

# Mixed Matrix Membranes Prepared from Non-Dried MOFs for CO<sub>2</sub>/CH<sub>4</sub> Separations

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Supplementary Information

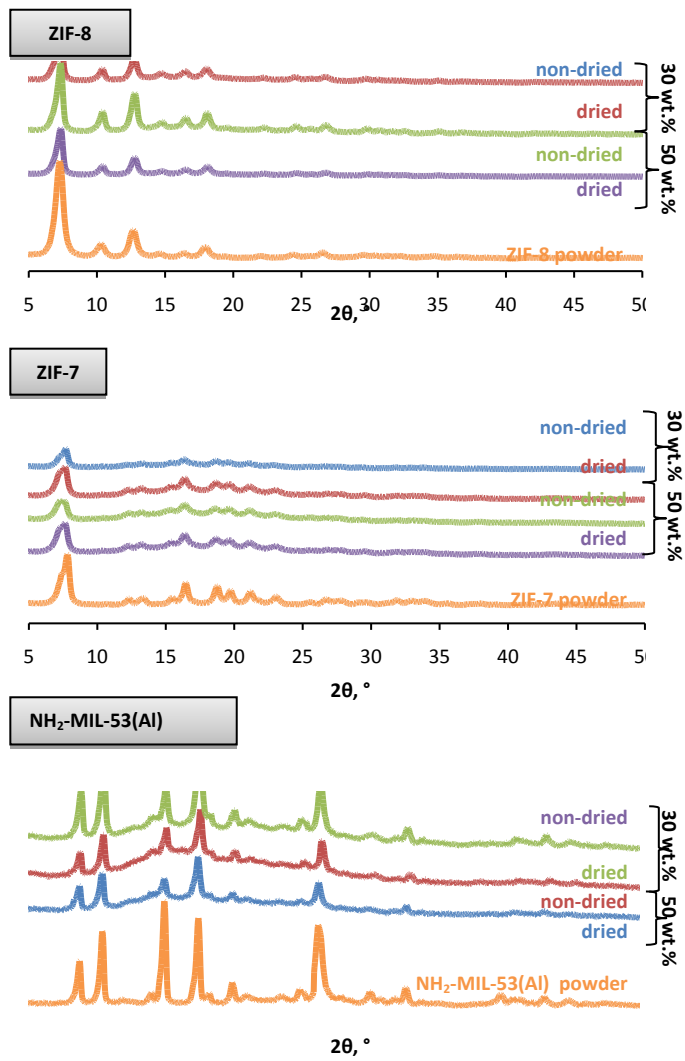


Fig. 1 XRD patterns of MMMs with non-dried and dried MOFs.

**Table 1. The gas separation measurements from this work.**

	MOF loading, wt.%	CO <sub>2</sub> permeability, Barrer	CO <sub>2</sub> /CH <sub>4</sub> selectivity
Unfilled Matrimid®	0	5.6±0.7	22.3±0.2
ZIF-8 <sup>n-dr</sup>	30	19.6±0.3	18.6±0.2
ZIF-8 <sup>dr</sup>	30	55.7±1.4	3.7±0.2
ZIF-7 <sup>n-dr</sup>	30	5.7±0.6	26.8±1.3
ZIF-7 <sup>dr</sup>	30	15.9±1	2.7±0.1
	50	15.3±1.4	3.23±0.1
MIL-53(Al)NH <sub>2</sub> <sup>n-dr</sup>	30	5.7±0.2	24.5±0.6
MIL-53(Al)NH <sub>2</sub> <sup>dr</sup>	30	29.9±2.4	5.9±0.1
	50	77.2±5.7	1.6±0.1

**Table 2. Maxwell predictions for Matrimid®/ZIF-8 MMMs.**

Loading, wt.%	CO <sub>2</sub> permeability, Barrer			CO <sub>2</sub> /CH <sub>4</sub> selectivity		
	Ref. <sup>1*</sup>	Ref. <sup>2**</sup>	Ref. <sup>3***</sup>	Ref. <sup>1*</sup>	Ref. <sup>2**</sup>	Ref. <sup>3***</sup>
10	7.8	10.8	10.9	26.8	34.9	35.0
20	7.5	14.3	14.4	20.7	34.7	34.9
30	7.2	18.7	18.8	16.2	34.6	34.8
40	6.9	24.5	24.8	12.6	34.4	34.8
50	6.7	32.5	33.1	9.9	34.1	34.6
60	6.4	44.4	45.4	7.7	33.8	34.5
70	6.2	63.6	65.7	5.9	33.2	34.2
80	6.0	100.1	105.3	4.4	32.2	33.8
90	5.7	196.8	217.2	3.2	29.6	32.4
100	5.5	1192.0	2658.0	2.2	2.8	3.3

\* ZIF-8 membrane at 2 atm feed pressure and 308 K, pure gas measurements

\*\* ZIF-8 membrane at 1.1-2 bar feed pressure and 298 K, pure gas measurements

\*\*\*ZIF-8 membrane at 1 bar feed pressure and 298 K, pure gas measurements

**Table 3. Maxwell predictions for Matrimid®/ZIF-7 MMMs.**

Loading, wt.%	CO <sub>2</sub> permeability, Barrer		CO <sub>2</sub> /CH <sub>4</sub> selectivity	
	Ref. <sup>4*</sup>	Ref. <sup>5**</sup>	Ref. <sup>4*</sup>	Ref. <sup>5**</sup>
10	8.8	9.5	30.1	32.1
20	9.7	11.1	25.9	29.5
30	10.6	13.0	22.4	27.1
40	11.6	15.3	19.2	24.7
50	12.7	18.0	16.2	22.2
60	14.0	21.4	13.3	19.5
70	15.4	25.6	10.4	16.3
80	17.0	31.1	7.5	12.5
90	18.9	38.5	4.4	7.6
100	21.0	49.0	1.1	0.9

\* ZIF-7 membrane at 1 bar feed pressure and 473 K, pure gas measurements

\*\* ZIF-7 membrane at 1 bar feed pressure and 493 K, pure gas measurements

**Table 4. Maxwell predictions for Matrimid®/MIL-53(Al)NH<sub>2</sub> MMMs.**

Loading, wt.%	CO <sub>2</sub> permeability, Barrer		CO <sub>2</sub> /CH <sub>4</sub> selectivity	
	Ref. <sup>6*</sup>	Ref. <sup>7**</sup>	Ref. <sup>6*</sup>	Ref. <sup>7**</sup>
10	8.6	9.9	41.2	34.6
20	9.2	12.2	48.6	34.1
30	9.9	14.9	57.7	33.7
40	10.6	18.2	68.9	33.2
50	11.3	22.3	83.0	32.7
60	12.1	27.7	101.1	32.0
70	13.0	35.1	124.7	31.2
80	13.9	45.5	156.5	30.1
90	14.9	61.7	201.1	28.5
100	16.0	90.0	266.7	25.7

\* Back-calculated from MMM data at 5 bar and 298 K, pure gas measurements

\*\* Back-calculated from MMM data at 10.3 bar and 308 K, pure gas measurements

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