Supporting Information

Metal–organic framework membranes: from fabrication to application in gas separation.

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l - Thickness (m)	*T* -Temperature (K)	*P* -Pressure (bar)

Table S1. Comparison of permeation properties of pure MOFs membranes reported in the literature for sorption-driven reverse selective CO_2/H_2 separation. (the data plotted for the reported polymers in Figure 71, b in the article is taken from the https://membrane-australasia.org/polymer-gas-separation-membranes/)

MOF	Support, Method	Permeance (mol/(m^2*s*Pa))		Permeation (Barrer)		H_2/CO_2	*l* (m)	*T* (K)	*P* (bar)	Ref.
		H_2	CO_2	H_2	CO_2					
[Ni_2(L-aspartic acid)$_2$(1,2-bis(4-pyridyl)ethylene))]·(Guest)	Nickel meshes	1.02X10-6	4.52X10-8	6.09X10+4	2.70X10+3	22.6	2.0X10-5	298	1	[1]
ZIF-22	APTES-functionalized Ti_2O	1.70X10-7	2.00X10-8	2.03X10+4	2.39X10+3	8.5	4.0X10-5	323	1	[2]
ZIF-90	APTES-functionalized Al_2O_3	2.50X10-7	3.48X10-8	1.49X10+4	2.08X10+3	7.2	2.0X10-5	473	1	[3]
ZIF-7	Al_2O_3, seeding	4.55X10-8	3.50X10-9	2.72X10+2	2.09X10+1	13.0	2.0X10-6	493	1	[4]
ZIF-69	Al_2O_3	6.70X10-8	2.55X10-8	1.00X10+4	3.81X10+3	2.6	5.0X10-5	298	1	[5]
HKUST-1	Al_2O_3, seeding	7.48X10-7	1.48X10-7	5.59X10+4	1.11X10+4	5.1	2.5X10-5	298	1	[6]
NH_2 -MIL-53(Al)	glass frit, seeding	2.67X10-6	9.80X10-8	1.20X10+5	4.39X10+3	27.3	1.5X10-5	288	1	[7]
ZIF-8	Al_2O_3 hollow fiber, seeding	4.32X10-7	1.22X10-7	2.58X10+3	7.29X10+2	3.5	2.0X10-6	298	1	[8]
JUC-150 [Ni_2(L-aspartic acid)$_2$(pyrazine)]	Nickel meshes	1.83X10-7	4.60X10-9	1.91X10+4	4.81X10+2	39.8	3.5X10-5	298	1	[9]
JUC-150 [Ni_2(L-aspartic acid)$_2$(bipy)]		1.82X10-6	1.65X10-7	2.45X10+5	2.22X10+4	11.0	4.5X10-5	298	1	
ZIF-100	polydopamine modified Al_2O_3	6.30X10-8	8.10 X10-10	1.88X10+3	2.42X10+1	77.8	1.0X10-5	298	1	[10]
Amine-modified Mg-MOF-74/CPO-27-Mg	MgO seeds, Al_2O_3	8.20X10-8	2.90X10-9	2.45X10+3	8.66X10+1	28.3	1.0X10-5	298	1	[11]
Mg-MOF-74/CPO-27-Mg		1.24X10-7	1.10X10-8	3.70X10+3	3.29X10+2	11.3	1.0X10-5	298	1	

ZIF-8	1H,1H,2H,2H-perfluoroalkyltriethoxysilanes modified Al_2O_3	2.66X10-7	1.55X10-8	1.59X10+4	9.26X10+2	17.2	2.0X10-5	473	1	[12]
ZIF-67	porous Al_2O_3 tube, from Cobalt carbonate	5.70X10-7	1.30X10-7	2.89X10+3	6.60X10+2	4.4	1.7X10-6	323	1	[13]
2D sheet Zn2(benzimidazole)4	porous Al_2O_3 tube, from GO coated ZnO	1.50X10-7	1.42X10-9	8.96X10+1	8.45X10-1	106.0	2.0X10-7	423	1	[14]
2D sheet Zn_2(benzimidazole)$_4$	porous Al_2O_3 tube, from ZnO	2.10X10-7	3.94X10-9	3.14X10+1	5.88X10-1	53.3	5.0X10-8	323,473	1	[15]
ZIF-8	reduced GO-modified PVDF hollow fibe. con-diffusion	6.79X10-7	2.72X10-8	3.04X10+2	1.22X10+1	25.0	1.5X10-7	298	1	[16]
ZIF-8-on-ZIF-67	Al_2O_3, LbL	1.20X10-8	9.00E-10	1.29X10+1	9.68X10-1	13.3	3.6X10-7	298	1	[17]
ZIF-8/2D g-C3N4	Al_2O_3, spin LbL	6.70X10-8	1.60X10-9	4.80X10+1	1.15X10+0	41.9	2.4X10-7	298	1	[18]
ZIF-8	polyacrylonitrile, PAN, electrophoretic nuclei assembly	9.90X10-8	1.36X10-8	1.48X10+2	2.03X10+1	7.3	5.0X10-7	298	1	[19]
2D sheet Zn_2(benzimidazole)4	Al_2O_3	6.51X10-7	5.20X10-9	1.94X10+1	1.55X10-1	125.2	1.0X10-8	293	1	[20]
2D sheet Zn_2(benzimidazole)$_4$		9.00X10-7	5.42X10-9	2.69X10+1	1.62X10-1	166.0	1.0X10-8	393	1	
CAU-10-H (Al, 1,3-benzene dicarboxylic acid)	Al_2O_3	3.80X10-9	3.62E-10	6.81X10+1	6.49X10+0	10.5	6.0X10-6	473	2	[21]
ZIF-9	APTES-functionalized Al_2O_3	7.43X10-6	5.00X10-7	1.11X10+6	7.47X10+4	14.9	5.0X10-5	298	1	[22]
COF-300	SiO_2 disk			1.10X10+5	1.83X10+4	6.0	4.5X10-5	298	1	[23]
Zn2(bdc)2(dabco)				2.80X10+5	4.00X10+4	7.0	1.2X10-4	298	1	
ZIF-8				1.20X10+5	1.32X10+4	9.1	6.0X10-5	298	1	
(COF-300)-(Zn_2(bdc)$_2$(dabco))				1.30X10+5	1.03X10+4	12.6	9.7X10-5	298	1	
(COF-300)-(ZIF-8)				1.10X10+5	8.15X10+3	13.5	1.0X10-4	298	1	

NH_2-MIL-125	Al_2O_3			4.25X10+3	5.20X10+2	8.2	2.0X10-6	298	1	[24]
CuBTC/MIL-100	polydopamine modified PVDF hollow fiber, converted CuBTC	8.80X10-8	1.13X10-9	5.26X10+3	6.77X10+1	77.6	2.0X10-5	298	2	[25]
CuBTC/MIL-100		1.05X10-7	1.18X10-9	6.27X10+3	7.05X10+1	89.0	2.0X10-5	358	2	
MIL-96(Al)	Al_2O_3, toluene seeding	5.30X10-7	6.09X10-8	1.11X10+4	1.27X10+3	8.7	7.0X10-6	298	1	[26]
MIL-96(Al)	Al_2O_3, DMF seeding	3.80X10-7	5.76X10-8	2.27X10+3	3.44X10+2	6.6	2.0X10-6	298	1	
ZIF-8	APTES, Titania-functionalized PVDF hollow fiber	2.01X10-5	2.86X10-6	6.00X10+4	8.53X10+3	7.0	1.0X10-6	293	1	[27]
ZIF-8	Al_2O_3	1.40X10-8	1.87X10-9	9.20X10+0	1.23X10+0	7.5	2.2X10-7	298	1	[28]
NH2-MIL-53	ammoniated PVDF hollow fibe	5.42X10-6	1.78X10-7	1.30X10+5	4.26X10+3	30.4	8.0X10-6	298	1	[29]
ZIF-7-NH_2 coated PEBAX 1657	Al_2O_3	1.00X10-7	5.26X10-9	5.97X10+3	3.14X10+2	19.0	2.0X10-5	298	1	[30]
$Zn_2(bim)_4$ nanosheets	Al_2O_3	1.20X10-6	1.35X10-8	3.58X10+0	4.03X10-2	89.0	1.0X10-9	298	1	[31]
MOF-5	Al_2O_3	4.70X10-6	1.05X10-6	3.51X10+5	7.84X10+4	4.5	2.5X10-5	298	1	[32]
MOF-5 oriented	graphite-coated Al_2O_3	8.30X10-7	2.10X10-7	9.92X10+4	2.51X10+4	4.0	4.0X10-5	298	1	[33]
HKUST-1	Al_2O_3 hollow fiber, seeding	7.25X10-8	5.50X10-9	2.82X10+3	2.14X10+2	13.2	1.3X10-5	313	1	[34]
ZIF-8	Al_2O_3	6.04X10-8	1.33X10-8	7.22X10+3	1.59X10+3	4.5	4.0X10-5	298	1	[35]
ZIF-8	Al_2O_3, seeding	1.87X10-6	5.00X10-7	1.40X10+5	3.73X10+4	3.7	2.5X10-5	298	1	[36]
ZIF-8/GO	Al_2O_3	1.45X10-7	6.46X10-9	1.52X10+4	6.75X10+2	22.4	3.5X10-5	523	1	[37]
ZIF-7	Al_2O_3, polyethyleneimine assisted seeding	7.40X10-8	1.10X10-8	3.32X10+2	4.93X10+1	6.7	1.5X10-6	473	1	[38]
ZIF-95	APTES-functionalized Al_2O_3	2.46X10-6	7.04X10-8	2.20X10+5	6.31X10+3	34.9	3.0X10-5	298	1	[39]
MIL-53	Al_2O_3, seeding	4.90X10-7	1.10X10-7	1.17X10+4	2.63X10+3	4.5	8.0X10-6	298	1	[40]

Ni-MOF-74	Al_2O_3, seeding	0.0000127	0.0000014	9.48X10+5	1.05X10+5	9.1	0.000025	298	1	[41]
ZIF-7-8	Al_2O_3, microwave	0.0000003	0.00000006	1.79X10+3	3.58X10+2	5.0	0.000002	298	1	[42]

Table S2. Comparison of permeation properties of pure MOFs membranes reported in the literature for diffusion-driven H_2/CO_2 separation. (the data plotted for the reported polymers in Figure 71, a in the article is taken from the https://membrane-australasia.org/polymer-gas-separation-membranes/)

MOF	Support	Permeation (Barrer)		CO_2/H_2	Mix gas		*l* (m)	*T* (K)	*P* (bar)	Ref.
		H_2	CO_2		%/%	CO_2/H_2				
CAU-1	Al_2O_3 hollow fiber, seeding	3.79X10+3	9.86X10+3	2.6			2.5X10-6	298	1	[43]
$[Cu_2(benzoate)_4(pyrazine)]_n$ [100] direction	single crystal	5.26X10-1	7.17X10-1	1.4	10/90	0.36	0.00016	298	1	[44]
		5.26X10-1	7.17X10-1		20/80	1.29	0.00016	298	1	
		5.26X10-1	7.17X10-1		70/30	2.19	0.00016	298	1	
		5.26X10-1	7.17X10-1		60/40	3.85	0.00016	298	1	
		5.26X10-1	7.17X10-1		50/50	4.08	0.00016	298	1	
		5.26X10-1	7.17X10-1		40/60	6.49	0.00016	298	1	
		5.26X10-1	7.17X10-1		30/70	14.17	0.00016	298	1	
		5.26X10-1	7.17X10-1		20/80	18.20	0.00016	298	1	
		5.26X10-1	7.17X10-1		10/90	32.65	0.00016	298	1	
sod-ZMOF	Al_2O_3	35.8	94.1	2.6	70/30	5.20	0.00005	298	2	[45]
MOF-5	Al_2O_3, seeding	710.9	8154.1	4.5	20/80	1.25	0.000014	298	2.7	[46]
		710.9	8154.1		60/40	1.75	0.000014	298	2.7	
		710.9	8154.1		40/60	2.60	0.000014	298	2.7	
		710.9	8154.1		82/18	4.50	0.000014	298	2.7	
MOF-5,CO_2 treated		5266.7	23709.7	4.5	98/2	5781.00	0.000014	298	5	[47]

Table S3. Comparison of permeation properties of pure MOFs membranes reported in the literature for CO_2/CH_4 separation. (the data plotted for the reported polymers in Figure 72, a in the article is taken from the https://membrane-australasia.org/polymer-gas-separation-membranes/)

MOF	Support, Method	Permeance (mol/(m^2*s*Pa))		Permeation (Barrer)		CO_2/CH_4	*l* (m)	*T* (K)	*P* (bar)	Ref.
		CH_4	CO_2	CH_4	CO_2					
MOF-5	Al_2O_3	1.38X10-7	0.00000015	5.75X10+3	6.27X10+3	1.1	0.000014	298	3	[48]
ZIF-8	Al_2O_3	2.41X10-6	0.0000169	6.49X10+4	4.54X10+5	7.0	0.000009	295	1	[49]
$Co_3(HCOO)_6$	silicon wafer, seeding	4.1513X10-7	0.00000225	1.49X10+4	8.06X10+4	5.4	0.000012	298	1	[50]
ZIF-69	Al_2O_3, seeding	8.6X10-9	2.36X10-8	1.03X10+3	2.82X10+3	2.7	0.00004	298	1	[51]
$[Cu_2(ndc)_2(dabco)]$	Al_2O_3	4X10-9	1.4X10-8	2.39X10+2	8.36X10+2	3.5	0.00002	298	1	[52]
Bio-MOF-1	stainless steel tube, seeding	0.00000046	0.00000119	2.06X10+4	5.33X10+4	2.6	0.000015	298	1.4	[53]
Bio-MOF-13	stainless steel tube, seeding	0.00000082	0.0000031	1.71X10+4	6.48X10+4	3.8	0.000007	298	1	[54]
Bio-MOF-14		0.00000118	0.00000416	4.58X10+4	1.62X10+5	3.5	0.000013	298	1	
ZIF-7-8	Al_2O_3, microwave	1.4X10-8	0.00000006	8.36X10+1	3.58X10+2	4.3	0.000002	298	1	[42]
sod-ZMOF	Al_2O_3	1.8 X10-10	6.3 X10-10	2.69X10+1	9.41X10+1	3.5	0.00005	298	2	[45]
MIL-100(In)	Al_2O_3	2.4658X10-7	0.0000009	3.68X10+3	1.34X10+4	3.7	0.000005	298	2	[55]
ZIF-8-ZnAl-NO_3 LDH composite membrane	Al_2O_3	7.5786 X10-10	9.7763X10-9	4.53X10+1	5.84X10+2	12.9	0.00002	363	1	[56]
CAU-1	Al_2O_3 hollow fiber, seeding	8.9189X10-8	0.00000132	6.66X10+2	9.86X10+3	14.8	0.0000025	298	1	[57]

Table S4. Comparison of permeation properties of pure MOFs membranes reported in the literature for CO_2/N_2 separation. (the data plotted for the reported polymers in Figure 72, b in the article is taken from the https://membrane-australasia.org/polymer-gas-separation-membranes/)

MOF	Support, Method	Permeance (mol/(m^2*s*Pa))		Permeation (Barrer)		CO_2/N_2	l (m)	T (K)	P (bar)	Ref.
		N_2	CO_2	N_2	CO_2					
MOF-5	Al_2O_3	1.82927X10-7	0.00000015	5.75X10+3	6.27X10+3	0.8	0.000014	298	3	[48]
ZIF-69	Al_2O_3, seeding	1.06X10-8	2.36X10-8	1.03X10+3	2.82X10+3	2.2	0.00004	298	1	[51]
ZIF-7-8	Al_2O_3, microwave	0.000000024	0.00000006	8.36X10+1	3.58X10+2	2.5	0.000002	298	1	[42]
sod-ZMOF	Al_2O_3	7.3 X10-11	6.3 X10-10	2.69X10+1	9.41X10+1	8.6	0.00005	298	2	[45]
MIL-100(In)	Al_2O_3	2.85714X10-7	0.0000009	3.68X10+3	1.34X10+4	3.2	0.000005	298	2	[55]
ZIF-8-ZnAl-NO_3 LDH composite membrane	Al_2O_3	2.44048X10-9	9.7763X10-9	4.53X10+1	5.84X10+2	4.0	0.00002	363	1	[56]
CAU-1	Al_2O_3 hollow fiber, seeding	5.04X10-8	0.00000132	6.66X10+2	9.86X10+3	26.2	0.0000025	298	1	[43]

Table S5. Comparison of permeation properties of pure MOFs membranes reported in the literature for C_2H_4/C_2H_6 separation. (the data plotted for the reported polymers in Figure 73, a in the article is taken from the [58])

MOF	Support, Method	Permeance (mol/(m^2*s*Pa))		Permeation (Barrer)		C_2H_4/C_2H_6	l (m)	T (K)	P (bar)	Ref.
		C_2H_4	C_2H_6	C_2H_4	C_2H_6					
MOF-5	Al_2O_3	0.000000018	6.66667X10-9	1.34X10+3	4.98X10+2	2.7	0.000025	298	1	[59]

Table S6. Comparison of permeation properties of pure MOFs membranes reported in the literature for C_3H_6/C_3H_8 separation. (the data plotted for the reported polymers in Figure 73, b in the article is taken from the [60])

MOF	Support, Method	Permeance (mol/(m^2*s*Pa))		Permeation (Barrer)		mix C_3H_6/C_3H_8	*l* (m)	*T* (K)	*P* (bar)	Ref.
		C_3H_6	C_3H_8	C_3H_6	C_3H_8					
ZIF-8	Al2O3 , counter-diffusion	2.7799X10-8	6.46488E-10	1.25X10+2	2.90X10+0	43.0	0.0000015	298	1	[61]
ZIF-8	Al2O3	8.09X10-9	1.97317E-10	2.42X10+2	5.89X10+0	41.0	0.00001	298	1	[62]
ZIF-8	Al2O3 , counter-diffusion	2.5X10-9	4.23729E-11	5.97X10+2	1.01X10+1	59.0	0.00008	298	1	[63]
ZIF-8	Al2O3, secondary growth	0.000000011	3.66667E-10	8.21X10+1	2.74X10+0	30.0	0.0000025	298	1	[64]
ZIF-8	PAI hollow fiber, IMMP	1.4405X10-8	9.47697E-11	3.49X10+2	2.29X10+0	152.0	0.0000081	298	1	[65]

Table S7. Comparison of permeation properties of pure MOFs membranes reported in the literature for C_4H_{10}/i-C_4H_{10} separation. (the data plotted for the reported polymers in Figure 73, c in the article is taken from the [66])

MOF	Support, Method	Permeation (Barrer)		C_4H_{10}/i-C_4H_{10}	*l* (m)	*T* (K)	*P* (bar)	Reference (DOI)
		C_4H_{10}	i-C_4H_{10}					
ZIF-90	carbon hollow fibers, fluidic processing technique	192	16	12	0.0000031	298	1	[67]

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