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Supporting information

Highly efficient CH_4 purification by LaBTB PCP-based mixed matrix membranes

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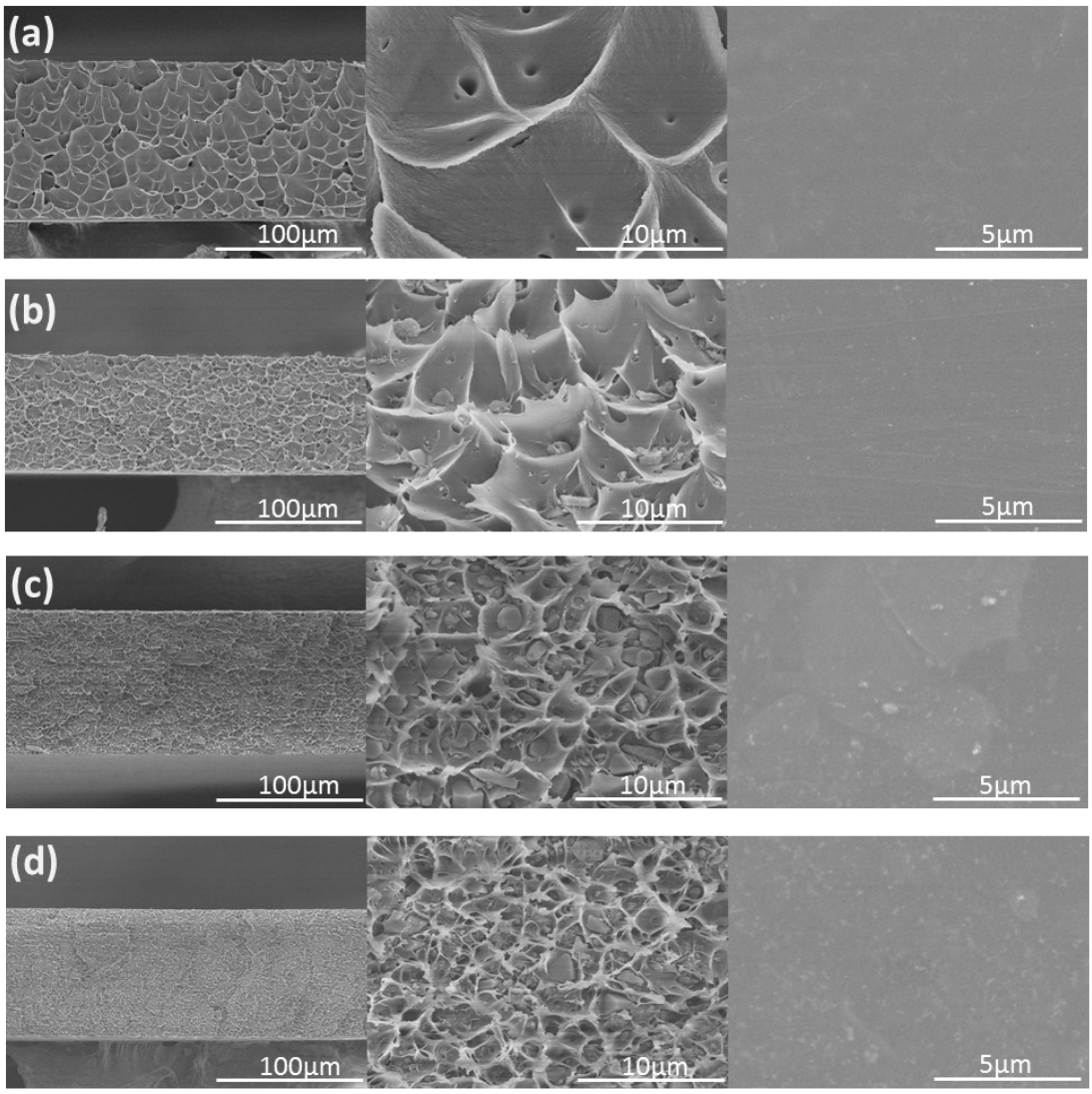

Figure S1. SEM images of 6FDA-DAM based MMMs with various LaBTB loadings. (a) 6FDA-DAM; (b) 5 % LaBTB/6FDA-DAM; (c) 15 % LaBTB/6FDA-DAM; (d) 20 % LaBTB/6FDA-DAM.

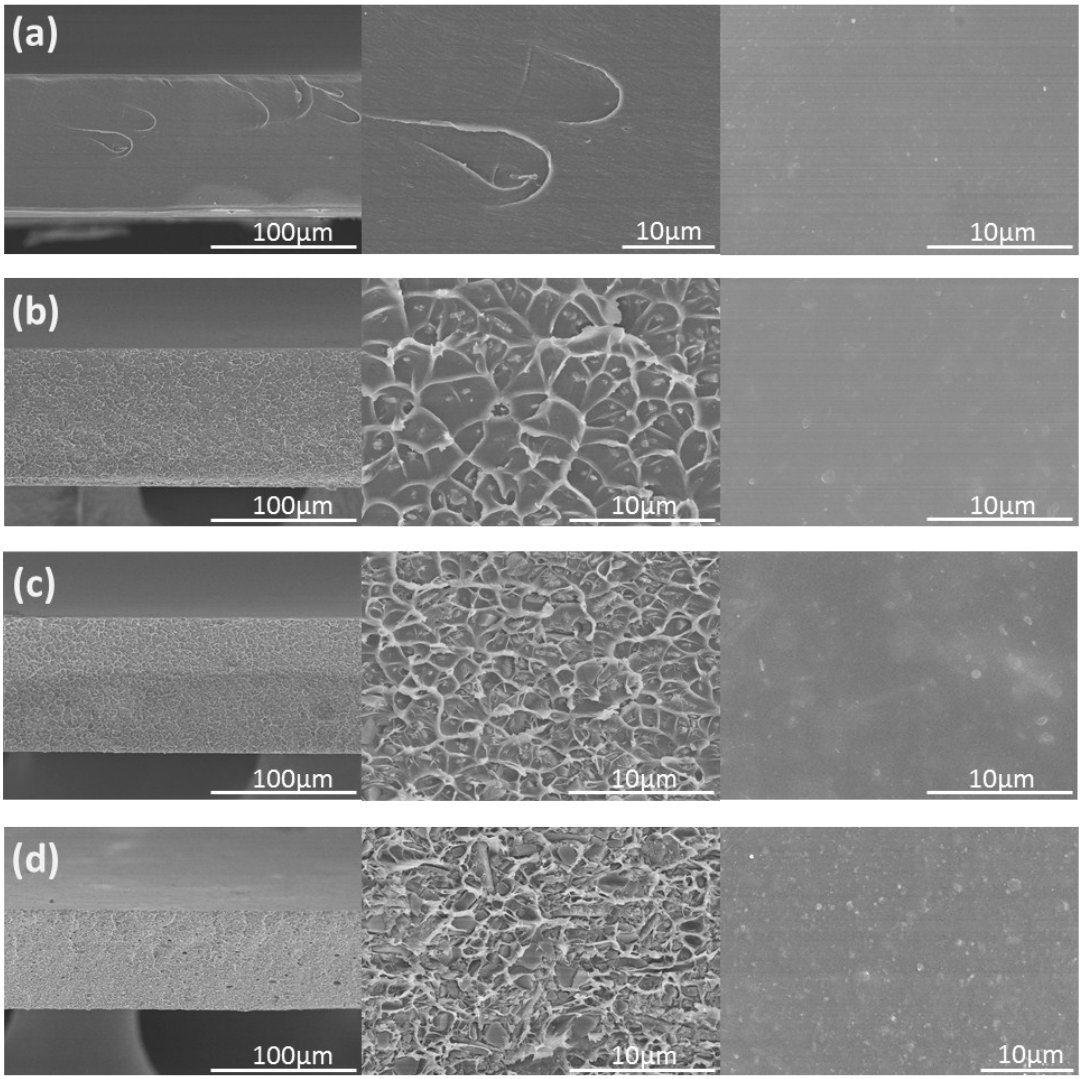

Figure S2. SEM images of Matrimid based MMMs with various LaBTB loadings. (a) Matrimid; (b) 5 % LaBTB/ Matrimid; (c) 10 % LaBTB/ Matrimid; (d) 20 % LaBTB/ Matrimid.

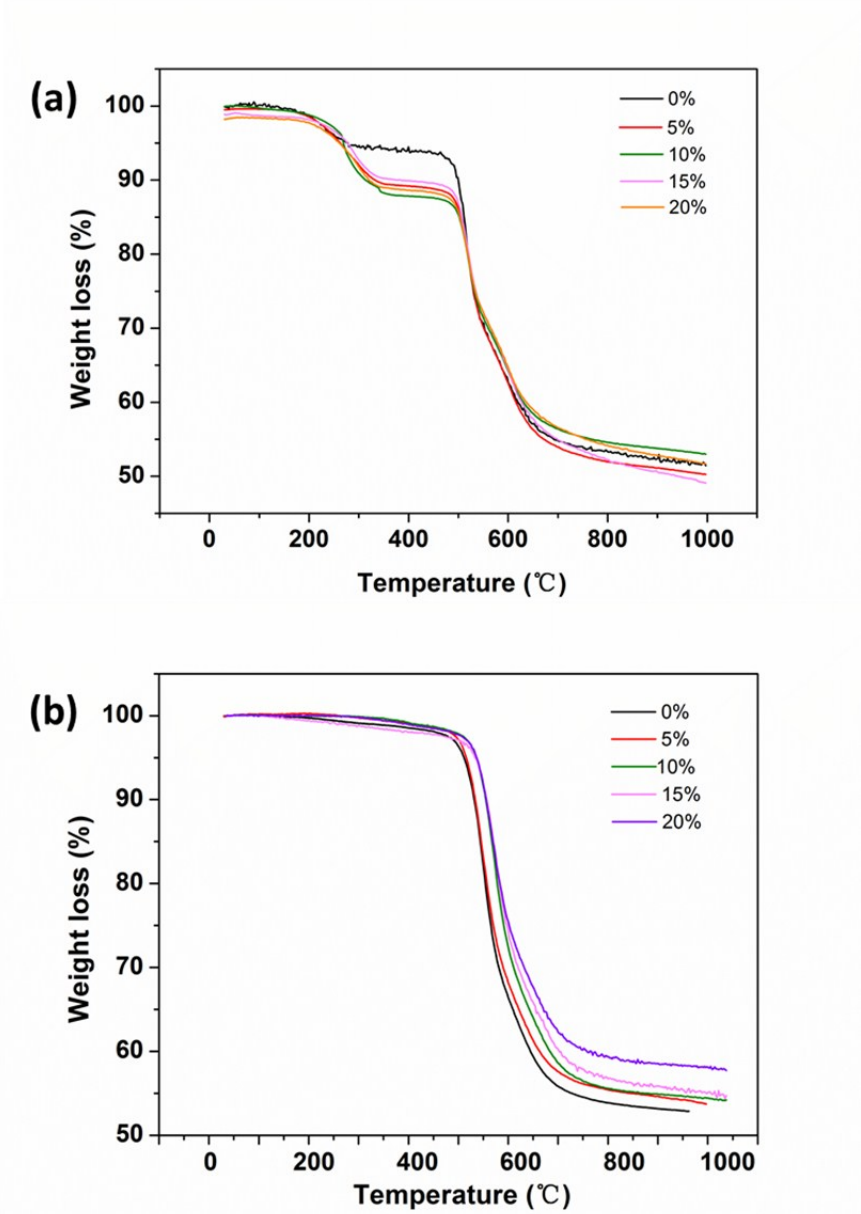

Figure S3. TG of (a) LaBTB/ Matrimid® MMMs and (b) LaBTB/ 6FDA-DAM MMMs.

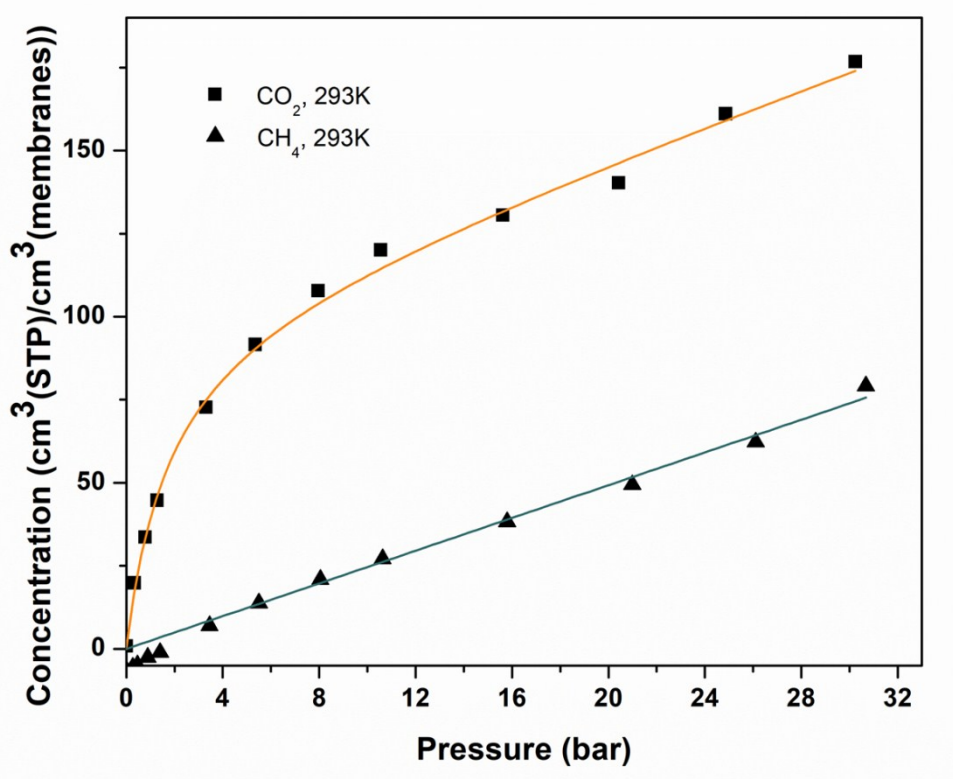

Figure S4. Pure gas (CO_2 and CH_4) sorption isotherms of 20% LaBTB/6FDA-DAM and fit with dual-mode model at room temperature.

Table S1. Solubility and diffusivity parameters of CO_2

Membranes	S_{CO2}	D_{CO2}	P_{CO2}
6FDA-DAM	15.5	30.3	471.2
10% LaBTB/6FDA-DAM	17.4	39.9	696.0
20% LaBTB/6FDA-DAM	21.9	23.1	505.2

S [10^{-2} cm^3 (STP) cm^{-3} $cmHg^{-1}$], **D** [10^{-8} cm^2 s^{-1}], **P** [barrer]

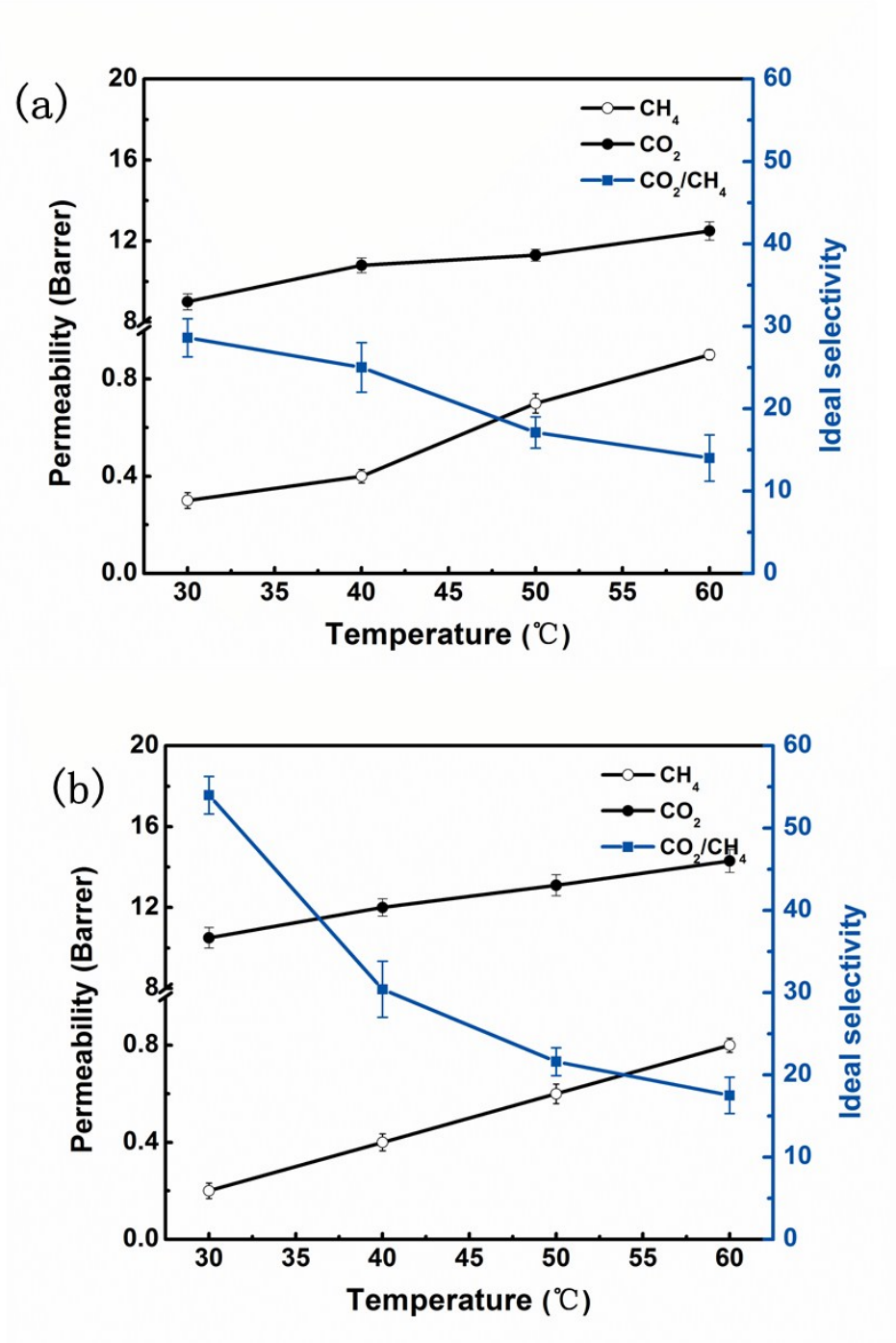

Figure S5. Results of single gas separation by (a) neat Matrimid® and (b) 15 % LaBTB/ Matrimid® under varied temperature, 0.35 MPa.

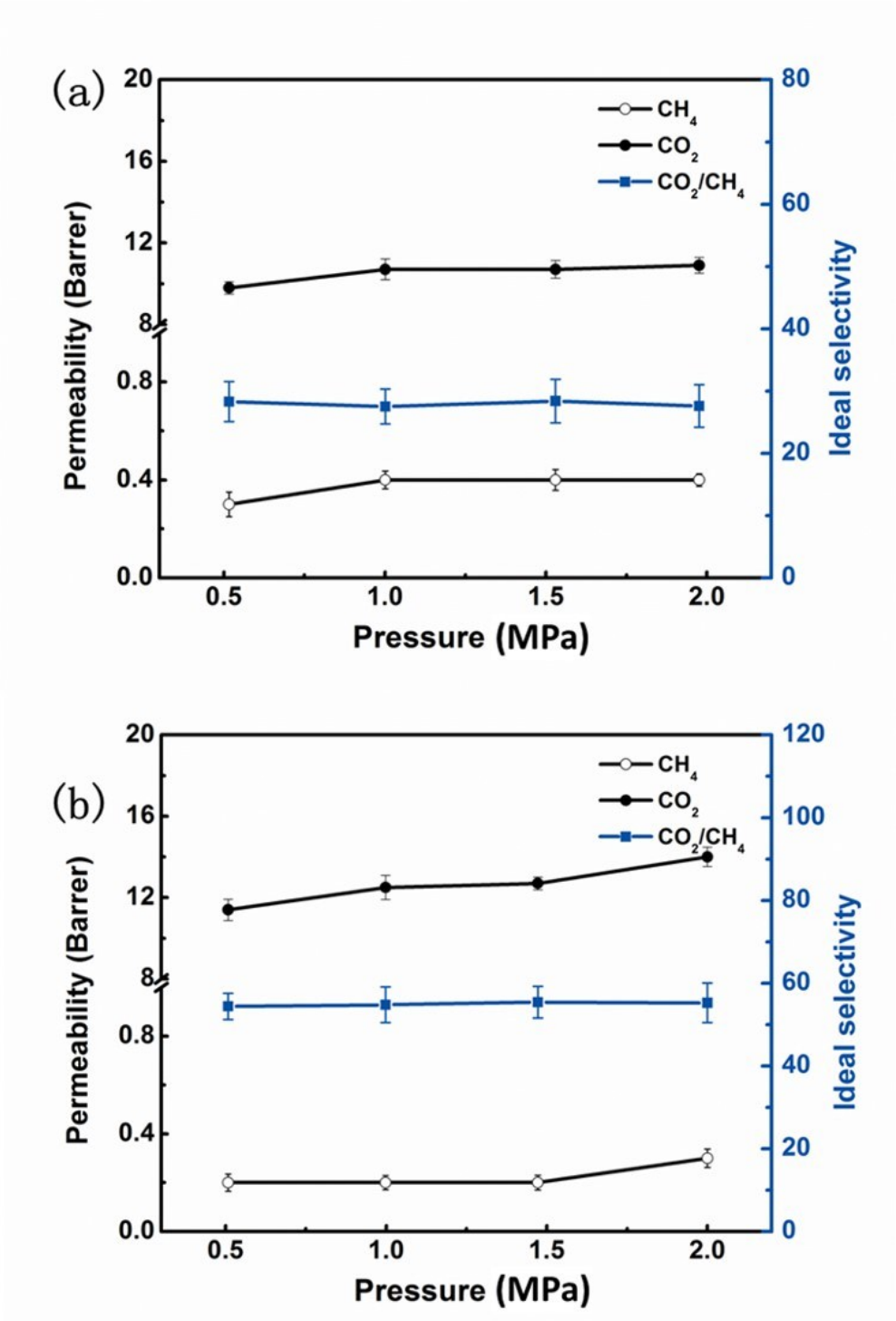

Figure S6. Results of single gas separation by (a) neat Matrimid® and (b) 15 % LaBTB/ Matrimid® under varied pressure, 20 ℃.

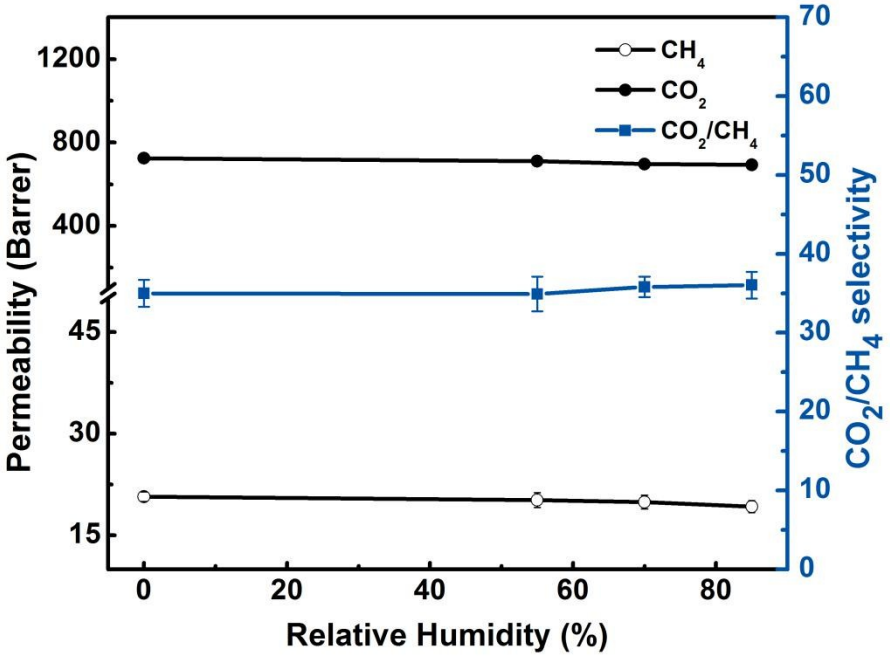

Figure S7. Mixed CO_2/CH_4 (1:1) gas separation performance in 10% LaBTB/6FDA-DAM membrane under varied humidified condition, 0.35 MPa, 25°C.

Table S2. Dual-mode sorption parameters for CO_2

		K_D	C_H	b	S_{CO2}	D_{CO2}	P_{CO2}
6FDA-DAM	20℃	3.98	53.24	0.90	15.53	30.33	471.21
	50℃	1.62	59.15	0.29	10.16	44.23	449.52
10% LaBTB/6FDA-DAM	20℃	2.70	73.74	0.66	17.41	39.98	696.06
	50℃	2.45	37.53	0.41	8.76	64.62	566.24

K_D [cm^3 (STP) cm^{-3} bar^{-1}], **C_H** [cm^3 (STP) cm^{-3}], **b** [bar^{-1}], **S** [10^{-2} cm^3 (STP) cm^{-3} $cmHg^{-1}$], **D** [10^{-8} cm^2 s^{-1}], **P** [barrer]

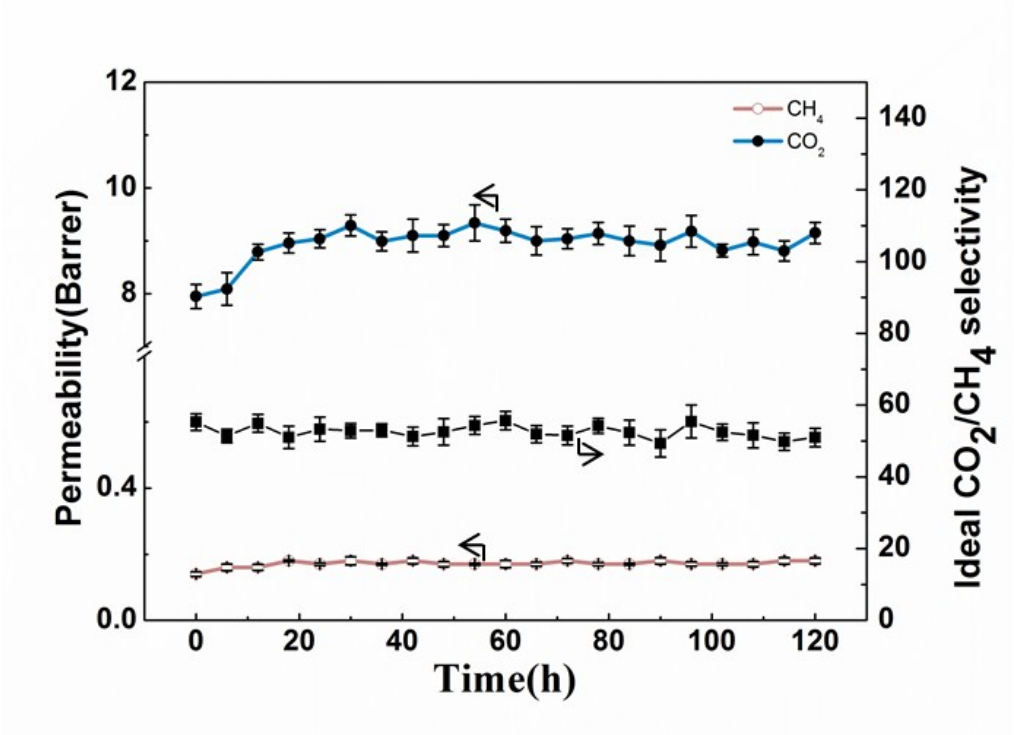

Figure S8. Result of long term test of 15 wt% LaBTB/ Matrimid® at 0.35 MPa, 20 ℃.