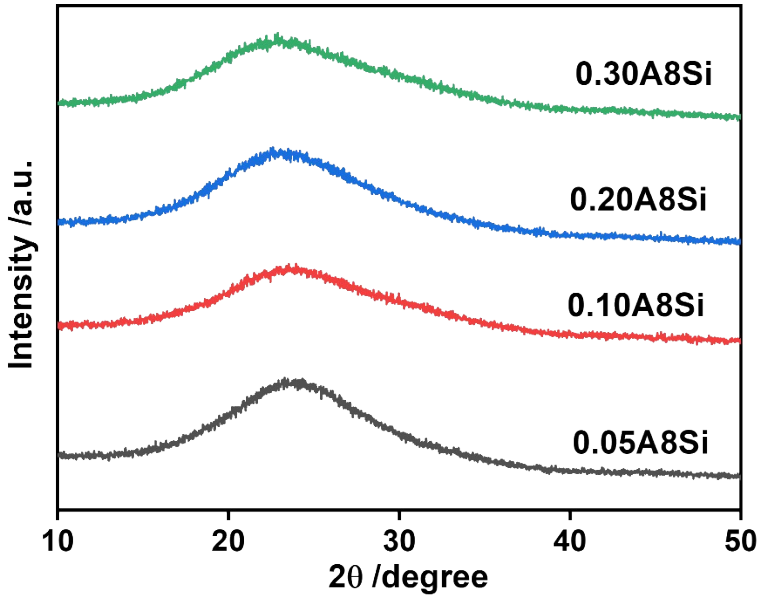


Figure S3. The XRD image of samples with different alkyl chain ratios.

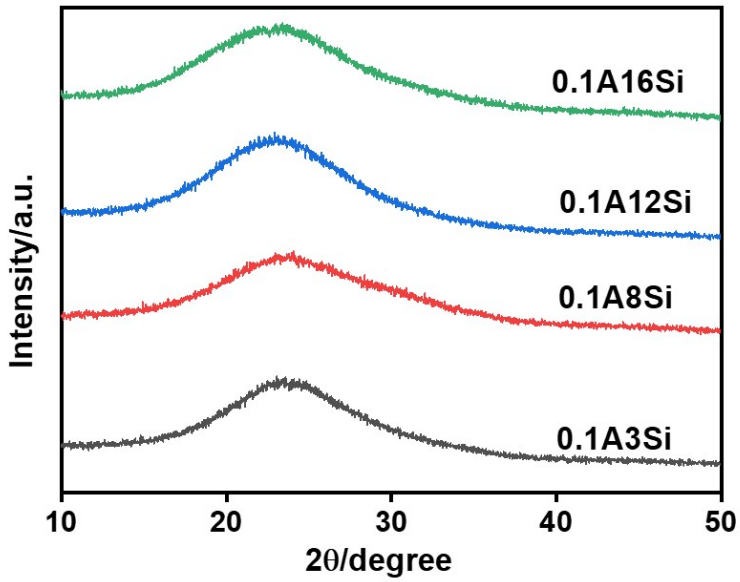


Figure S4. The XRD image of samples with different alkyl chain lengths.

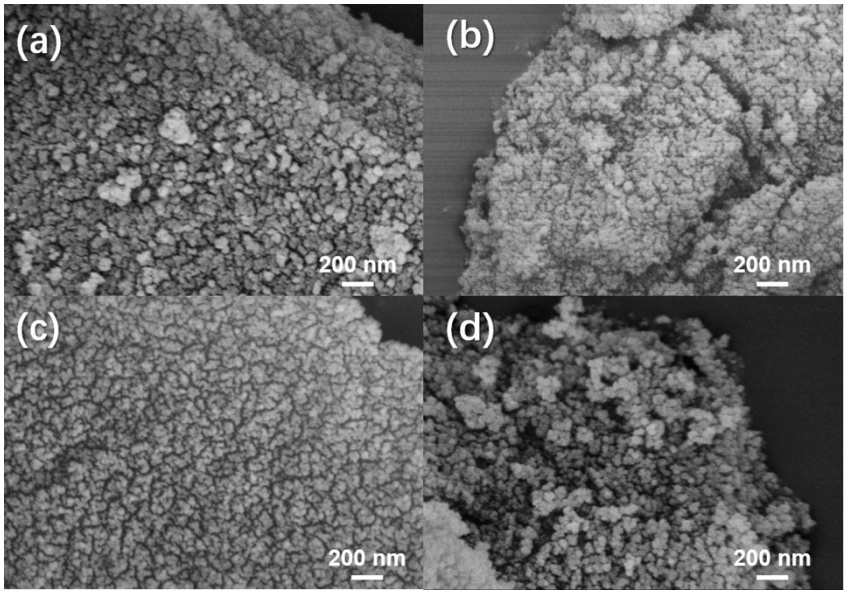


Figure S5. The SEM images of (a)0.1A3Si (b)0.1A8Si (c)0.1A12Si (d)0.1A16Si

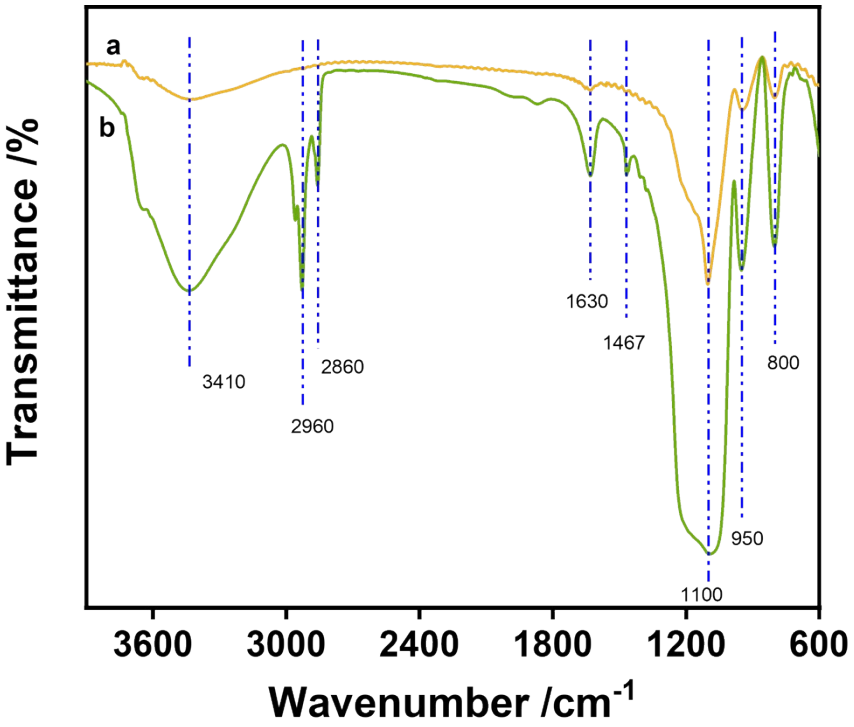


Figure S6. FT-IR spectra of SiO_2 (a, yellow) and 0.1A8Si (b, green) samples

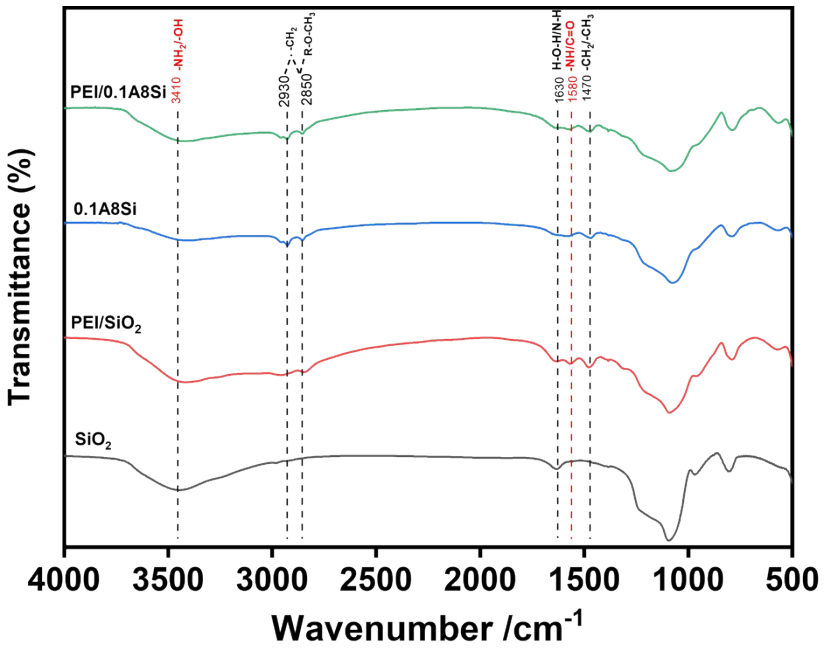


Figure S7. FT-IR spectra of SiO_2 and alkyl-SiO_2 after loading PEI

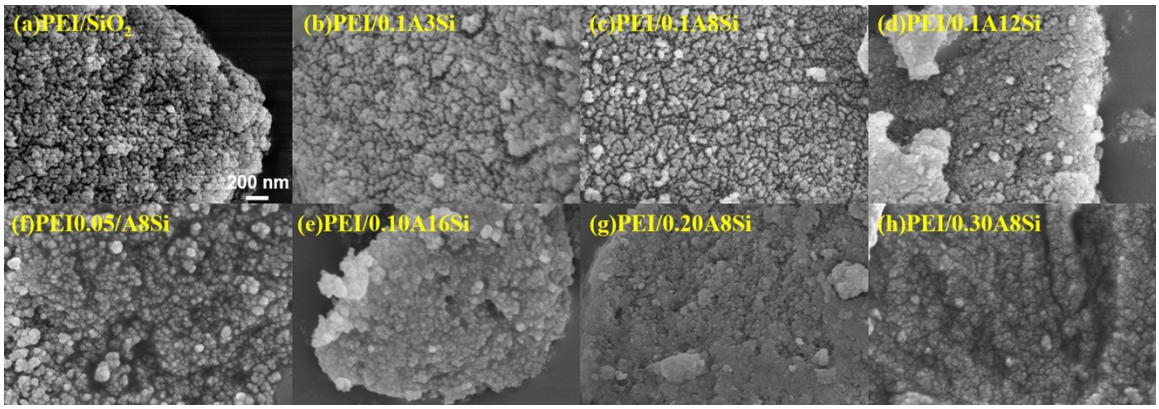


Figure S8. The SEM images of SiO_2 and alkyl-SiO_2 after loading PEI: (a)PEI/SiO_2, (b) PEI/0.1A3Si, (c) PEI/0.1A8Si, (d) PEI/0.1A12Si, (e) PEI/0.1A16Si, (f) PEI/0.05A8Si, (g) PEI/0.2A8Si, and (h) PEI/0.3A8Si.

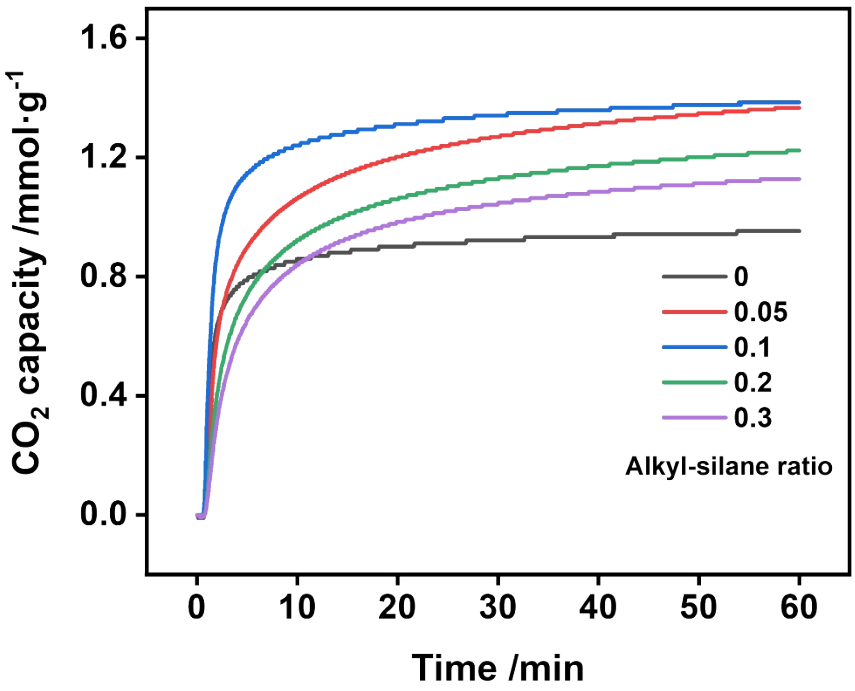


Figure S9. The performance of CO_2 adsorption by various PEI sorbents at 45 °C: PEI/A8Si with different alkyl chain ratios.

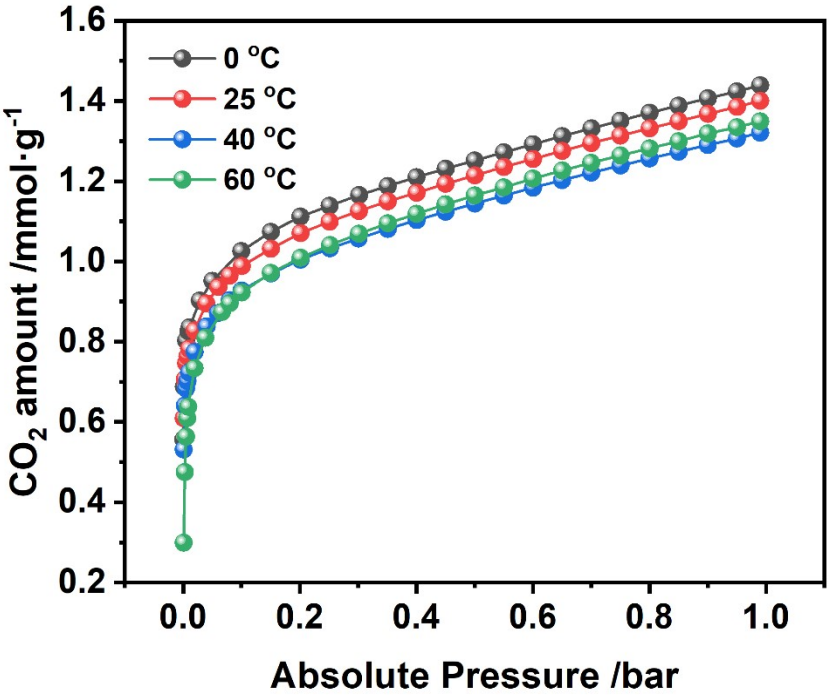


Figure S10. CO_2 adsorption isotherms (0-1 bar) of PEI/0.1A8Si under different temperatures.

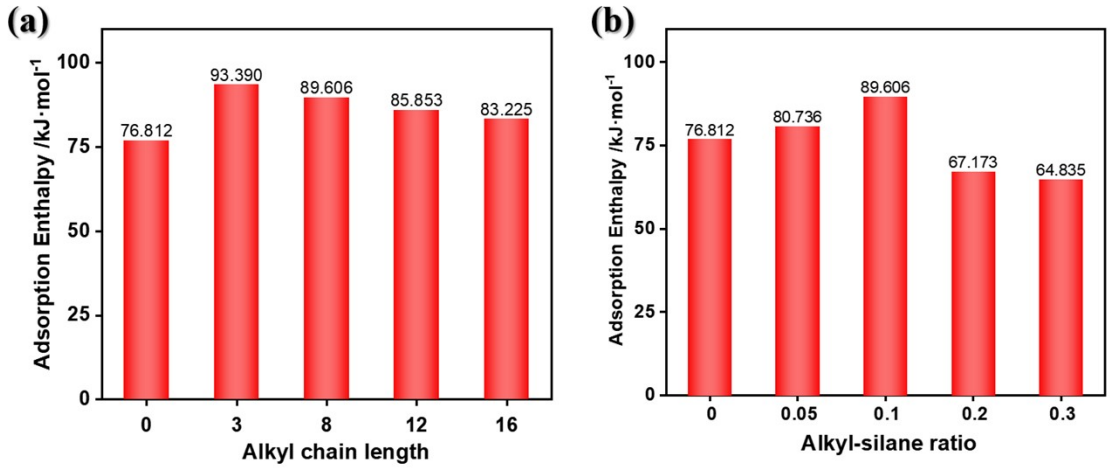


Figure S11. The adsorption heat of the solid amine adsorbent. (a)different the alkyl chain length; (b)different alkyl-silane ratio.

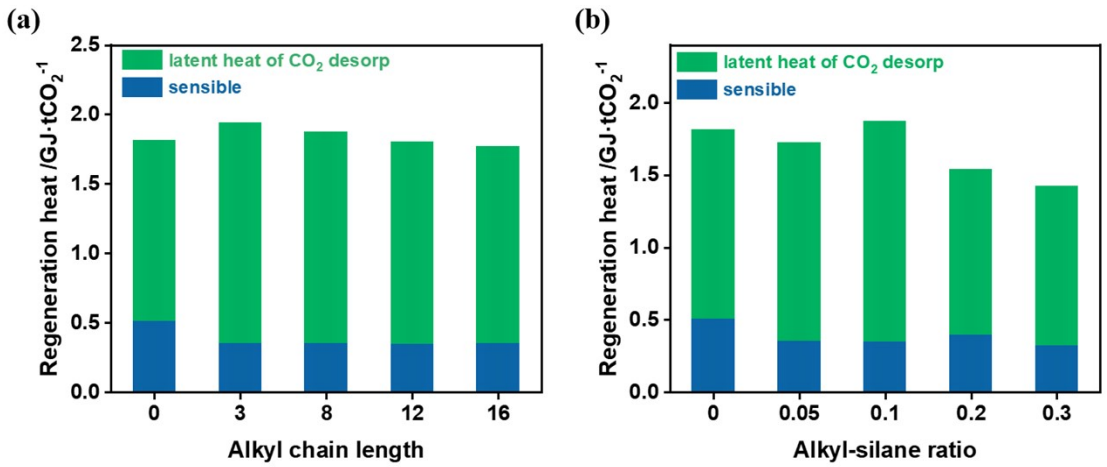


Figure S12. The specific adsorption heat and energy duty for regeneration of the solid amine adsorbent. (a)different the alkyl chain length; (b)different alkyl-silane ratio.

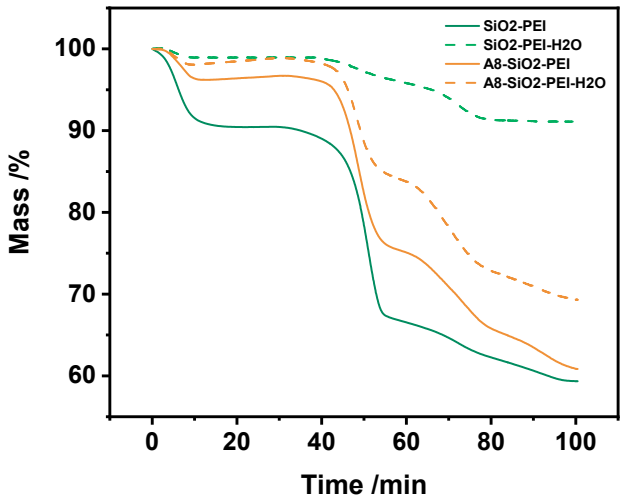


Figure S13. The weight loss variation of the samples

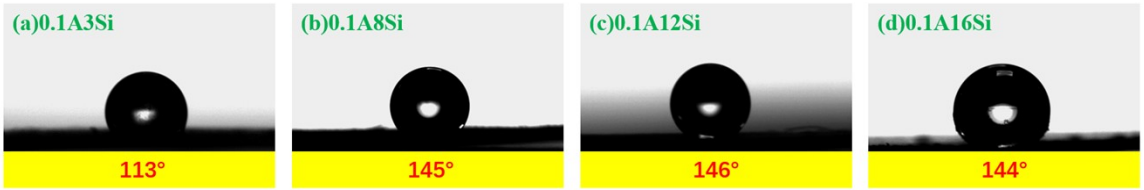


Figure S14. The water contact angle images of samples with different alkyl chain lengths

Figure S15. The water contact angle images of samples with different alkyl chain ratios

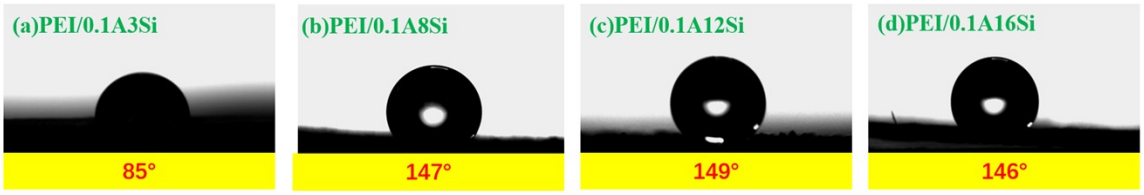


Figure S16. The water contact angle images of samples with different alkyl chain lengths after loading PEI

Figure S17. The water contact angle images of samples with different alkyl chain ratios after loading PEI

Supplementary Tables

Table S1. Detailed information on silanes used in this work.

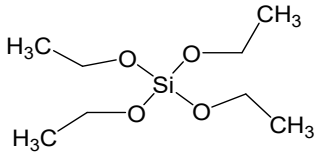
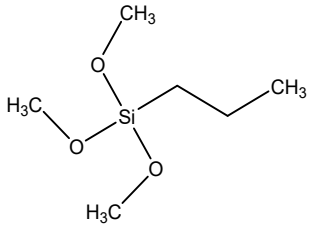
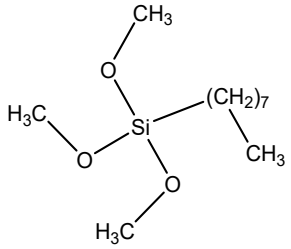
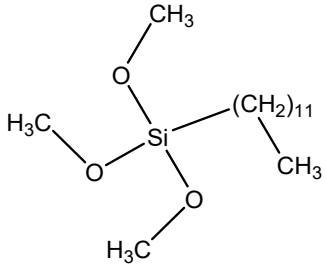
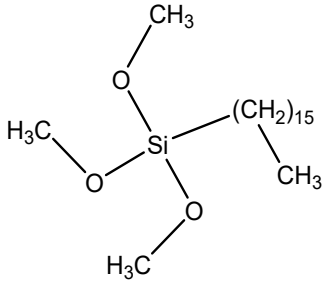
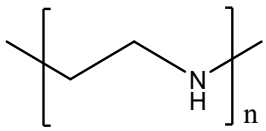
Silane	Structure	Molecular formula	Mw ($g \cdot mol^{-1}$)
TEOS		$(C_2H_5O)Si$	208.33
PTMS		$C_6H_{16}O_3Si$	164.27
OTMS		$C_{11}H_{26}O_3Si$	234.41
DTMS		$C_{15}H_{34}O_3Si$	290.52
HTMS		$C_{16}H_{42}O_3Si$	346.62
PEI		$(CH_2CH_2NH)_n$	600

Table S2. The elemental composition (Si, O, C) and C/Si ratios obtained from XPS analysis.

	Si(%)	O(%)	C(%)	C/Si
SiO_2	31.86	58.95	9.16	0.29
0.05A8Si	26.22	46.58	27.21	1.04
0.1A8Si	25.43	44.92	29.64	1.17
0.2A8Si	23.67	40.37	35.96	1.52
0.3A8Si	22.25	38.04	39.71	1.78