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APPENDICES

Appendix A The Calculation of Gas Permeation Rate and Selectivity.

The permeance or pressure normalized flux of component 'i' is expressed as a thickness normalized permeation rate, $\frac{P}{\delta}_i$. Permeances are expressed in gas permeation units, GPU, where GPU = $1 \cdot 10^{-6}$ cm³(STP)/cm².sec.cmHg.

$$\frac{P}{\delta}_i = \frac{Q_i \times 14.7 \times 10^6}{(A) \times (\Delta P) \times 76}$$

Where

- $\frac{P}{\delta}_i$ = permeance of gas 'i' (GPU)
- P = permeability of gas 'i' (cm³(STP).cm/cm².sec.cmHg)
- δ = thickness of membrane (cm)
- Q_i = volumetric flow rate of gas 'i' (cm³/sec)
- A = area of membrane (cm²)
- ΔP = pressure different across membrane (psi)

The ideal separation selectivity of a membrane for gas 'i' to gas 'j' is evaluated as follows:

$$S_{i,j} = \frac{\frac{P}{\delta}_i}{\frac{P}{\delta}_j}$$

$S_{i,j}$ = ideal selectivity

Appendix B The Experimental Flow Rate of Carbon Dioxide (CO₂), Methane (CH₄) and Nitrogen (N₂) of Mixed Matrix Membranes in Separation Performance Study at Room Temperature and Pressure 50 psia.

Table B1 CA

membrane thickness : 154 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	4.97	2.0121	176.11	176.86	2.75
			5.03	1.9881	174.01		
			4.99	2.0040	175.41		
			4.83	2.0704	181.22		
			4.93	2.0284	177.54		
CH ₄	50	10	41.50	0.2410	21.09	21.12	0.12
			41.04	0.2437	21.33		
			41.52	0.2408	21.08		
			41.51	0.2409	21.09		
			41.65	0.2401	21.02		
N ₂	50	10	41.47	0.2411	21.11	21.22	0.09
			41.12	0.2432	21.29		
			41.04	0.2437	21.33		
			41.33	0.2420	21.18		
			41.32	0.2420	21.18		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 8.37$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 8.34$$

Table B2 SR/CA

membrane thickness : 272 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	4.09	0.2445	21.40	21.58	0.14
			4.05	0.2469	21.61		
			4.07	0.2457	21.51		
			4.02	0.2488	21.77		
			4.05	0.2469	21.61		
CH ₄	50	1	56.02	0.0179	1.56	1.64	0.07
			55.21	0.0181	1.59		
			50.09	0.0200	1.75		
			53.36	0.0187	1.64		
			52.78	0.0189	1.66		
N ₂	50	1	67.07	0.0149	1.31	1.32	0.01
			65.67	0.0152	1.33		
			66.34	0.0151	1.32		
			66.16	0.0151	1.32		
			65.82	0.0152	1.33		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 13.17$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 16.32$$

Table B3 10%AC/SR/CA

membrane thickness : 242 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.23	0.3096	27.10	26.54	0.68
			3.45	0.2899	25.37		
			3.25	0.3077	26.93		
			3.28	0.3049	26.69		
			3.29	0.3040	26.60		
CH ₄	50	1	33.47	0.0299	2.62	2.61	0.02
			33.96	0.0294	2.58		
			33.57	0.0298	2.61		
			33.46	0.0299	2.62		
			33.52	0.0298	2.61		
N ₂	50	1	48.51	0.0206	1.80	1.81	0.01
			48.20	0.0207	1.82		
			48.46	0.0206	1.81		
			48.59	0.0206	1.80		
			48.70	0.0205	1.80		
CO ₂ selectivity =				10.19			
CH ₄							
CO ₂ selectivity =				14.70			
N ₂							

Table B4 20%AC/SR/CA

membrane thickness : 201 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	2.87	0.3484	30.50	30.06	0.39
			2.91	0.3436	30.08		
			2.95	0.3390	29.67		
			2.95	0.3390	29.67		
			2.88	0.3472	30.39		
CH ₄	50	1	38.89	0.0257	2.25	2.24	0.02
			39.18	0.0255	2.23		
			39.54	0.0253	2.21		
			38.64	0.0259	2.27		
			39.38	0.0254	2.22		
N ₂	50	1	53.61	0.0187	1.63	1.63	0.01
			54.01	0.0185	1.62		
			53.60	0.0187	1.63		
			53.87	0.0186	1.62		
			53.63	0.0186	1.63		
CO ₂ selectivity =				13.44			
CH ₄							
CO ₂ selectivity =				18.46			
N ₂							

Table B5 30%AC/SR/CA

membrane thickness : 244 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	4.10	0.2439	21.35	21.29	0.18
			4.08	0.2451	21.45		
			4.15	0.2410	21.09		
			4.15	0.2410	21.09		
			4.08	0.2451	21.45		
CH ₄	50	1	50.94	0.0196	1.72	1.74	0.01
			49.87	0.0201	1.76		
			50.26	0.0199	1.74		
			50.43	0.0198	1.74		
			50.58	0.0198	1.73		
N ₂	50	1	56.10	0.0178	1.56	1.55	0.01
			56.32	0.0178	1.55		
			56.59	0.0177	1.55		
			56.57	0.0177	1.55		
			56.40	0.0177	1.55		
CO ₂ selectivity =				12.26			
CH ₄							
CO ₂ selectivity =				13.72			
N ₂							

Table B6 10%PEG/30%AC/SR/CA

membrane thickness : 244 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	4.13	0.2421	21.19	20.97	0.24
			4.23	0.2364	20.69		
			4.12	0.2427	21.24		
			4.20	0.2381	20.84		
			4.19	0.2387	20.89		
CH ₄	50	1	36.23	0.0276	2.42	2.41	0.01
			36.15	0.0277	2.42		
			36.45	0.0274	2.40		
			36.56	0.0274	2.39		
			36.55	0.0274	2.39		
N ₂	50	1	62.29	0.0161	1.41	1.39	0.01
			63.48	0.0158	1.38		
			63.13	0.0158	1.39		
			62.18	0.0161	1.41		
			63.47	0.0158	1.38		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 8.72$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 15.07$$

Table B7 20%PEG/30%AC/SR/CA

membrane thickness : 251 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	4.97	0.2012	17.61	17.61	0.33
			5.01	0.1996	17.47		
			4.83	0.2070	18.12		
			4.97	0.2012	17.61		
			5.08	0.1969	17.23		
CH ₄	50	1	78.13	0.0128	1.12	1.12	0.00
			78.20	0.0128	1.12		
			78.25	0.0128	1.12		
			78.10	0.0128	1.12		
			78.13	0.0128	1.12		
N ₂	50	1	125.84	0.0079	0.70	0.68	0.01
			130.99	0.0076	0.67		
			131.95	0.0076	0.66		
			127.10	0.0079	0.69		
			128.23	0.0078	0.68		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 15.72$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 25.91$$

Table B8 30%PEG/30%AC/SR/CA

membrane thickness : 229 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	5.98	0.1672	14.64	14.93	0.33
			5.79	0.1727	15.12		
			5.97	0.1675	14.66		
			5.91	0.1692	14.81		
			5.68	0.1761	15.41		
CH ₄	50	1	95.23	0.0105	0.92	0.92	0.01
			95.25	0.0105	0.92		
			94.51	0.0106	0.93		
			94.46	0.0106	0.93		
			96.84	0.0103	0.90		
N ₂	50	1	173.33	0.0058	0.50	0.49	0.01
			178.91	0.0056	0.49		
			180.03	0.0056	0.49		
			182.08	0.0055	0.48		
			175.44	0.0057	0.50		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 16.24$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 30.34$$

Table B9 10%DEA/30%AC/SR/CA

membrane thickness : 262 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	35.83	0.2791	24.43	24.17	0.42
			35.47	0.2819	24.68		
			37.13	0.2693	23.57		
			36.21	0.2762	24.17		
			36.47	0.2742	24.00		
CH ₄	50	1	31.81	0.0314	2.75	2.73	0.03
			32.53	0.0307	2.69		
			31.75	0.0315	2.76		
			32.08	0.0312	2.73		
			32.18	0.0311	2.72		
N ₂	50	1	62.07	0.0161	1.41	1.41	0.01
			62.63	0.0160	1.40		
			62.69	0.0160	1.40		
			62.17	0.0161	1.41		
			61.49	0.0163	1.42		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 8.86$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 17.18$$

Table B10 20%DEA/30%AC/SR/CA

membrane thickness : 242 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	38.90	0.2571	22.50	22.48	0.04
			38.90	0.2571	22.50		
			38.85	0.2574	22.53		
			38.99	0.2565	22.45		
			39.01	0.2563	22.44		
CH ₄	50	1	37.54	0.0266	2.33	2.32	0.01
			37.45	0.0267	2.34		
			37.85	0.0264	2.31		
			37.80	0.0265	2.32		
			37.65	0.0266	2.32		
N ₂	50	1	67.40	0.0148	1.30	1.30	0.01
			67.12	0.0149	1.30		
			67.46	0.0148	1.30		
			66.63	0.0150	1.31		
			66.87	0.0150	1.31		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 9.67$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 17.23$$

Table B11 30%DEA/30%AC/SR/CA

membrane thickness : 212 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	39.30	0.2545	22.27	21.51	0.48
			40.42	0.2474	21.65		
			41.03	0.2437	21.33		
			41.57	0.2406	21.06		
			41.23	0.2425	21.23		
CH ₄	50	1	48.61	0.0206	1.80	1.80	0.01
			48.62	0.0206	1.80		
			48.92	0.0204	1.79		
			48.71	0.0205	1.80		
			48.84	0.0205	1.79		
N ₂	50	1	83.67	0.0120	1.05	1.05	0.00
			83.32	0.0120	1.05		
			83.05	0.0120	1.05		
			82.83	0.0121	1.06		
			82.73	0.0121	1.06		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 11.98$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 20.43$$

Table B12 10%NaX/SR/CA

membrane thickness : 157 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	22.3	0.4484	39.25	38.50	0.50
			23.1	0.4329	37.89		
			22.67	0.4411	38.61		
			22.89	0.4369	38.24		
			22.74	0.4398	38.49		
CH ₄	50	1	37.33	0.0268	2.34	2.39	0.04
			36.56	0.0274	2.39		
			36.96	0.0271	2.37		
			36.77	0.0272	2.38		
			35.89	0.0279	2.44		
N ₂	50	1	59.96	0.0167	1.46	1.49	0.02
			57.92	0.0173	1.51		
			58.57	0.0171	1.49		
			58.78	0.0170	1.49		
			59.14	0.0169	1.48		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 16.14$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 25.89$$

Table B13 20%NaX/SR/CA

membrane thickness : 223 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	44.3	0.2257	19.76	19.88	0.13
			44.35	0.2255	19.74		
			43.69	0.2289	20.03		
			43.97	0.2274	19.91		
			43.89	0.2278	19.94		
CH ₄	50	1	51.79	0.0193	1.69	1.68	0.01
			52.63	0.0190	1.66		
			52.37	0.0191	1.67		
			51.69	0.0193	1.69		
			52.29	0.0191	1.67		
N ₂	50	1	65.66	0.0152	1.33	1.33	0.01
			66.83	0.0150	1.31		
			65.67	0.0152	1.33		
			66.24	0.0151	1.32		
			65.23	0.0153	1.34		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 11.84$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 14.97$$

Table B14 30%NaX/SR/CA

membrane thickness : 225 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	10	56.59	0.1767	15.47	15.48	0.07
			56.16	0.1781	15.59		
			56.4	0.1773	15.52		
			56.83	0.1760	15.40		
			56.74	0.1762	15.43		
CH ₄	50	1	68.22	0.0147	1.28	1.28	0.00
			68.57	0.0146	1.28		
			68.33	0.0146	1.28		
			68.02	0.0147	1.29		
			68.55	0.0146	1.28		
N ₂	50	1	87.39	0.0114	1.00	1.00	0.00
			87.21	0.0115	1.00		
			87.63	0.0114	1.00		
			87.83	0.0114	1.00		
			87.34	0.0114	1.00		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 12.09$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 15.47$$

Table B15 10%PEG/10%NaX/SR/CA

membrane thickness : 252 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	5.1	0.1961	17.16	17.06	0.29
			5.01	0.1996	17.47		
			5.24	0.1908	16.70		
			5.13	0.1949	17.06		
			5.18	0.1931	16.90		
CH ₄	50	1	146.68	0.0068	0.60	0.61	0.01
			140.4	0.0071	0.62		
			142.1	0.0070	0.62		
			143.4	0.0070	0.61		
			144.58	0.0069	0.61		
N ₂	50	1	154.24	0.0065	0.57	0.58	0.01
			148.18	0.0067	0.59		
			150.74	0.0066	0.58		
			152.63	0.0066	0.57		
			149.64	0.0067	0.58		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 27.95$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 29.44$$

Table B16 20%PEG/10%NaX/SR/CA

membrane thickness : 224 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	7.74	0.1292	11.31	11.47	0.17
			7.53	0.1328	11.62		
			7.5	0.1333	11.67		
			7.67	0.1304	11.41		
			7.72	0.1295	11.34		
CH ₄	50	1	337.25	0.0030	0.26	0.27	0.01
			336.12	0.0030	0.26		
			326.06	0.0031	0.27		
			324.98	0.0031	0.27		
			321.19	0.0031	0.27		
N ₂	50	1	347.26	0.0029	0.25	0.26	0.01
			348.62	0.0029	0.25		
			358.61	0.0028	0.24		
			337.26	0.0030	0.26		
			319.2	0.0031	0.27		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 43.11$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 44.77$$

Table B17 30%PEG/10%NaX/SR/CA

membrane thickness : 238 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	10.25	0.0976	8.54	8.69	0.17
			10.31	0.0970	8.49		
			9.95	0.1005	8.80		
			9.83	0.1017	8.90		
			10.03	0.0997	8.73		
CH ₄	50	1	490.37	0.0020	0.18	0.17	0.02
			484.8	0.0021	0.18		
			616.98	0.0016	0.14		
			568.91	0.0018	0.15		
			500.12	0.0020	0.18		
N ₂	50	1	483.32	0.0021	0.18	0.17	0.01
			521.97	0.0019	0.17		
			504.45	0.0020	0.17		
			478.9	0.0021	0.18		
			538.81	0.0019	0.16		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 52.37$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 50.09$$

Table B18 30%PEG/5%NaX/SR/CA

membrane thickness : 280 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	13.84	0.0723	6.32	6.47	0.08
			13.52	0.0740	6.47		
			13.44	0.0744	6.51		
			13.43	0.0745	6.52		
			13.46	0.0743	6.50		
CH ₄	50	1	560.83	0.0018	0.16	0.15	0.00
			582.71	0.0017	0.15		
			600.9	0.0017	0.15		
			604.61	0.0017	0.14		
			586.97	0.0017	0.15		
N ₂	50	1	640.48	0.0016	0.14	0.14	0.00
			622.82	0.0016	0.14		
			632.36	0.0016	0.14		
			636.24	0.0016	0.14		
			628.48	0.0016	0.14		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 43.35$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 46.69$$

Table B19 30%PEG/15%NaX/SR/CA

membrane thickness : 191 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	10.63	0.0941	8.23	8.07	0.10
			10.93	0.0915	8.01		
			10.88	0.0919	8.04		
			10.85	0.0922	8.07		
			10.96	0.0912	7.99		
CH ₄	50	1	712.83	0.0014	0.12	0.13	0.00
			680.15	0.0015	0.13		
			713.6	0.0014	0.12		
			665.88	0.0015	0.13		
			731.95	0.0014	0.12		
N ₂	50	1	615.73	0.0016	0.14	0.13	0.01
			722.98	0.0014	0.12		
			709.86	0.0014	0.12		
			566.88	0.0018	0.15		
			704.95	0.0014	0.12		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 64.53$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 60.65$$

Table B20 30%PEG/20%NaX/SR/CA

membrane thickness : 249 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	25.59	0.0391	3.42	3.38	0.05
			26.18	0.0382	3.34		
			26.34	0.0380	3.32		
			26.02	0.0384	3.36		
			25.36	0.0394	3.45		
CH ₄	50	1	873.1	0.0011	0.10	0.09	0.00
			942.36	0.0011	0.09		
			914.23	0.0011	0.10		
			988.12	0.0010	0.09		
			954.29	0.0010	0.09		
N ₂	50	1	1048.16	0.0010	0.08	0.08	0.00
			1075.68	0.0009	0.08		
			1064.23	0.0009	0.08		
			1058.47	0.0009	0.08		
			1044.21	0.0010	0.08		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 36.03$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 40.86$$

Table B21 30%PEG/30%NaX/SR/CA

membrane thickness : 263 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	55.81	0.0179	1.57	1.62	0.03
			53.82	0.0186	1.63		
			53.44	0.0187	1.64		
			54.64	0.0183	1.60		
			52.92	0.0189	1.65		
CH ₄	50	1	893.28	0.0011	0.10	0.10	0.00
			928.87	0.0011	0.09		
			941.89	0.0011	0.09		
			884.62	0.0011	0.10		
			956.23	0.0010	0.09		
N ₂	50	1	1148.51	0.0009	0.08	0.07	0.00
			1232.48	0.0008	0.07		
			1264.44	0.0008	0.07		
			1276.93	0.0008	0.07		
			1185.14	0.0008	0.07		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 17.01$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 22.54$$

Table B22 10%DEA/10%NaX/SR/CA

membrane thickness : 221 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	2.43	0.4115	36.02	35.85	0.60
			2.48	0.4032	35.29		
			2.49	0.4016	35.15		
			2.4	0.4167	36.47		
			2.41	0.4149	36.32		
CH ₄	50	1	38.66	0.0259	2.26	2.29	0.02
			38.31	0.0261	2.28		
			37.87	0.0264	2.31		
			38.21	0.0262	2.29		
			37.88	0.0264	2.31		
N ₂	50	1	53.3	0.0188	1.64	1.62	0.01
			54.22	0.0184	1.61		
			53.67	0.0186	1.63		
			54.18	0.0185	1.62		
			54.01	0.0185	1.62		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 15.64$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 22.07$$

Table B23 20%DEA/10%NaX/SR/CA

membrane thickness : 228 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.33	0.3003	26.28	25.44	1.19
			3.47	0.2882	25.22		
			3.24	0.3086	27.01		
			3.58	0.2793	24.45		
			3.61	0.2770	24.25		
CH ₄	50	1	64.31	0.0155	1.36	1.35	0.01
			65.49	0.0153	1.34		
			64.69	0.0155	1.35		
			64.12	0.0156	1.37		
			64.49	0.0155	1.36		
N ₂	50	1	81.19	0.0123	1.08	1.09	0.01
			80.1	0.0125	1.09		
			80.64	0.0124	1.09		
			80.48	0.0124	1.09		
			80.91	0.0124	1.08		

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{CH}_4} = 18.78$$

$$\frac{\text{CO}_2 \text{ selectivity}}{\text{N}_2} = 23.45$$

Table B24 30%DEA/10%NnX/SR/CA

membrane thickness : 206 micron							
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.63	0.2755	24.11	23.53	0.81
			3.57	0.2801	24.52		
			3.87	0.2584	22.62		
			3.83	0.2611	22.85		
			3.72	0.2688	23.53		
CH ₄	50	1	85.29	0.0117	1.03	1.02	0.01
			85.27	0.0117	1.03		
			84.85	0.0118	1.03		
			86.51	0.0116	1.01		
			85.98	0.0116	1.02		
N ₂	50	1	102.67	0.0097	0.85	0.86	0.00
			102.96	0.0097	0.85		
			101.69	0.0098	0.86		
			101.81	0.0098	0.86		
			102.38	0.0098	0.85		

CO ₂ selectivity	=	23.00
CH ₄		
CO ₂ selectivity	=	27.50
N ₂		

Table B25 10%LiX/SR/CA

membrane thickness : 313 micron							
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.21	0.3115	28.60	28.95	0.36
			3.2	0.3125	28.70		
			3.19	0.3135	29.18		
			3.19	0.3135	28.79		
			3.21	0.3115	29.47		
CH ₄	50	1	36.15	0.0277	2.03	1.99	0.03
			35.68	0.0280	1.96		
			35.48	0.0282	2.01		
			35.71	0.0280	1.96		
			35.33	0.0283	1.97		
N ₂	50	1	61.2	0.0163	1.43	1.46	0.02
			60.94	0.0164	1.44		
			58.97	0.0170	1.48		
			59.62	0.0168	1.47		
			59.23	0.0169	1.48		

CO ₂ selectivity	=	11.15
CH ₄		
CO ₂ selectivity	=	18.74
N ₂		

Table B26 20%LiX/SR/CA

membrane thickness : 254 micron							
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	4.05	0.2469	21.61	21.43	0.32
			4.1	0.2439	21.35		
			4.18	0.2392	20.94		
			4.02	0.2488	21.77		
			4.08	0.2451	21.45		
CH ₄	50	1	41.56	0.0241	2.11	2.12	0.01
			41.23	0.0243	2.12		
			41.41	0.0241	2.11		
			40.89	0.0245	2.14		
			41.03	0.0244	2.13		
N ₂	50	1	63.23	0.0158	1.38	1.38	0.00
			63.5	0.0157	1.38		
			63.34	0.0158	1.38		
			63.74	0.0157	1.37		
			63.6	0.0157	1.38		

CO ₂ selectivity	=	10.09
CH ₄		
CO ₂ selectivity	=	15.54
N ₂		

Table B27 30%LiX/SR/CA

membrane thickness : 220 micron							
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	6.37	0.1570	13.74	13.72	0.18
			6.35	0.1575	13.78		
			6.44	0.1553	13.59		
			6.27	0.1595	13.96		
			6.48	0.1543	13.51		
CH ₄	50	1	53.2	0.0188	1.65	1.68	0.02
			51.41	0.0195	1.70		
			52.15	0.0192	1.68		
			51.69	0.0193	1.69		
			52.1	0.0192	1.68		
N ₂	50	1	64.3	0.0156	1.36	1.36	0.00
			64.12	0.0156	1.37		
			64.23	0.0156	1.36		
			64.15	0.0156	1.36		
			64.5	0.0155	1.36		
CO ₂ selectivity =				8.17			
CH ₄							
CO ₂ selectivity =				10.07			
N ₂							

Table B28 10%PEG/10%LiX/SR/CA

membrane thickness : 229 micron							
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	5.87	0.1704	14.91	14.93	0.12
			5.89	0.1698	14.86		
			5.78	0.1730	15.14		
			5.9	0.1695	14.84		
			5.88	0.1701	14.89		
CH ₄	50	1	138.11	0.0072	0.63	0.70	0.05
			124.44	0.0080	0.70		
			118.25	0.0085	0.74		
			134.48	0.0074	0.65		
			116.74	0.0086	0.75		
N ₂	50	1	221.25	0.0045	0.40	0.39	0.01
			218.56	0.0046	0.40		
			219.2	0.0046	0.40		
			218.67	0.0046	0.40		
			231.28	0.0043	0.38		
CO ₂ selectivity =				21.46			
CH ₄							
CO ₂ selectivity =				37.81			
N ₂							

Table B29 20%PEG/10%LiX/SR/CA

membrane thickness : 238 micron							
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	9.1	0.1099	9.62	9.13	0.33
			9.4	0.1064	9.31		
			9.81	0.1019	8.92		
			9.86	0.1014	8.88		
			9.83	0.1017	8.90		
CH ₄	50	1	318.91	0.0031	0.27	0.26	0.01
			341.08	0.0029	0.26		
			348.64	0.0029	0.25		
			326.21	0.0031	0.27		
			320.21	0.0031	0.27		
N ₂	50	1	377.96	0.0026	0.23	0.23	0.01
			391.45	0.0026	0.22		
			408.92	0.0024	0.21		
			381.44	0.0026	0.23		
			365.13	0.0027	0.24		
CO ₂ selectivity =				34.47			
CH ₄							
CO ₂ selectivity =				40.09			
N ₂							

Table B30 30%PEG/10%LiX/SR/CA

membrane thickness : 215 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	10.77	0.0929	8.13	8.26	0.09
			10.53	0.0950	8.31		
			10.46	0.0956	8.37		
			10.59	0.0944	8.27		
			10.67	0.0937	8.20		
CH ₄	50	1	440.08	0.0023	0.20	0.19	0.00
			451.62	0.0022	0.19		
			467.12	0.0021	0.19		
			459.18	0.0022	0.19		
			448.69	0.0022	0.20		
N ₂	50	1	408.42	0.0024	0.21	0.21	0.01
			421.88	0.0024	0.21		
			443.78	0.0023	0.20		
			428.65	0.0023	0.20		
			419.36	0.0024	0.21		

CO₂ selectivity = 42.74

CH₄

CO₂ selectivity = 40.00

N₂

Table B31 30%PEG/5%LiX/SR/CA

membrane thickness : 244 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	8.87	0.1127	9.87	9.77	0.13
			9.13	0.1095	9.59		
			8.86	0.1129	9.88		
			9.03	0.1107	9.69		
			8.92	0.1121	9.81		
CH ₄	50	1	360.41	0.0028	0.24	0.24	0.00
			353.11	0.0028	0.24		
			369.88	0.0027	0.24		
			358.12	0.0028	0.24		
			359.26	0.0028	0.24		
N ₂	50	1	362.44	0.0028	0.24	0.24	0.00
			356.04	0.0028	0.25		
			358.86	0.0028	0.24		
			361.65	0.0028	0.24		
			359.3	0.0028	0.24		

CO₂ selectivity = 40.41

CH₄

CO₂ selectivity = 40.14

N₂

Table B32 30%PEG/15%LiX/SR/CA

membrane thickness : 244 micron

Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	17.24	0.0580	5.08	5.13	0.07
			17.36	0.0576	5.04		
			16.82	0.0595	5.20		
			17.01	0.0588	5.15		
			16.97	0.0589	5.16		
CH ₄	50	1	601.44	0.0017	0.15	0.14	0.00
			640.92	0.0016	0.14		
			618.04	0.0016	0.14		
			631.26	0.0016	0.14		
			633.15	0.0016	0.14		
N ₂	50	1	772.89	0.0013	0.11	0.11	0.00
			788.11	0.0013	0.11		
			769.88	0.0013	0.11		
			776.13	0.0013	0.11		
			780.13	0.0013	0.11		

CO₂ selectivity = 36.58

CH₄

CO₂ selectivity = 45.52

N₂

Table B33 30%PEG/20%LiX/SR/CA

membrane thickness : 226 micron							
Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	25.38	0.0394	3.45	3.50	0.04
			25.17	0.0397	3.48		
			25.11	0.0398	3.49		
			24.73	0.0404	3.54		
			24.68	0.0405	3.55		
CH ₄	50	1	508.2	0.0020	0.17	0.17	0.00
			500.47	0.0020	0.17		
			524.81	0.0019	0.17		
			518.56	0.0019	0.17		
			520.45	0.0019	0.17		
N ₂	50	1	901.22	0.0011	0.10	0.10	0.00
			900.41	0.0011	0.10		
			899.25	0.0011	0.10		
			901.85	0.0011	0.10		
			900.21	0.0011	0.10		
CO ₂ selectivity =			20.56				
CH ₄							
CO ₂ selectivity =			36.01				
N ₂							

Table B34 30%PEG/30%LiX/SR/CA

membrane thickness : 230 micron							
Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	28.19	0.0355	3.10	3.08	0.04
			28.84	0.0347	3.03		
			28.11	0.0356	3.11		
			28.91	0.0346	3.03		
			28.06	0.0356	3.12		
CH ₄	50	1	544.86	0.0018	0.16	0.16	0.00
			577.81	0.0017	0.15		
			569.25	0.0018	0.15		
			550.78	0.0018	0.16		
			561.76	0.0018	0.16		
N ₂	50	1	910.87	0.0011	0.10	0.10	0.00
			909.3	0.0011	0.10		
			935.32	0.0011	0.09		
			924.12	0.0011	0.09		
			920.56	0.0011	0.10		
CO ₂ selectivity =			19.73				
CH ₄							
CO ₂ selectivity =			32.37				
N ₂							

Table B35 10%DEA/10%LiX/SR/CA

membrane thickness : 204 micron							
Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.05	0.3279	28.70	28.15	0.46
			3.17	0.3155	27.61		
			3.15	0.3175	27.79		
			3.07	0.3257	28.51		
			3.11	0.3215	28.14		
CH ₄	50	1	87.09	0.0115	1.01	1.00	0.00
			87.67	0.0114	1.00		
			87.33	0.0115	1.00		
			87.54	0.0114	1.00		
			86.84	0.0115	1.01		
N ₂	50	1	79.19	0.0126	1.11	1.12	0.01
			76.8	0.0130	1.14		
			78.32	0.0128	1.12		
			79.21	0.0126	1.11		
			78.58	0.0127	1.11		
CO ₂ selectivity =			28.07				
CH ₄							
CO ₂ selectivity =			25.22				
N ₂							

Table B36 20%DEA/10%LiX/SR/CA

membrane thickness : 205 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.5	0.2857	25.01	24.08	0.79
			3.77	0.2653	23.22		
			3.72	0.2688	23.53		
			3.53	0.2833	24.80		
			3.67	0.2725	23.85		
CH ₄	50	1	94.12	0.0106	0.93	0.93	0.01
			94.77	0.0106	0.92		
			93.29	0.0107	0.94		
			93.16	0.0107	0.94		
			93.45	0.0107	0.94		
N ₂	50	1	86.47	0.0116	1.01	1.02	0.00
			85.83	0.0117	1.02		
			85.47	0.0117	1.02		
			86.13	0.0116	1.02		
			86.07	0.0116	1.02		

$\frac{\text{CO}_2}{\text{CH}_4}$ selectivity = 25.79

$\frac{\text{CO}_2}{\text{N}_2}$ selectivity = 23.66

Table B37 30%DEA/10%LiX/SR/CA

membrane thickness : 211 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	3.76	0.2660	23.28	23.44	0.26
			3.79	0.2639	23.09		
			3.69	0.2710	23.72		
			3.73	0.2681	23.47		
			3.7	0.2703	23.66		
CH ₄	50	1	122.14	0.0082	0.72	0.72	0.01
			120.87	0.0083	0.72		
			121.44	0.0082	0.72		
			120.06	0.0083	0.73		
			122.96	0.0081	0.71		
N ₂	50	1	115.67	0.0086	0.76	0.75	0.00
			115.92	0.0086	0.76		
			116.08	0.0086	0.75		
			116.77	0.0086	0.75		
			116.14	0.0086	0.75		

$\frac{\text{CO}_2}{\text{CH}_4}$ selectivity = 32.54

$\frac{\text{CO}_2}{\text{N}_2}$ selectivity = 31.10

Table B38 30%DEA/10%NaX/SR/CA + H₂O

membrane thickness : 231 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	50	1	6.22	0.1608	14.07	13.85	0.19
			6.37	0.1570	13.74		
			6.38	0.1567	13.72		
			6.24	0.1603	14.03		
			6.4	0.1563	13.68		
CH ₄	50	1	154.45	0.0065	0.57	0.56	0.01
			158.67	0.0063	0.55		
			157.06	0.0064	0.56		
			157.12	0.0064	0.56		
			160.81	0.0062	0.54		
N ₂	50	1	169.97	0.0059	0.51	0.51	0.01
			168.67	0.0059	0.52		
			169.45	0.0059	0.52		
			175.47	0.0057	0.50		
			171.92	0.0058	0.51		

$\frac{\text{CO}_2}{\text{CH}_4}$ selectivity = 24.93

$\frac{\text{CO}_2}{\text{N}_2}$ selectivity = 27.06

Appendix C The Experimental Flow Rate of Carbon Dioxide (CO₂), Methane (CH₄) and Nitrogen (N₂) of Mixed Matrix Membranes in Separation Performance Study at Room Temperature and pressure 10-100 psia

Table C1 SR/CA

membrane thickness :		272		micron		Average of Permeance (GPU)	STDEV of Permeance
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)		
CO ₂	10	1	40.44	0.0247	10.82	10.65	0.12
		1	41.34	0.0242	10.59		
		1	41.63	0.0240	10.51		
		1	40.89	0.0245	10.70		
		1	41.12	0.0243	10.64		
	20	1	12.97	0.0771	16.87	16.88	0.08
		1	13.03	0.0767	16.79		
		1	12.87	0.0777	17.00		
		1	12.95	0.0772	16.90		
		1	13	0.0769	16.83		
	30	1	7.43	0.1346	19.63	19.62	0.08
		1	7.43	0.1346	19.63		
		1	7.44	0.1344	19.61		
		1	7.48	0.1337	19.50		
		1	7.4	0.1351	19.71		
	40	1	5.23	0.1912	20.92	20.70	0.17
		1	5.35	0.1869	20.45		
		1	5.28	0.1894	20.72		
		1	5.3	0.1887	20.64		
		1	5.27	0.1898	20.76		
50	1	4.09	0.2445	21.40	21.58	0.14	
	1	4.05	0.2469	21.61			
	1	4.07	0.2457	21.51			
	1	4.02	0.2488	21.77			
	1	4.05	0.2469	21.61			
CH ₄	10	1	636.67	0.0016	0.69	0.71	0.01
		1	616.11	0.0016	0.71		
		1	609.73	0.0016	0.72		
		1	622.87	0.0016	0.70		
		1	618.65	0.0016	0.71		
	20	1	189.54	0.0053	1.15	1.19	0.04
		1	188.23	0.0053	1.16		
		1	179.61	0.0056	1.22		
		1	175.6	0.0057	1.25		
		1	183.45	0.0055	1.19		
	30	1	103.59	0.0097	1.41	1.40	0.00
		1	104.22	0.0096	1.40		
		1	104.37	0.0096	1.40		
		1	103.93	0.0096	1.40		
		1	104.21	0.0096	1.40		
	40	1	73.65	0.0136	1.49	1.46	0.03
		1	73.51	0.0136	1.49		
		1	75.15	0.0133	1.46		
		1	74.61	0.0134	1.47		
		1	76.94	0.0130	1.42		
50	1	56.02	0.0179	1.56	1.64	0.07	
	1	55.21	0.0181	1.59			
	1	50.09	0.0200	1.75			
	1	53.36	0.0187	1.64			
	1	52.78	0.0189	1.66			
N ₂	10	1	385.41	0.0026	1.14	1.15	0.01
		1	381.11	0.0026	1.15		
		1	378.81	0.0026	1.16		
		1	382.43	0.0026	1.14		
		1	380.01	0.0026	1.15		
	20	1	185.62	0.0054	1.18	1.17	0.01
		1	187.54	0.0053	1.17		
		1	184.56	0.0054	1.19		
		1	186.12	0.0054	1.18		
		1	188.12	0.0053	1.16		
	30	1	121.15	0.0083	1.20	1.21	0.01
		1	120.12	0.0083	1.21		
		1	119.97	0.0083	1.22		
		1	119.64	0.0084	1.22		
		1	120.83	0.0083	1.21		
	40	1	88.65	0.0113	1.23	1.28	0.02
		1	84.62	0.0118	1.29		
		1	85.62	0.0117	1.28		
		1	84.56	0.0118	1.29		
		1	85	0.0118	1.29		
50	1	67.07	0.0149	1.31	1.32	0.01	
	1	65.67	0.0152	1.33			
	1	66.34	0.0151	1.32			
	1	66.16	0.0151	1.32			
	1	65.82	0.0152	1.33			

Table C2 20%AC/SR/CA

membrane thickness :		201		micron			
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	25.74	0.0389	17.00	16.83	0.15
		1	25.76	0.0388	16.99		
		1	26.2	0.0382	16.70		
		1	26.16	0.0382	16.73		
		1	26.19	0.0382	16.71		
	20	1	8.58	0.1166	25.50	25.56	0.20
		1	8.59	0.1164	25.47		
		1	8.55	0.1170	25.59		
		1	8.45	0.1183	25.90		
		1	8.63	0.1159	25.36		
	30	1	5.36	0.1866	27.22	28.05	0.56
		1	5.11	0.1957	28.55		
		1	5.17	0.1934	28.22		
		1	5.25	0.1905	27.79		
		1	5.12	0.1953	28.49		
	40	1	3.8	0.2632	28.79	28.72	0.35
		1	3.87	0.2584	28.27		
		1	3.82	0.2618	28.64		
		1	3.74	0.2674	29.25		
		1	3.82	0.2618	28.64		
50	1	2.87	0.3484	30.50	30.06	0.39	
	1	2.91	0.3436	30.08			
	1	2.95	0.3390	29.67			
	1	2.95	0.3390	29.67			
	1	2.88	0.3472	30.39			
CH ₄	10	1	203.12	0.0049	2.15	1.97	0.18
		1	228.23	0.0044	1.92		
		1	235.12	0.0043	1.86		
		1	203.3	0.0049	2.15		
		1	248.12	0.0040	1.76		
	20	1	102.3	0.0098	2.14	2.08	0.05
		1	109.32	0.0091	2.00		
		1	103.23	0.0097	2.12		
		1	104.59	0.0096	2.09		
		1	106.56	0.0094	2.05		
	30	1	72.87	0.0137	2.00	2.02	0.05
		1	73.46	0.0136	1.99		
		1	74.11	0.0135	1.97		
		1	70.45	0.0142	2.07		
		1	70.15	0.0143	2.08		
	40	1	49.53	0.0202	2.21	2.21	0.01
		1	49.81	0.0201	2.20		
		1	49.25	0.0203	2.22		
		1	49.44	0.0202	2.21		
		1	49.37	0.0203	2.22		
50	1	38.89	0.0257	2.25	2.24	0.02	
	1	39.18	0.0255	2.23			
	1	39.54	0.0253	2.21			
	1	38.64	0.0259	2.27			
	1	39.38	0.0254	2.22			
N ₂	10	1	300.44	0.0033	1.46	1.46	0.01
		1	301.87	0.0033	1.45		
		1	298.61	0.0033	1.47		
		1	299.88	0.0033	1.46		
		1	296.89	0.0034	1.47		
	20	1	129.18	0.0077	1.69	1.67	0.04
		1	128.61	0.0078	1.70		
		1	128.54	0.0078	1.70		
		1	135.63	0.0074	1.61		
		1	134.32	0.0074	1.63		
	30	1	84.08	0.0119	1.74	1.73	0.02
		1	85.08	0.0118	1.71		
		1	83.28	0.0120	1.75		
		1	84.32	0.0119	1.73		
		1	85.23	0.0117	1.71		
	40	1	63.79	0.0157	1.72	1.69	0.02
		1	64.1	0.0156	1.71		
		1	65.87	0.0152	1.66		
		1	65.28	0.0153	1.68		
		1	65.08	0.0154	1.68		
50	1	48.51	0.0206	1.80	1.81	0.01	
	1	48.2	0.0207	1.82			
	1	48.46	0.0206	1.81			
	1	48.59	0.0206	1.80			
	1	48.7	0.0205	1.80			

Table C3 10%PEG/20%AC/SR/CA

membrane thickness :

244 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	44.83	0.0223	9.76	9.76	0.12
		1	44.86	0.0223	9.76		
		1	44.51	0.0225	9.83		
		1	45.7	0.0219	9.58		
		1	44.25	0.0226	9.89		
	20	1	13.26	0.0754	16.50	15.48	0.62
		1	14.46	0.0692	15.13		
		1	14.33	0.0698	15.27		
		1	14.06	0.0711	15.56		
		1	14.66	0.0682	14.93		
	30	1	8.05	0.1242	18.12	18.16	0.13
		1	8.07	0.1239	18.08		
		1	8.1	0.1235	18.01		
		1	7.98	0.1253	18.28		
		1	7.97	0.1255	18.30		
	40	1	5.63	0.1776	19.43	19.31	0.33
		1	5.83	0.1715	18.77		
		1	5.67	0.1764	19.30		
		1	5.64	0.1773	19.40		
		1	5.57	0.1795	19.64		
50	1	4.13	0.2421	21.19	20.97	0.24	
	1	4.23	0.2364	20.69			
	1	4.12	0.2427	21.24			
	1	4.2	0.2381	20.84			
	1	4.19	0.2387	20.89			
CH ₄	10	1	150.58	0.0066	2.91	2.91	0.00
		1	150.6	0.0066	2.91		
		1	150.56	0.0066	2.91		
		1	150.56	0.0066	2.91		
		1	150.58	0.0066	2.91		
	20	1	88.23	0.0113	2.48	2.48	0.00
		1	88.25	0.0113	2.48		
		1	88.2	0.0113	2.48		
		1	87.96	0.0114	2.49		
		1	88.31	0.0113	2.48		
	30	1	56.1	0.0178	2.60	2.60	0.00
		1	56.08	0.0178	2.60		
		1	56.08	0.0178	2.60		
		1	56.16	0.0178	2.60		
		1	56.12	0.0178	2.60		
	40	1	41.53	0.0241	2.63	2.63	0.00
		1	41.5	0.0241	2.64		
		1	41.5	0.0241	2.64		
		1	41.58	0.0241	2.63		
		1	41.63	0.0240	2.63		
50	1	36.23	0.0276	2.42	2.41	0.01	
	1	36.15	0.0277	2.42			
	1	36.45	0.0274	2.40			
	1	36.56	0.0274	2.39			
	1	36.55	0.0274	2.39			
N ₂	10	1	341.23	0.0029	1.28	1.28	0.02
		1	335.14	0.0030	1.31		
		1	348.52	0.0029	1.26		
		1	338.25	0.0030	1.29		
		1	345.15	0.0029	1.27		
	20	1	167.56	0.0060	1.31	1.31	0.01
		1	165.25	0.0061	1.32		
		1	166.54	0.0060	1.31		
		1	168.47	0.0059	1.30		
		1	169.44	0.0059	1.29		
	30	1	111.89	0.0089	1.30	1.30	0.00
		1	112.08	0.0089	1.30		
		1	112.36	0.0089	1.30		
		1	111.68	0.0090	1.31		
		1	111.44	0.0090	1.31		
	40	1	80.56	0.0124	1.36	1.34	0.01
		1	81.23	0.0123	1.35		
		1	82.32	0.0121	1.33		
		1	81.65	0.0122	1.34		
		1	82.11	0.0122	1.33		
50	1	62.29	0.0161	1.41	1.39	0.01	
	1	63.48	0.0158	1.38			
	1	63.13	0.0158	1.39			
	1	62.18	0.0161	1.41			
	1	63.47	0.0158	1.38			

Table C4 20%PEG/20%AC/SR/CA

membrane thickness :

251

micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	56.73	0.0176	7.71	7.69	0.05
		1	56.81	0.0176	7.70		
		1	57.03	0.0175	7.67		
		1	57.43	0.0174	7.62		
		1	56.55	0.0177	7.74		
	20	1	17.31	0.0578	12.64	12.48	0.17
		1	17.37	0.0576	12.60		
		1	17.43	0.0574	12.55		
		1	17.71	0.0565	12.36		
		1	17.85	0.0560	12.26		
	30	1	9.31	0.1074	15.67	15.19	0.29
		1	9.55	0.1047	15.28		
		1	9.7	0.1031	15.04		
		1	9.73	0.1028	14.99		
		1	9.74	0.1027	14.98		
	40	1	6.59	0.1517	16.60	16.75	0.13
		1	6.57	0.1522	16.65		
		1	6.47	0.1546	16.91		
		1	6.54	0.1529	16.73		
		1	6.49	0.1541	16.86		
50	1	4.97	0.2012	17.61	17.61	0.33	
	1	5.01	0.1996	17.47			
	1	4.83	0.2070	18.12			
	1	4.97	0.2012	17.61			
	1	5.08	0.1969	17.23			
CH ₄	10	1	378.6	0.0026	1.16	1.16	0.00
		1	378.65	0.0026	1.16		
		1	378.61	0.0026	1.16		
		1	378.68	0.0026	1.16		
		1	378.66	0.0026	1.16		
	20	1	215.14	0.0046	1.02	1.02	0.00
		1	215.2	0.0046	1.02		
		1	215.18	0.0046	1.02		
		1	215.16	0.0046	1.02		
		1	215.21	0.0046	1.02		
	30	1	131.62	0.0076	1.11	1.11	0.00
		1	131.63	0.0076	1.11		
		1	131.6	0.0076	1.11		
		1	131.55	0.0076	1.11		
		1	131.59	0.0076	1.11		
	40	1	98.82	0.0101	1.11	1.11	0.00
		1	98.98	0.0101	1.11		
		1	99.03	0.0101	1.10		
		1	98.8	0.0101	1.11		
		1	98.88	0.0101	1.11		
50	1	78.13	0.0128	1.12	1.12	0.00	
	1	78.2	0.0128	1.12			
	1	78.25	0.0128	1.12			
	1	78.1	0.0128	1.12			
	1	78.13	0.0128	1.12			
N ₂	10	1	613.25	0.0016	0.71	0.71	0.01
		1	629.32	0.0016	0.70		
		1	615.21	0.0016	0.71		
		1	608.13	0.0016	0.72		
		1	637.23	0.0016	0.69		
	20	1	306.07	0.0033	0.71	0.72	0.00
		1	304.91	0.0033	0.72		
		1	306.86	0.0033	0.71		
		1	305.18	0.0033	0.72		
		1	306.07	0.0033	0.71		
	30	1	198.32	0.0050	0.74	0.72	0.01
		1	206.31	0.0048	0.71		
		1	204.22	0.0049	0.71		
		1	199.31	0.0050	0.73		
		1	200.35	0.0050	0.73		
	40	1	155.01	0.0065	0.71	0.69	0.01
		1	157.84	0.0063	0.69		
		1	158.77	0.0063	0.69		
		1	159.25	0.0063	0.69		
		1	157.81	0.0063	0.69		
50	1	125.84	0.0079	0.70	0.68	0.01	
	1	130.99	0.0076	0.67			
	1	131.95	0.0076	0.66			
	1	127.1	0.0079	0.69			
	1	128.23	0.0078	0.68			

Table C5 30%PEG/20%AC/SR/CA

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	83.86	0.0119	5.22	5.24	0.08
		1	83.94	0.0119	5.21		
		1	84.86	0.0118	5.16		
		1	81.44	0.0123	5.37		
		1	83.45	0.0120	5.24		
	20	1	20.29	0.0493	10.78	10.52	0.23
		1	20.4	0.0490	10.73		
		1	20.89	0.0479	10.47		
		1	21.33	0.0469	10.26		
		1	21.13	0.0473	10.36		
	30	1	11.65	0.0858	12.52	12.47	0.25
		1	11.46	0.0873	12.73		
		1	12.07	0.0829	12.09		
		1	11.56	0.0865	12.62		
		1	11.77	0.0850	12.39		
	40	1	7.95	0.1258	13.76	13.69	0.11
		1	7.97	0.1255	13.73		
		1	8.06	0.1241	13.57		
		1	8.06	0.1241	13.57		
		1	7.93	0.1261	13.80		
50	1	5.98	0.1672	14.64	14.93	0.33	
	1	5.79	0.1727	15.12			
	1	5.97	0.1675	14.66			
	1	5.91	0.1692	14.81			
	1	5.68	0.1761	15.41			
CH ₄	10	1	371.49	0.0027	1.18	1.18	0.01
		1	370.58	0.0027	1.18		
		1	376.88	0.0027	1.16		
		1	368.52	0.0027	1.19		
		1	374.12	0.0027	1.17		
	20	1	183.08	0.0055	1.20	1.19	0.01
		1	185.62	0.0054	1.18		
		1	183.64	0.0054	1.19		
		1	184.21	0.0054	1.19		
		1	184.06	0.0054	1.19		
	30	1	126.7	0.0079	1.15	1.15	0.01
		1	126.75	0.0079	1.15		
		1	126.81	0.0079	1.15		
		1	126.23	0.0079	1.16		
		1	125.44	0.0080	1.16		
	40	1	102.3	0.0098	1.07	1.07	0.00
		1	101.54	0.0098	1.08		
		1	102.2	0.0098	1.07		
		1	101.54	0.0098	1.08		
		1	102.53	0.0098	1.07		
50	1	95.23	0.0105	0.92	0.92	0.01	
	1	95.25	0.0105	0.92			
	1	94.51	0.0106	0.93			
	1	94.46	0.0106	0.93			
	1	96.84	0.0103	0.90			
N ₂	10	1	871.28	0.0011	0.50	0.48	0.01
		1	888.61	0.0011	0.49		
		1	923.81	0.0011	0.47		
		1	931.24	0.0011	0.47		
		1	905.14	0.0011	0.48		
	20	1	421.88	0.0024	0.52	0.50	0.01
		1	445.3	0.0022	0.49		
		1	438.81	0.0023	0.50		
		1	430.44	0.0023	0.51		
		1	440.85	0.0023	0.50		
	30	1	277.64	0.0036	0.53	0.57	0.05
		1	292.86	0.0034	0.50		
		1	248.69	0.0040	0.59		
		1	241.45	0.0041	0.60		
		1	238.11	0.0042	0.61		
	40	1	240.01	0.0042	0.46	0.47	0.01
		1	232.81	0.0043	0.47		
		1	236.44	0.0042	0.46		
		1	234.61	0.0043	0.47		
		1	222.81	0.0045	0.49		
50	1	173.33	0.0058	0.50	0.49	0.01	
	1	178.91	0.0056	0.49			
	1	180.03	0.0056	0.49			
	1	182.084	0.0055	0.48			
	1	175.44	0.0057	0.50			

Table C6 10%DEA/20%AC/SR/CA

membrane thickness :

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micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	23.74	0.0421	18.43	18.89	0.54
		1	23.32	0.0429	18.77		
		1	22.07	0.0453	19.83		
		1	23.33	0.0429	18.76		
		1	23.48	0.0426	18.64		
	20	1	10.33	0.0968	21.18	21.02	0.52
		1	10.73	0.0932	20.39		
		1	10.46	0.0956	20.92		
		1	10.52	0.0951	20.80		
		1	10.04	0.0996	21.79		
	30	10	58.02	0.1724	25.14	24.94	0.19
		10	59.19	0.1689	24.65		
		10	58.65	0.1705	24.87		
		10	58.42	0.1712	24.97		
		10	58.19	0.1719	25.07		
	40	10	42.69	0.2342	25.63	25.83	0.13
		10	42.12	0.2374	25.98		
		10	42.46	0.2355	25.77		
		10	42.33	0.2362	25.85		
		10	42.22	0.2369	25.91		
50	10	35.83	0.2791	24.43	24.17	0.42	
	10	35.47	0.2819	24.68			
	10	37.13	0.2693	23.57			
	10	36.21	0.2762	24.17			
	10	36.47	0.2742	24.00			
CH ₄	10	1	209.12	0.0048	2.09	2.08	0.01
		1	210.54	0.0047	2.08		
		1	211.18	0.0047	2.07		
		1	210.96	0.0047	2.07		
		1	211.13	0.0047	2.07		
	20	1	86.54	0.0116	2.53	2.53	0.02
		1	86.14	0.0116	2.54		
		1	87.23	0.0115	2.51		
		1	87.02	0.0115	2.51		
		1	86.01	0.0116	2.54		
	30	1	58.66	0.0170	2.49	2.50	0.02
		1	58.47	0.0171	2.49		
		1	58.75	0.0170	2.48		
		1	57.92	0.0173	2.52		
		1	58.06	0.0172	2.51		
	40	1	42.07	0.0238	2.60	2.58	0.01
		1	42.31	0.0236	2.59		
		1	42.64	0.0235	2.57		
		1	42.64	0.0235	2.57		
		1	42.41	0.0236	2.58		
50	1	31.81	0.0314	2.75	2.73	0.03	
	1	32.53	0.0307	2.69			
	1	31.75	0.0315	2.76			
	1	32.08	0.0312	2.73			
	1	32.18	0.0311	2.72			
N ₂	10	1	290.81	0.0034	1.50	1.46	0.04
		1	298.61	0.0033	1.47		
		1	295.86	0.0034	1.48		
		1	311.88	0.0032	1.40		
		1	304.63	0.0033	1.44		
	20	1	157.97	0.0063	1.39	1.36	0.01
		1	162.07	0.0062	1.35		
		1	159.61	0.0063	1.37		
		1	161.87	0.0062	1.35		
		1	160.11	0.0062	1.37		
	30	1	101.85	0.0098	1.43	1.44	0.00
		1	101.27	0.0099	1.44		
		1	101.5	0.0099	1.44		
		1	101.49	0.0099	1.44		
		1	101.64	0.0098	1.44		
	40	1	77.85	0.0128	1.41	1.42	0.01
		1	77.42	0.0129	1.41		
		1	76.93	0.0130	1.42		
		1	77.23	0.0129	1.42		
		1	77.08	0.0130	1.42		
50	1	62.07	0.0161	1.41	1.41	0.01	
	1	62.63	0.0160	1.40			
	1	62.69	0.0160	1.40			
	1	62.17	0.0161	1.41			
	1	61.49	0.0163	1.42			

Table C7 20%DEA/20%AC/SR/CA

membrane thickness :

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micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	27.42	0.0365	15.96	16.05	0.30
		1	26.89	0.0372	16.28		
		1	27.01	0.0370	16.20		
		1	28.11	0.0356	15.57		
		1	26.92	0.0371	16.26		
	20	1	10.65	0.0939	20.55	20.03	0.31
		1	11.03	0.0907	19.84		
		1	10.89	0.0918	20.09		
		1	11.02	0.0907	19.86		
		1	11.04	0.0906	19.82		
	30	10	64.23	0.1557	22.71	22.65	0.15
		10	63.84	0.1566	22.85		
		10	64.59	0.1548	22.59		
		10	65.02	0.1538	22.44		
		10	64.42	0.1552	22.65		
	40	10	48.51	0.2061	22.55	22.80	0.24
		10	47.23	0.2117	23.17		
		10	48.16	0.2076	22.72		
		10	48.25	0.2073	22.68		
		10	47.79	0.2092	22.89		
50	10	38.9	0.2571	22.50	22.48	0.04	
	10	38.9	0.2571	22.50			
	10	38.85	0.2574	22.53			
	10	38.99	0.2565	22.45			
	10	39.01	0.2563	22.44			
CH ₄	10	1	284.51	0.0035	1.54	1.54	0.01
		1	282.64	0.0035	1.55		
		1	284.1	0.0035	1.54		
		1	287.33	0.0035	1.52		
		1	284.75	0.0035	1.54		
	20	1	124.54	0.0080	1.76	1.77	0.01
		1	122.62	0.0082	1.78		
		1	123.84	0.0081	1.77		
		1	123.77	0.0081	1.77		
		1	124.24	0.0080	1.76		
	30	1	74.12	0.0135	1.97	1.96	0.00
		1	74.3	0.0135	1.96		
		1	74.28	0.0135	1.96		
		1	74.16	0.0135	1.97		
		1	74.41	0.0134	1.96		
	40	1	56.32	0.0178	1.94	1.94	0.00
		1	56.12	0.0178	1.95		
		1	56.3	0.0178	1.94		
		1	56.47	0.0177	1.94		
		1	56.33	0.0178	1.94		
50	1	37.54	0.0266	2.33	2.32	0.01	
	1	37.45	0.0267	2.34			
	1	37.85	0.0264	2.31			
	1	37.8	0.0265	2.32			
	1	37.65	0.0266	2.32			
N ₂	10	1	441.59	0.0023	0.99	0.96	0.04
		1	478.11	0.0021	0.92		
		1	468.13	0.0021	0.93		
		1	433.59	0.0023	1.01		
		1	472.63	0.0021	0.93		
	20	1	181.66	0.0055	1.20	1.19	0.01
		1	183.68	0.0054	1.19		
		1	186.41	0.0054	1.17		
		1	184.88	0.0054	1.18		
		1	183.23	0.0055	1.19		
	30	1	113.15	0.0088	1.29	1.29	0.03
		1	111.84	0.0089	1.30		
		1	118.18	0.0085	1.23		
		1	110.43	0.0091	1.32		
		1	112.68	0.0089	1.29		
	40	1	84.01	0.0119	1.30	1.30	0.00
		1	84.58	0.0118	1.29		
		1	84.43	0.0118	1.30		
		1	84.66	0.0118	1.29		
		1	84.36	0.0119	1.30		
50	1	67.4	0.0148	1.30	1.30	0.01	
	1	67.12	0.0149	1.30			
	1	67.46	0.0148	1.30			
	1	66.63	0.0150	1.31			
	1	66.87	0.0150	1.31			

Table C8 30%DEA/20%AC/SR/CA

Gas		membrane thickness :		212		micron	
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	32.64	0.0306	13.41	13.14	0.21
		1	33.18	0.0301	13.19		
		1	33.76	0.0296	12.96		
		1	33.97	0.0294	12.88		
		1	33.07	0.0302	13.23		
	20	1	12.1	0.0826	18.08	19.14	0.82
		1	11.86	0.0843	18.45		
		1	11.23	0.0890	19.49		
		1	10.99	0.0910	19.91		
		1	11.07	0.0903	19.77		
	30	10	66.92	0.1494	21.80	21.94	0.08
		10	66.41	0.1506	21.97		
		10	66.33	0.1508	21.99		
		10	66.52	0.1503	21.93		
		10	66.33	0.1508	21.99		
	40	10	50.33	0.1987	21.74	21.73	0.10
		10	50.19	0.1992	21.80		
		10	50.42	0.1983	21.70		
		10	50.69	0.1973	21.58		
		10	50.08	0.1997	21.85		
50	10	39.3	0.2545	22.27	21.51	0.48	
	10	40.42	0.2474	21.65			
	10	41.03	0.2437	21.33			
	10	41.57	0.2406	21.06			
	10	41.23	0.2425	21.23			
CH ₄	10	1	317.38	0.0032	1.38	1.37	0.00
		1	318.42	0.0031	1.37		
		1	319.07	0.0031	1.37		
		1	318.11	0.0031	1.38		
		1	318.78	0.0031	1.37		
	20	1	137.06	0.0073	1.60	1.60	0.01
		1	135.48	0.0074	1.62		
		1	137.27	0.0073	1.59		
		1	136.39	0.0073	1.60		
		1	136.47	0.0073	1.60		
	30	1	85.65	0.0117	1.70	1.71	0.01
		1	84.68	0.0118	1.72		
		1	85.42	0.0117	1.71		
		1	84.99	0.0118	1.72		
		1	85.08	0.0118	1.71		
	40	1	64.24	0.0156	1.70	1.71	0.01
		1	64.46	0.0155	1.70		
		1	64.34	0.0155	1.70		
		1	63.87	0.0157	1.71		
		1	63.91	0.0156	1.71		
50	1	48.61	0.0206	1.80	1.80	0.01	
	1	48.62	0.0206	1.80			
	1	48.92	0.0204	1.79			
	1	48.71	0.0205	1.80			
	1	48.84	0.0205	1.79			
N ₂	10	1	463.61	0.0022	0.94	0.96	0.03
		1	452.92	0.0022	0.97		
		1	431.63	0.0023	1.01		
		1	473.85	0.0021	0.92		
		1	459.54	0.0022	0.95		
	20	1	222.84	0.0045	0.98	1.01	0.03
		1	210.18	0.0048	1.04		
		1	220.51	0.0045	0.99		
		1	212.18	0.0047	1.03		
		1	216.77	0.0046	1.01		
	30	1	187.9	0.0053	0.78	0.78	0.00
		1	187.53	0.0053	0.78		
		1	186.45	0.0054	0.78		
		1	186.87	0.0054	0.78		
		1	187.31	0.0053	0.78		
	40	1	100.64	0.0099	1.09	1.08	0.01
		1	101.86	0.0098	1.07		
		1	102.05	0.0098	1.07		
		1	102.28	0.0098	1.07		
		1	101.23	0.0099	1.08		
50	1	83.67	0.0120	1.05	1.05	0.00	
	1	83.32	0.0120	1.05			
	1	83.05	0.0120	1.05			
	1	82.83	0.0121	1.06			
	1	82.73	0.0121	1.06			

Table C9 10%NaX/SR/CA

membrane thickness :		252		micron			
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	23.84	0.0419	18.36	18.70	0.29
		1	22.99	0.0435	19.04		
		1	23.1	0.0433	18.95		
		1	23.45	0.0426	18.66		
		1	23.68	0.0422	18.48		
	20	1	8.84	0.1131	24.75	25.44	1.05
		1	8.99	0.1112	24.34		
		1	8.1	0.1235	27.01		
		1	8.45	0.1183	25.90		
		1	8.68	0.1152	25.21		
	30	10	43.86	0.2280	33.26	33.30	0.19
		10	43.53	0.2297	33.51		
		10	44.1	0.2268	33.08		
		10	43.98	0.2274	33.17		
		10	43.6	0.2294	33.46		
	40	10	29.55	0.3384	37.03	36.60	0.62
		10	29.53	0.3386	37.05		
		10	30.43	0.3286	35.95		
		10	29.51	0.3389	37.08		
		10	30.48	0.3281	35.90		
50	10	22.3	0.4484	39.25	38.50	0.50	
	10	23.1	0.4329	37.89			
	10	22.67	0.4411	38.61			
	10	22.89	0.4369	38.24			
	10	22.74	0.4398	38.49			
CH ₄	10	1	229.17	0.0044	1.91	1.93	0.04
		1	221.87	0.0045	1.97		
		1	223.07	0.0045	1.96		
		1	228.65	0.0044	1.91		
		1	232.98	0.0043	1.88		
	20	1	102.51	0.0098	2.13	2.13	0.00
		1	102.4	0.0098	2.14		
		1	102.85	0.0097	2.13		
		1	102.81	0.0097	2.13		
		1	102.38	0.0098	2.14		
	30	1	63.31	0.0158	2.30	2.30	0.00
		1	63.53	0.0157	2.30		
		1	63.4	0.0158	2.30		
		1	63.49	0.0158	2.30		
		1	63.28	0.0158	2.31		
	40	1	45.31	0.0221	2.41	2.41	0.01
		1	45.53	0.0220	2.40		
		1	45.4	0.0220	2.41		
		1	45.49	0.0220	2.41		
		1	45.28	0.0221	2.42		
50	1	37.33	0.0268	2.34	2.39	0.04	
	1	36.56	0.0274	2.39			
	1	36.96	0.0271	2.37			
	1	36.77	0.0272	2.38			
	1	35.89	0.0279	2.44			
N ₂	10	1	336.1	0.0030	1.30	1.30	0.01
		1	335.67	0.0030	1.30		
		1	336.43	0.0030	1.30		
		1	330.97	0.0030	1.32		
		1	338.55	0.0030	1.29		
	20	1	143.51	0.0070	1.52	1.44	0.05
		1	157.4	0.0064	1.39		
		1	152.76	0.0065	1.43		
		1	151.44	0.0066	1.44		
		1	155.65	0.0064	1.41		
	30	1	98.42	0.0102	1.48	1.48	0.01
		1	98.98	0.0101	1.47		
		1	98.5	0.0102	1.48		
		1	98.82	0.0101	1.48		
		1	98.11	0.0102	1.49		
	40	1	75.31	0.0133	1.45	1.45	0.00
		1	75.53	0.0132	1.45		
		1	75.4	0.0133	1.45		
		1	75.49	0.0132	1.45		
		1	75.28	0.0133	1.45		
50	1	59.96	0.0167	1.46	1.49	0.02	
	1	57.92	0.0173	1.51			
	1	58.57	0.0171	1.49			
	1	58.78	0.0170	1.49			
	1	59.14	0.0169	1.48			

Table C10 10%PEG/10%NaX/SR/CA

membrane thickness :		252		micron			
Gas	P (psia)	vol. (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	48.64	0.0206	9.00	9.19	0.25
		1	48.12	0.0208	9.09		
		1	46.51	0.0215	9.41		
		1	46.12	0.0217	9.49		
		1	48.98	0.0204	8.94		
	20	1	18.07	0.0553	12.11	12.08	0.30
		1	18.66	0.0536	11.73		
		1	17.56	0.0569	12.46		
		1	18.49	0.0541	11.83		
		1	17.84	0.0561	12.27		
	30	1	10.89	0.0918	13.40	13.47	0.08
		1	10.76	0.0929	13.56		
		1	10.89	0.0918	13.40		
		1	10.77	0.0929	13.55		
		1	10.84	0.0923	13.46		
	40	1	7.4	0.1351	14.79	14.75	0.08
		1	7.44	0.1344	14.71		
		1	7.44	0.1344	14.71		
		1	7.36	0.1359	14.87		
		1	7.45	0.1342	14.69		
	50	1	5.1	0.1961	17.16	17.06	0.29
		1	5.01	0.1996	17.47		
		1	5.24	0.1908	16.70		
		1	5.13	0.1949	17.06		
		1	5.18	0.1931	16.90		
	60	10	35.54	0.2814	20.52	20.82	0.37
		10	35.76	0.2796	20.40		
		10	35.06	0.2852	20.80		
		10	34.54	0.2895	21.12		
		10	34.32	0.2914	21.25		
70	10	27.67	0.3614	22.59	22.30	0.35	
	10	27.98	0.3574	22.34			
	10	28.56	0.3501	21.89			
	10	28.43	0.3517	21.99			
	10	27.56	0.3628	22.69			
80	10	21.67	0.4615	25.24	24.61	0.67	
	10	22.98	0.4352	23.81			
	10	21.56	0.4638	25.37			
	10	22.43	0.4458	24.39			
	10	22.56	0.4433	24.25			
90	10	18.08	0.5531	26.90	26.59	0.32	
	10	18.13	0.5516	26.82			
	10	18.2	0.5495	26.72			
	10	18.43	0.5426	26.38			
	10	18.6	0.5376	26.14			
100	10	15.08	0.6631	29.02	28.63	0.41	
	10	15.13	0.6609	28.93			
	10	15.2	0.6579	28.79			
	10	15.43	0.6481	28.36			
	10	15.6	0.6410	28.05			
CH ₄	30	1	407.1	0.0025	0.36	0.36	0.00
		1	405.49	0.0025	0.36		
		1	402.58	0.0025	0.36		
		1	404.56	0.0025	0.36		
		1	404.98	0.0025	0.36		
	50	1	146.68	0.0068	0.60	0.61	0.01
		1	140.4	0.0071	0.62		
		1	142.1	0.0070	0.62		
		1	143.4	0.0070	0.61		
		1	144.58	0.0069	0.61		
	60	1	131.16	0.0076	0.56	0.54	0.01
		1	135.04	0.0072	0.52		
		1	138.9	0.0072	0.53		
		1	135.46	0.0074	0.54		
		1	136.62	0.0073	0.53		
	80	1	88.47	0.0113	0.62	0.62	0.01
		1	89.6	0.0112	0.61		
		1	86.54	0.0116	0.63		
		1	87.26	0.0115	0.63		
		1	88.13	0.0113	0.62		
100	1	63.1	0.0158	0.69	0.68	0.01	
	1	64.54	0.0155	0.68			
	1	64.97	0.0154	0.67			
	1	63.59	0.0157	0.69			
	1	64.15	0.0156	0.68			

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
N ₂	30	1	266.83	0.0037	0.55	0.56	0.01
		1	260.11	0.0038	0.56		
		1	256.08	0.0039	0.57		
		1	262.35	0.0038	0.56		
		1	264.42	0.0038	0.55		
	50	1	154.24	0.0065	0.57	0.58	0.01
		1	148.18	0.0067	0.59		
		1	150.74	0.0066	0.58		
		1	152.63	0.0066	0.57		
		1	149.64	0.0067	0.58		
	60	1	122.48	0.0082	0.60	0.60	0.00
		1	122.15	0.0082	0.60		
		1	121.66	0.0082	0.60		
		1	121.96	0.0082	0.60		
		1	122.07	0.0082	0.60		
	80	1	94.15	0.0106	0.58	0.58	0.00
		1	95.98	0.0104	0.57		
		1	94.12	0.0106	0.58		
		1	94.59	0.0106	0.58		
		1	94.78	0.0106	0.58		
100	1	74.66	0.0134	0.59	0.59	0.00	
	1	74.86	0.0134	0.58			
	1	74.34	0.0135	0.59			
	1	74.02	0.0135	0.59			
	1	74.59	0.0134	0.59			

Table C11 20%PEG/10%NaX/SR/CA

membrane thickness: 244 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	103.76	0.0096	4.22	4.32	0.13
		1	104.81	0.0095	4.18		
		1	98.48	0.0102	4.44		
		1	98.25	0.0102	4.45		
		1	101.28	0.0099	4.32		
	20	1	46.96	0.0213	4.66	4.91	0.19
		1	42.44	0.0236	5.16		
		1	45.73	0.0219	4.79		
		1	43.98	0.0227	4.98		
		1	44.13	0.0227	4.96		
	30	1	19.6	0.0510	7.44	7.26	0.12
		1	20.38	0.0491	7.16		
		1	20.39	0.0490	7.15		
		1	19.94	0.0502	7.32		
		1	20.13	0.0497	7.25		
	40	1	13.81	0.0724	7.92	7.93	0.09
		1	13.68	0.0731	8.00		
		1	13.68	0.0731	8.00		
		1	14.05	0.0712	7.79		
		1	13.74	0.0728	7.96		
	50	1	7.74	0.1292	11.31	11.47	0.17
		1	7.53	0.1328	11.62		
		1	7.5	0.1333	11.67		
		1	7.67	0.1304	11.41		
		1	7.72	0.1295	11.34		
	60	10	49.86	0.2006	14.63	14.58	0.21
		10	49.87	0.2005	14.63		
		10	49.07	0.2038	14.86		
		10	50.98	0.1962	14.31		
		10	50.45	0.1982	14.46		
	70	10	36.54	0.2737	17.11	16.54	0.37
		10	37.5	0.2667	16.67		
		10	38.65	0.2587	16.18		
		10	38.06	0.2627	16.43		
		10	38.3	0.2611	16.32		
	80	10	28.78	0.3475	19.01	17.79	1.08
		10	30.05	0.3328	18.20		
		10	29.76	0.3360	18.38		
		10	32.2	0.3106	16.99		
		10	33.43	0.2991	16.36		
90	10	22.08	0.4529	22.02	20.32	1.20	
	10	24.76	0.4039	19.64			
	10	25.76	0.3882	18.88			
	10	23.3	0.4292	20.87			
	10	24.11	0.4148	20.17			
100	10	19.1	0.5236	22.91	22.97	0.25	
	10	18.76	0.5330	23.33			
	10	19.32	0.5176	22.65			
	10	19.13	0.5227	22.88			
	10	18.98	0.5269	23.06			

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CH ₄	30	1	384.65	0.0026	0.38	0.37	0.03
		1	409.31	0.0024	0.36		
		1	431.2	0.0023	0.34		
		1	416.3	0.0024	0.35		
		1	360.31	0.0028	0.40		
	50	1	337.25	0.0030	0.26	0.27	0.01
		1	336.12	0.0030	0.26		
		1	326.06	0.0031	0.27		
		1	324.98	0.0031	0.27		
		1	321.19	0.0031	0.27		
	60	1	244.88	0.0041	0.30	0.30	0.00
		1	244.96	0.0041	0.30		
		1	248.99	0.0040	0.29		
		1	250.64	0.0040	0.29		
		1	246.15	0.0041	0.30		
	80	1	192.84	0.0052	0.28	0.29	0.00
		1	187.13	0.0053	0.29		
		1	191.86	0.0052	0.29		
		1	190.15	0.0053	0.29		
		1	188.64	0.0053	0.29		
100	1	142.28	0.0070	0.31	0.31	0.00	
	1	142.85	0.0070	0.31			
	1	141.93	0.0070	0.31			
	1	142.01	0.0070	0.31			
	1	141.87	0.0070	0.31			
N ₂	30	1	479.77	0.0021	0.30	0.31	0.00
		1	463.81	0.0022	0.31		
		1	461.99	0.0022	0.32		
		1	462.65	0.0022	0.32		
		1	470.64	0.0021	0.31		
	50	1	347.26	0.0029	0.25	0.26	0.01
		1	348.62	0.0029	0.25		
		1	358.61	0.0028	0.24		
		1	337.26	0.0030	0.26		
		1	319.2	0.0031	0.27		
	60	1	234.23	0.0043	0.31	0.31	0.00
		1	238.26	0.0042	0.31		
		1	240.11	0.0042	0.30		
		1	236.18	0.0042	0.31		
		1	237.95	0.0042	0.31		
	80	1	171.23	0.0058	0.32	0.31	0.01
		1	183.61	0.0054	0.30		
		1	176.56	0.0057	0.31		
		1	172.32	0.0058	0.32		
		1	182.6	0.0055	0.30		
100	1	132.32	0.0076	0.33	0.33	0.00	
	1	136.8	0.0073	0.32			
	1	134.46	0.0074	0.33			
	1	133.51	0.0075	0.33			
	1	132.89	0.0075	0.33			

Table C12 30%PEG/10%NaX/SR/CA

membrane thickness: 238 micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	186.36	0.0054	2.35	2.38	0.12
		1	173.54	0.0058	2.52		
		1	177.84	0.0056	2.46		
		1	196.12	0.0051	2.23		
		1	189.11	0.0053	2.31		
	20	1	76	0.0132	2.88	2.88	0.06
		1	78.52	0.0127	2.79		
		1	73.74	0.0136	2.97		
		1	75.62	0.0132	2.89		
		1	76.41	0.0131	2.86		
	30	1	29.03	0.0344	5.03	5.02	0.00
		1	29.04	0.0344	5.02		
		1	29.03	0.0344	5.03		
		1	29.04	0.0344	5.02		
		1	29.03	0.0344	5.03		
	40	1	18.31	0.0546	5.98	6.03	0.04
		1	18.07	0.0553	6.05		
		1	17.99	0.0556	6.08		
		1	18.15	0.0551	6.03		
		1	18.23	0.0549	6.00		
50	1	10.25	0.0976	8.54	8.69	0.17	
	1	10.31	0.0970	8.49			
	1	9.95	0.1005	8.80			
	1	9.83	0.1017	8.90			
	1	10.03	0.0997	8.73			

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
	60	10	71.76	0.1394	10.16	9.95	0.13
		10	73.87	0.1354	9.87		
		10	73.5	0.1361	9.92		
		10	74.2	0.1348	9.83		
		10	73.18	0.1366	9.97		
	70	10	53.2	0.1880	11.75	11.43	0.24
		10	55.13	0.1814	11.34		
		10	55.09	0.1815	11.35		
		10	53.98	0.1853	11.58		
		10	56.13	0.1782	11.14		
	80	10	44.65	0.2240	12.25	11.68	0.34
		10	46.98	0.2129	11.64		
		10	47.87	0.2089	11.43		
		10	47.98	0.2084	11.40		
		10	46.87	0.2134	11.67		
	90	10	35.87	0.2788	13.56	13.72	0.21
		10	34.67	0.2884	14.03		
		10	35.7	0.2801	13.62		
		10	35.87	0.2788	13.56		
		10	35.07	0.2851	13.87		
100	10	24.1	0.4149	18.16	17.37	0.47	
	10	25.87	0.3865	16.92			
	10	25.23	0.3964	17.35			
	10	25.56	0.3912	17.12			
	10	25.3	0.3953	17.30			
CH ₄	30	1	633.12	0.0016	0.23	0.24	0.01
		1	584.61	0.0017	0.25		
		1	593.12	0.0017	0.25		
		1	620.1	0.0016	0.24		
		1	641.23	0.0016	0.23		
	50	1	490.37	0.0020	0.18	0.17	0.02
		1	484.8	0.0021	0.18		
		1	616.98	0.0016	0.14		
		1	568.91	0.0018	0.15		
		1	500.12	0.0020	0.18		
	60	1	400.87	0.0025	0.18	0.20	0.01
		1	371.71	0.0027	0.20		
		1	389.44	0.0026	0.19		
		1	348.52	0.0029	0.21		
		1	350.16	0.0029	0.21		
	80	1	276.18	0.0036	0.20	0.19	0.01
		1	296.82	0.0034	0.18		
		1	292.46	0.0034	0.19		
		1	286.14	0.0035	0.19		
		1	284.31	0.0035	0.19		
100	1	234.05	0.0043	0.19	0.18	0.00	
	1	240.28	0.0042	0.18			
	1	238.12	0.0042	0.18			
	1	241.13	0.0041	0.18			
	1	239.41	0.0042	0.18			
N ₂	30	1	748.41	0.0013	0.19	0.19	0.00
		1	760.81	0.0013	0.19		
		1	755.49	0.0013	0.19		
		1	758.91	0.0013	0.19		
		1	756.31	0.0013	0.19		
	50	1	483.32	0.0021	0.18	0.17	0.01
		1	521.97	0.0019	0.17		
		1	504.45	0.0020	0.17		
		1	478.9	0.0021	0.18		
		1	538.81	0.0019	0.16		
	60	1	358.92	0.0028	0.20	0.20	0.01
		1	370.56	0.0027	0.20		
		1	384.18	0.0026	0.19		
		1	364.59	0.0027	0.20		
		1	372.64	0.0027	0.20		
	80	1	318.29	0.0031	0.17	0.19	0.01
		1	284.58	0.0035	0.19		
		1	285.64	0.0035	0.19		
		1	284.56	0.0035	0.19		
		1	286.63	0.0035	0.19		
100	1	230.88	0.0043	0.19	0.19	0.00	
	1	232.17	0.0043	0.19			
	1	229.45	0.0044	0.19			
	1	228.61	0.0044	0.19			
	1	231.64	0.0043	0.19			

Table C13 10%DEA/10%NaX/SR/CA

Gas		membrane thickness :		221	micron			
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance	
CO ₂	10	1	46.12	0.0217	9.49	9.54	0.00	
		1	46.01	0.0217	9.51			
		1	45.25	0.0221	9.67			
		1	45.88	0.0218	9.54			
		1	46.21	0.0216	9.47			
	20	1	18.12	0.0552	12.08	11.64	0.31	
		1	18.45	0.0542	11.86			
		1	19.21	0.0521	11.39			
		1	19.06	0.0525	11.48			
		1	19.22	0.0520	11.39			
	30	1	9.58	0.1044	15.23	15.61	0.22	
		1	9.25	0.1081	15.77			
		1	9.32	0.1073	15.65			
		1	9.33	0.1072	15.64			
		1	9.25	0.1081	15.77			
	40	1	4.2	0.2381	26.05	25.71	0.40	
		1	4.26	0.2347	25.68			
		1	4.33	0.2309	25.27			
		1	4.18	0.2392	26.17			
		1	4.31	0.2320	25.39			
50	1	2.43	0.4115	36.02	35.85	0.60		
	1	2.48	0.4032	35.29				
	1	2.49	0.4016	35.15				
	1	2.4	0.4167	36.47				
	1	2.41	0.4149	36.32				
CH ₄	10	1	205.25	0.0049	2.13	2.12	0.01	
		1	208.25	0.0048	2.10			
		1	206.52	0.0048	2.12			
		1	206.33	0.0048	2.12			
		1	207.12	0.0048	2.11			
	20	1	99.66	0.0100	2.20	2.19	0.03	
		1	98.31	0.0102	2.23			
		1	101.87	0.0098	2.15			
		1	100.21	0.0100	2.18			
		1	99.88	0.0100	2.19			
	30	1	70.65	0.0142	2.06	2.07	0.01	
		1	70.48	0.0142	2.07			
		1	70.44	0.0142	2.07			
		1	69.98	0.0143	2.08			
		1	71.04	0.0141	2.05			
	40	1	53.25	0.0188	2.05	2.05	0.02	
		1	53.25	0.0188	2.05			
		1	53.52	0.0187	2.04			
		1	54.33	0.0184	2.01			
		1	53.12	0.0188	2.06			
50	1	38.66	0.0259	2.26	2.29	0.02		
	1	38.31	0.0261	2.28				
	1	37.87	0.0264	2.31				
	1	38.21	0.0262	2.29				
	1	37.88	0.0264	2.31				
N ₂	10	1	286.83	0.0035	1.53	1.53	0.02	
		1	290.11	0.0034	1.51			
		1	286.08	0.0035	1.53			
		1	282.35	0.0035	1.55			
		1	284.42	0.0035	1.54			
	20	1	133.3	0.0075	1.64	1.62	0.01	
		1	134.22	0.0075	1.63			
		1	135.67	0.0074	1.61			
		1	135.18	0.0074	1.62			
		1	136.01	0.0074	1.61			
	30	1	87.48	0.0114	1.67	1.67	0.01	
		1	86.15	0.0116	1.69			
		1	87.66	0.0114	1.66			
		1	87.96	0.0114	1.66			
		1	87.07	0.0115	1.68			
	40	1	64.15	0.0156	1.71	1.69	0.02	
		1	65.98	0.0152	1.66			
		1	64.12	0.0156	1.71			
		1	64.59	0.0155	1.69			
		1	64.78	0.0154	1.69			
50	1	53.3	0.0188	1.64	1.62	0.01		
	1	54.22	0.0184	1.61				
	1	53.67	0.0186	1.63				
	1	54.18	0.0185	1.62				
	1	54.01	0.0185	1.62				

Table C14 20%DEA/10%NaX/SR/CA

membrane thickness :

228

micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	121.36	0.0082	3.61	3.51	0.00
		1	125.26	0.0080	3.49		
		1	125.5	0.0080	3.49		
		1	125.54	0.0080	3.49		
		1	125.38	0.0080	3.49		
	20	1	36.89	0.0271	5.93	6.03	0.07
		1	35.78	0.0279	6.12		
		1	36.54	0.0274	5.99		
		1	36.13	0.0277	6.06		
		1	35.99	0.0278	6.08		
	30	1	18.36	0.0545	7.95	7.86	0.08
		1	18.45	0.0542	7.91		
		1	18.65	0.0536	7.82		
		1	18.52	0.0540	7.88		
		1	18.86	0.0530	7.73		
	40	1	7.36	0.1359	14.87	14.64	0.33
		1	7.25	0.1379	15.09		
		1	7.65	0.1307	14.30		
		1	7.53	0.1328	14.53		
		1	7.58	0.1319	14.43		
50	1	3.33	0.3003	26.28	25.44	1.19	
	1	3.47	0.2882	25.22			
	1	3.24	0.3086	27.01			
	1	3.58	0.2793	24.45			
	1	3.61	0.2770	24.25			
CH ₄	10	1	374.48	0.0027	1.17	1.17	0.03
		1	387.54	0.0026	1.13		
		1	366.52	0.0027	1.19		
		1	368.33	0.0027	1.19		
		1	368.25	0.0027	1.19		
	20	1	204.45	0.0049	1.07	1.08	0.01
		1	201.31	0.0050	1.09		
		1	200.87	0.0050	1.09		
		1	201.21	0.0050	1.09		
		1	204.88	0.0049	1.07		
	30	1	113.54	0.0088	1.28	1.28	0.03
		1	118.46	0.0084	1.23		
		1	110.25	0.0091	1.32		
		1	112.44	0.0089	1.30		
		1	114.56	0.0087	1.27		
	40	1	83.51	0.0120	1.31	1.31	0.01
		1	83.25	0.0120	1.31		
		1	83.32	0.0120	1.31		
		1	84.45	0.0118	1.30		
		1	83.12	0.0120	1.32		
50	1	64.31	0.0155	1.36	1.35	0.01	
	1	65.49	0.0153	1.34			
	1	64.69	0.0155	1.35			
	1	64.12	0.0156	1.37			
	1	64.49	0.0155	1.36			
N ₂	10	1	479.77	0.0021	0.91	0.94	0.01
		1	463.81	0.0022	0.94		
		1	461.99	0.0022	0.95		
		1	462.65	0.0022	0.95		
		1	470.64	0.0021	0.93		
	20	1	224.1	0.0045	0.98	0.98	0.03
		1	217.54	0.0046	1.01		
		1	216.98	0.0046	1.01		
		1	234.48	0.0043	0.93		
		1	228.46	0.0044	0.96		
	30	1	133.15	0.0075	1.10	1.07	0.02
		1	135.14	0.0073	1.07		
		1	135.65	0.0074	1.08		
		1	136.55	0.0073	1.07		
		1	138.54	0.0072	1.05		
	40	1	97.48	0.0103	1.12	1.13	0.01
		1	96.25	0.0104	1.14		
		1	97.6	0.0102	1.12		
		1	97.54	0.0103	1.12		
		1	96.07	0.0104	1.14		
50	1	81.19	0.0123	1.08	1.09	0.01	
	1	80.1	0.0125	1.09			
	1	80.64	0.0124	1.09			
	1	80.48	0.0124	1.09			
	1	80.91	0.0124	1.08			

Table C15 30%DEA/10%NaX/SR/CA

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	511.23	0.0020	0.86	0.84	0.00
		1	518.65	0.0019	0.84		
		1	536.41	0.0019	0.82		
		1	524.68	0.0019	0.83		
		1	521.26	0.0019	0.84		
	20	1	216.32	0.0046	1.01	1.04	0.10
		1	196.46	0.0051	1.11		
		1	223.15	0.0045	0.98		
		1	186.48	0.0054	1.17		
		1	234.65	0.0043	0.93		
	30	1	56.36	0.0177	2.59	2.42	0.13
		1	60.08	0.0166	2.43		
		1	64.38	0.0155	2.27		
		1	58.61	0.0171	2.49		
		1	62.36	0.0160	2.34		
	40	1	13.65	0.0733	8.02	7.95	0.11
		1	13.58	0.0736	8.06		
		1	14.05	0.0712	7.79		
		1	13.68	0.0731	8.00		
		1	13.88	0.0720	7.88		
50	1	3.63	0.2755	24.11	23.53	0.81	
	1	3.57	0.2801	24.52			
	1	3.87	0.2584	22.62			
	1	3.83	0.2611	22.85			
	1	3.72	0.2688	23.53			
CH ₄	10	1	633.12	0.0016	0.69	0.71	0.03
		1	584.61	0.0017	0.75		
		1	593.12	0.0017	0.74		
		1	620.1	0.0016	0.71		
		1	641.23	0.0016	0.68		
	20	1	264.48	0.0038	0.83	0.82	0.01
		1	270.54	0.0037	0.81		
		1	266.52	0.0038	0.82		
		1	268.33	0.0037	0.82		
		1	268.25	0.0037	0.82		
	30	1	163.57	0.0061	0.89	0.89	0.01
		1	164.25	0.0061	0.89		
		1	164.63	0.0061	0.89		
		1	162.15	0.0062	0.90		
		1	164.55	0.0061	0.89		
	40	1	108.45	0.0092	1.01	1.01	0.01
		1	108.66	0.0092	1.01		
		1	107.14	0.0093	1.02		
		1	107.56	0.0093	1.02		
		1	108.96	0.0092	1.00		
50	1	85.29	0.0117	1.03	1.02	0.01	
	1	85.27	0.0117	1.03			
	1	84.85	0.0118	1.03			
	1	86.51	0.0116	1.01			
	1	85.98	0.0116	1.02			
N ₂	10	1	748.41	0.0013	0.58	0.58	0.00
		1	760.81	0.0013	0.58		
		1	755.49	0.0013	0.58		
		1	758.91	0.0013	0.58		
		1	756.31	0.0013	0.58		
	20	1	358.92	0.0028	0.61	0.59	0.02
		1	370.56	0.0027	0.59		
		1	384.18	0.0026	0.57		
		1	364.59	0.0027	0.60		
		1	372.64	0.0027	0.59		
	30	1	221.9	0.0045	0.66	0.65	0.00
		1	224.41	0.0045	0.65		
		1	225.6	0.0044	0.65		
		1	223.25	0.0045	0.65		
		1	223.4	0.0045	0.65		
	40	1	148.6	0.0067	0.74	0.73	0.02
		1	144.52	0.0069	0.76		
		1	146.6	0.0068	0.75		
		1	156.54	0.0064	0.70		
		1	150.97	0.0066	0.72		
50	1	102.67	0.0097	0.85	0.86	0.00	
	1	102.96	0.0097	0.85			
	1	101.69	0.0098	0.86			
	1	101.81	0.0098	0.86			
	1	102.38	0.0098	0.85			

Table C16 10%LiX/SR/CA

membrane thickness :

313

micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	32.19	0.0311	13.60	13.35	0.25
		1	32.4	0.0309	13.51		
		1	33.77	0.0296	12.96		
		1	32.54	0.0307	13.45		
		1	33.01	0.0303	13.26		
	20	1	10.69	0.0935	20.47	20.31	0.13
		1	10.86	0.0921	20.15		
		1	10.82	0.0924	20.22		
		1	10.74	0.0931	20.37		
		1	10.75	0.0930	20.36		
	30	1	5.98	0.1672	24.39	24.28	0.31
		1	6.03	0.1658	24.19		
		1	6.06	0.1650	24.07		
		1	6.08	0.1645	23.99		
		1	5.89	0.1698	24.77		
	40	1	4.38	0.2283	24.98	25.46	0.43
		1	4.28	0.2336	25.56		
		1	4.27	0.2342	25.62		
		1	4.36	0.2294	25.09		
		1	4.2	0.2381	26.05		
50	1	3.21	0.3115	27.27	27.18	0.22	
	1	3.23	0.3096	27.10			
	1	3.26	0.3067	26.85			
	1	3.19	0.3135	27.44			
	1	3.21	0.3115	27.27			
CH ₄	10	1	639.86	0.0016	0.68	0.68	0.01
		1	648.51	0.0015	0.67		
		1	661.18	0.0015	0.66		
		1	651.23	0.0015	0.67		
		1	638.57	0.0016	0.69		
	20	1	139.77	0.0072	1.57	1.56	0.00
		1	140.81	0.0071	1.55		
		1	140.19	0.0071	1.56		
		1	140.2	0.0071	1.56		
		1	139.86	0.0072	1.56		
	30	1	74.28	0.0135	1.96	1.97	0.00
		1	74.22	0.0135	1.97		
		1	74.14	0.0135	1.97		
		1	74.31	0.0135	1.96		
		1	74.08	0.0135	1.97		
	40	1	49	0.0204	2.23	2.24	0.01
		1	48.86	0.0205	2.24		
		1	48.98	0.0204	2.23		
		1	49.23	0.0203	2.22		
		1	48.52	0.0206	2.25		
50	1	36.15	0.0277	2.42	2.45	0.02	
	1	35.68	0.0280	2.45			
	1	35.48	0.0282	2.47			
	1	35.71	0.0280	2.45			
	1	35.33	0.0283	2.48			
N ₂	10	1	321.71	0.0031	1.36	1.37	0.01
		1	320.63	0.0031	1.36		
		1	318.24	0.0031	1.38		
		1	320.49	0.0031	1.37		
		1	319.78	0.0031	1.37		
	20	1	158.61	0.0063	1.38	1.37	0.01
		1	160.18	0.0062	1.37		
		1	161.72	0.0062	1.35		
		1	159.62	0.0063	1.37		
		1	160.74	0.0062	1.36		
	30	1	98.1	0.0102	1.49	1.49	0.00
		1	97.59	0.0102	1.49		
		1	97.98	0.0102	1.49		
		1	98.06	0.0102	1.49		
		1	98.25	0.0102	1.48		
	40	1	71.68	0.0140	1.53	1.52	0.01
		1	72.66	0.0138	1.51		
		1	72.77	0.0137	1.50		
		1	72.04	0.0139	1.52		
		1	71.48	0.0140	1.53		
50	1	61.2	0.0163	1.43	1.46	0.02	
	1	60.94	0.0164	1.44			
	1	58.97	0.0170	1.48			
	1	59.62	0.0168	1.47			
	1	59.23	0.0169	1.48			

Table C17 10%PEG/10%LIX/SR/CA

membrane thickness :		229		micron			
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	122.44	0.0082	3.57	3.49	0.08
		1	129.49	0.0077	3.38		
		1	123.49	0.0081	3.54		
		1	125.12	0.0080	3.50		
		1	126.54	0.0079	3.46		
	20	1	19.57	0.0511	11.18	11.17	0.14
		1	19.23	0.0520	11.38		
		1	19.72	0.0507	11.10		
		1	19.88	0.0503	11.01		
		1	19.54	0.0512	11.20		
	30	1	9.96	0.1004	14.65	14.54	0.10
		1	9.98	0.1002	14.62		
		1	10.13	0.0987	14.40		
		1	10.02	0.0998	14.56		
		1	10.09	0.0991	14.46		
	40	1	7.41	0.1350	14.77	14.58	0.25
		1	7.54	0.1326	14.51		
		1	7.69	0.1300	14.23		
		1	7.36	0.1359	14.87		
		1	7.54	0.1326	14.51		
	50	1	5.87	0.1704	14.91	14.93	0.12
		1	5.89	0.1698	14.86		
		1	5.78	0.1730	15.14		
		1	5.9	0.1695	14.84		
		1	5.88	0.1701	14.89		
	60	10	45.87	0.2180	15.90	15.94	0.07
		10	45.87	0.2180	15.90		
		10	45.5	0.2198	16.03		
		10	45.57	0.2194	16.01		
		10	45.98	0.2175	15.86		
70	10	37.67	0.2655	16.60	16.61	0.09	
	10	37.98	0.2633	16.46			
	10	37.56	0.2662	16.65			
	10	37.43	0.2672	16.70			
	10	37.56	0.2662	16.65			
80	10	31.09	0.3216	17.60	17.32	0.17	
	10	31.87	0.3138	17.17			
	10	31.56	0.3169	17.33			
	10	31.78	0.3147	17.21			
	10	31.6	0.3165	17.31			
90	10	23.65	0.4228	20.56	20.51	0.12	
	10	23.65	0.4228	20.56			
	10	23.56	0.4244	20.64			
	10	23.9	0.4184	20.35			
	10	23.8	0.4202	20.43			
100	10	18.7	0.5348	23.40	22.53	0.66	
	10	19.98	0.5005	21.90			
	10	19.76	0.5061	22.15			
	10	19.78	0.5056	22.13			
	10	18.98	0.5269	23.06			
CH ₄	30	1	312.23	0.0032	0.47	0.52	0.03
		1	268.23	0.0037	0.54		
		1	269.48	0.0037	0.54		
		1	281.65	0.0036	0.52		
		1	276.18	0.0036	0.53		
	50	1	138.11	0.0072	0.63	0.70	0.05
		1	124.44	0.0080	0.70		
		1	118.25	0.0085	0.74		
		1	134.48	0.0074	0.65		
		1	116.74	0.0086	0.75		
	70	1	80.63	0.0124	0.78	0.78	0.01
		1	79.55	0.0126	0.79		
		1	80.48	0.0124	0.78		
		1	78.64	0.0127	0.80		
		1	79.78	0.0125	0.78		
	80	1	76.16	0.0131	0.72	0.71	0.00
		1	77.15	0.0130	0.71		
		1	77.12	0.0130	0.71		
		1	76.88	0.0130	0.71		
		1	77.17	0.0130	0.71		
100	1	68.12	0.0147	0.64	0.64	0.01	
	1	69.25	0.0144	0.63			
	1	67.13	0.0149	0.65			
	1	69.14	0.0145	0.63			
	1	68.45	0.0146	0.64			

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
N ₂	30	1	364.52	0.0027	0.40	0.40	0.01
		1	359.11	0.0028	0.41		
		1	369.41	0.0027	0.39		
		1	367.2	0.0027	0.40		
		1	371.28	0.0027	0.39		
	50	1	221.25	0.0045	0.40	0.39	0.01
		1	218.56	0.0046	0.40		
		1	219.2	0.0046	0.40		
		1	218.67	0.0046	0.40		
		1	231.28	0.0043	0.38		
	60	1	184.23	0.0054	0.40	0.41	0.01
		1	174.55	0.0057	0.42		
		1	175.65	0.0057	0.42		
		1	181.8	0.0055	0.40		
		1	179.36	0.0056	0.41		
	80	1	119.36	0.0084	0.46	0.46	0.00
		1	118.58	0.0084	0.46		
		1	120.4	0.0083	0.45		
		1	119.28	0.0084	0.46		
		1	120.58	0.0083	0.45		
100	1	87.32	0.0115	0.50	0.50	0.00	
	1	88.12	0.0113	0.50			
	1	87.59	0.0114	0.50			
	1	88.04	0.0114	0.50			
	1	88.14	0.0113	0.50			

Table C18 20%PEG/10%LiX/SR/CA

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	269.45	0.0037	1.62	1.68	0.04
		1	254.11	0.0039	1.72		
		1	255.63	0.0039	1.71		
		1	256.33	0.0039	1.71		
		1	265.48	0.0038	1.65		
	20	1	34.54	0.0290	6.34	6.61	0.26
		1	33.58	0.0298	6.52		
		1	33.95	0.0295	6.45		
		1	31.45	0.0318	6.96		
		1	32.15	0.0311	6.81		
	30	1	17.25	0.0580	8.46	8.05	0.25
		1	18.44	0.0542	7.91		
		1	18.51	0.0540	7.88		
		1	17.97	0.0556	8.12		
		1	18.49	0.0541	7.89		
	40	1	12.28	0.0814	8.91	8.83	0.22
		1	12.14	0.0824	9.01		
		1	12.6	0.0794	8.68		
		1	12.91	0.0779	8.52		
		1	12.15	0.0823	9.00		
	50	1	9.1	0.1099	9.62	9.13	0.33
		1	9.4	0.1064	9.31		
		1	9.81	0.1019	8.92		
		1	9.86	0.1014	8.88		
		1	9.83	0.1017	8.90		
	60	10	57.87	0.1728	12.60	12.59	0.12
		10	58.87	0.1699	12.39		
		10	57.5	0.1739	12.69		
		10	57.57	0.1737	12.67		
		10	57.98	0.1725	12.58		
	70	10	47.4	0.2110	13.19	13.07	0.10
		10	47.67	0.2098	13.12		
		10	48.34	0.2069	12.93		
		10	48.05	0.2081	13.01		
		10	47.67	0.2098	13.12		
	80	10	36.67	0.2727	14.92	14.93	0.08
		10	36.98	0.2704	14.79		
		10	36.56	0.2735	14.96		
		10	36.43	0.2745	15.02		
		10	36.56	0.2735	14.96		
90	10	29.76	0.3360	16.34	16.44	0.09	
	10	29.56	0.3383	16.45			
	10	29.7	0.3367	16.37			
	10	29.43	0.3398	16.52			
	10	29.4	0.3401	16.54			
100	10	23.96	0.4174	18.27	18.62	0.31	
	10	23.87	0.4189	18.33			
	10	23.25	0.4301	18.82			
	10	23.43	0.4268	18.68			
	10	23.06	0.4337	18.98			

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CH ₄	30	1	576.31	0.0017	0.25	0.26	0.01
		1	546.3	0.0018	0.27		
		1	551.45	0.0018	0.26		
		1	586.59	0.0017	0.25		
		1	594.54	0.0017	0.25		
	50	1	318.91	0.0031	0.27	0.26	0.01
		1	341.08	0.0029	0.26		
		1	348.64	0.0029	0.25		
		1	326.21	0.0031	0.27		
		1	320.21	0.0031	0.27		
	60	1	300.82	0.0033	0.21	0.21	0.00
		1	305.14	0.0033	0.20		
		1	294.26	0.0034	0.21		
		1	296.14	0.0034	0.21		
		1	297.56	0.0034	0.21		
	80	1	208.11	0.0048	0.26	0.26	0.01
		1	213.54	0.0047	0.26		
		1	214.58	0.0047	0.25		
		1	205.41	0.0049	0.27		
		1	206.4	0.0048	0.27		
100	1	165.32	0.0060	0.26	0.26	0.01	
	1	163.22	0.0061	0.27			
	1	171.59	0.0058	0.26			
	1	168.47	0.0059	0.26			
	1	162.78	0.0061	0.27			
N ₂	30	1	614.2	0.0016	0.24	0.24	0.00
		1	608.25	0.0016	0.24		
		1	611.87	0.0016	0.24		
		1	615.6	0.0016	0.24		
		1	623.41	0.0016	0.23		
	50	1	377.96	0.0026	0.23	0.23	0.01
		1	391.45	0.0026	0.22		
		1	408.92	0.0024	0.21		
		1	381.44	0.0026	0.23		
		1	365.13	0.0027	0.24		
	60	1	316.43	0.0032	0.23	0.23	0.01
		1	340.18	0.0029	0.21		
		1	310.84	0.0032	0.23		
		1	321.49	0.0031	0.23		
		1	308.61	0.0032	0.24		
	80	1	278.23	0.0036	0.20	0.20	0.01
		1	265.14	0.0038	0.21		
		1	281.45	0.0036	0.19		
		1	263.48	0.0038	0.21		
		1	274.34	0.0036	0.20		
100	1	221.81	0.0045	0.20	0.19	0.01	
	1	243.25	0.0041	0.18			
	1	238.56	0.0042	0.18			
	1	214.66	0.0047	0.20			
	1	225.6	0.0044	0.19			

Table C19 30%PEG/10%LIX/SR/CA

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	364.11	0.0027	1.20	1.21	0.01
		1	356.23	0.0028	1.23		
		1	361.49	0.0028	1.21		
		1	358.64	0.0028	1.22		
		1	362.59	0.0028	1.21		
	20	1	37.08	0.0270	5.90	5.75	0.12
		1	38.51	0.0260	5.68		
		1	39.02	0.0256	5.61		
		1	37.49	0.0267	5.84		
		1	38.26	0.0261	5.72		
	30	1	20.67	0.0484	7.06	7.09	0.04
		1	20.68	0.0484	7.05		
		1	20.61	0.0485	7.08		
		1	20.39	0.0490	7.15		
		1	20.49	0.0488	7.12		
	40	1	13.87	0.0721	7.89	7.85	0.11
		1	14.16	0.0706	7.73		
		1	13.67	0.0732	8.00		
		1	13.98	0.0715	7.83		
		1	14.05	0.0712	7.79		
50	1	10.77	0.0929	8.13	8.26	0.09	
	1	10.53	0.0950	8.31			
	1	10.46	0.0956	8.37			
	1	10.59	0.0944	8.27			
	1	10.67	0.0937	8.20			

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	60	10	79.76	0.1254	9.14	9.15	0.19
		10	77.32	0.1293	9.43		
		10	81.7	0.1224	8.93		
		10	80.6	0.1241	9.05		
		10	79.54	0.1257	9.17		
	70	10	66.1	0.1513	9.46	9.27	0.25
		10	65.09	0.1536	9.61		
		10	68.76	0.1454	9.09		
		10	68.5	0.1460	9.13		
		10	69.11	0.1447	9.05		
	80	10	46.1	0.2169	11.87	11.79	0.08
		10	46.09	0.2170	11.87		
		10	46.8	0.2137	11.69		
		10	46.54	0.2149	11.75		
		10	46.5	0.2151	11.76		
	90	10	33.76	0.2962	14.40	14.69	0.16
		10	32.9	0.3040	14.78		
		10	32.98	0.3032	14.74		
		10	33.04	0.3027	14.72		
		10	32.87	0.3042	14.79		
100	10	27.8	0.3597	15.74	16.10	0.30	
	10	26.5	0.3774	16.51			
	10	26.98	0.3706	16.22			
	10	27.13	0.3686	16.13			
	10	27.56	0.3628	15.88			
CH ₄	50	1	440.08	0.0023	0.20	0.19	0.00
		1	451.62	0.0022	0.19		
		1	467.12	0.0021	0.19		
		1	459.18	0.0022	0.19		
		1	448.69	0.0022	0.20		
	60	1	394.88	0.0025	0.18	0.19	0.01
		1	362.6	0.0028	0.20		
		1	370.87	0.0027	0.20		
		1	384.69	0.0026	0.19		
		1	369.58	0.0027	0.20		
	80	1	219.8	0.0045	0.25	0.25	0.01
		1	216.29	0.0046	0.25		
		1	232	0.0043	0.24		
		1	224.69	0.0045	0.24		
		1	221.69	0.0045	0.25		
	100	1	152.9	0.0065	0.29	0.28	0.00
		1	158.1	0.0063	0.28		
		1	155.97	0.0064	0.28		
		1	157.15	0.0064	0.28		
		1	154.69	0.0065	0.28		
N ₂	30	1	653.84	0.0015	0.22	0.22	0.00
		1	658.83	0.0015	0.22		
		1	661.25	0.0015	0.22		
		1	659.25	0.0015	0.22		
		1	660.29	0.0015	0.22		
	50	1	408.42	0.0024	0.21	0.21	0.01
		1	421.88	0.0024	0.21		
		1	443.78	0.0023	0.20		
		1	428.65	0.0023	0.20		
		1	419.36	0.0024	0.21		
	60	1	326.79	0.0031	0.22	0.21	0.01
		1	347.21	0.0029	0.21		
		1	359.11	0.0028	0.20		
		1	350.26	0.0029	0.21		
		1	337.69	0.0030	0.22		
	80	1	277.59	0.0036	0.20	0.19	0.00
		1	281.28	0.0036	0.19		
		1	285.77	0.0035	0.19		
		1	279.24	0.0036	0.20		
		1	283.16	0.0035	0.19		
100	1	193.87	0.0052	0.23	0.23	0.00	
	1	190.32	0.0053	0.23			
	1	191.65	0.0052	0.23			
	1	190.69	0.0052	0.23			
	1	192.69	0.0052	0.23			

Table C20 10%DEA/10%LiX/SR/CA

Gas		membrane thickness :		204		micron			
Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance		
CO ₂	10	1	28.92	0.0346	15.13	15.36	0.15		
		1	28.17	0.0355	15.54				
		1	28.61	0.0350	15.30				
		1	28.34	0.0353	15.44				
		1	28.47	0.0351	15.37				
	20	1	10.02	0.0998	21.84	21.61	0.19		
		1	10.26	0.0975	21.33				
		1	10.1	0.0990	21.67				
		1	10.16	0.0984	21.54				
		1	10.09	0.0991	21.69				
	30	1	5.8	0.1724	25.15	25.16	0.14		
		1	5.79	0.1727	25.20				
		1	5.83	0.1715	25.02				
		1	5.75	0.1739	25.37				
		1	5.82	0.1718	25.07				
	40	1	3.99	0.2506	27.42	27.41	0.34		
		1	3.93	0.2545	27.84				
		1	4.07	0.2457	26.88				
		1	3.98	0.2513	27.49				
		1	3.99	0.2506	27.42				
50	1	3.05	0.3279	28.70	28.15	0.46			
	1	3.17	0.3155	27.61					
	1	3.15	0.3175	27.79					
	1	3.07	0.3257	28.51					
	1	3.11	0.3215	28.14					
CH ₄	20	1	341.87	0.0029	0.64	0.64	0.00		
		1	336.11	0.0030	0.65				
		1	340.81	0.0029	0.64				
		1	338.26	0.0030	0.65				
		1	339.46	0.0029	0.64				
	30	1	168.51	0.0059	0.87	0.87	0.00		
		1	166.89	0.0060	0.87				
		1	169.13	0.0059	0.86				
		1	168.59	0.0059	0.87				
		1	168.45	0.0059	0.87				
	40	1	100.86	0.0099	1.08	1.08	0.01		
		1	101.86	0.0098	1.07				
		1	100.27	0.0100	1.09				
		1	100.77	0.0099	1.09				
		1	101.14	0.0099	1.08				
	50	1	87.09	0.0115	1.01	1.00	0.00		
		1	87.67	0.0114	1.00				
		1	87.33	0.0115	1.00				
		1	87.54	0.0114	1.00				
		1	86.84	0.0115	1.01				
N ₂	10	1	445.84	0.0022	0.98	0.98	0.01		
		1	448.52	0.0022	0.98				
		1	440.12	0.0023	0.99				
		1	446.47	0.0022	0.98				
		1	443.28	0.0023	0.99				
	20	1	200.85	0.0050	1.09	1.09	0.00		
		1	200.22	0.0050	1.09				
		1	201.45	0.0050	1.09				
		1	201.12	0.0050	1.09				
		1	200.69	0.0050	1.09				
	30	1	130.45	0.0077	1.12	1.11	0.01		
		1	132.4	0.0076	1.10				
		1	131.71	0.0076	1.11				
		1	132.04	0.0076	1.10				
		1	131.57	0.0076	1.11				
	40	1	97.82	0.0102	1.12	1.12	0.01		
		1	98.44	0.0102	1.11				
		1	97.18	0.0103	1.13				
		1	98.24	0.0102	1.11				
		1	97.94	0.0102	1.12				
50	1	79.19	0.0126	1.11	1.12	0.01			
	1	76.8	0.0130	1.14					
	1	78.32	0.0128	1.12					
	1	79.21	0.0126	1.11					
	1	78.58	0.0127	1.11					

Table C21 20%DEA/10%LiX/SR/CA

membrane thickness :

205

micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	34.25	0.0292	12.78	12.35	0.44
		1	34.36	0.0291	12.74		
		1	37.33	0.0268	11.72		
		1	36.08	0.0277	12.13		
		1	35.28	0.0283	12.40		
	20	1	11.59	0.0863	18.88	19.11	0.40
		1	11.29	0.0886	19.38		
		1	11.59	0.0863	18.88		
		1	11.67	0.0857	18.75		
		1	11.12	0.0899	19.68		
	30	1	6.56	0.1524	22.24	21.87	0.22
		1	6.65	0.1504	21.94		
		1	6.72	0.1488	21.71		
		1	6.7	0.1493	21.77		
		1	6.72	0.1488	21.71		
	40	1	4.73	0.2114	23.13	23.29	0.27
		1	4.66	0.2146	23.48		
		1	4.7	0.2128	23.28		
		1	4.63	0.2160	23.63		
		1	4.77	0.2096	22.94		
50	1	3.5	0.2857	25.01	24.08	0.79	
	1	3.77	0.2653	23.22			
	1	3.72	0.2688	23.53			
	1	3.53	0.2833	24.80			
	1	3.67	0.2725	23.85			
CH ₄	20	1	341.23	0.0029	0.64	0.65	0.01
		1	332.81	0.0030	0.66		
		1	340.12	0.0029	0.64		
		1	338.52	0.0030	0.65		
		1	336.45	0.0030	0.65		
	30	1	177.69	0.0056	0.82	0.83	0.02
		1	177.73	0.0056	0.82		
		1	177.81	0.0056	0.82		
		1	170.43	0.0059	0.86		
		1	175.48	0.0057	0.83		
	40	1	134.73	0.0074	0.81	0.82	0.00
		1	133.46	0.0075	0.82		
		1	134.52	0.0074	0.81		
		1	133.25	0.0075	0.82		
		1	134.06	0.0075	0.82		
	50	1	94.12	0.0106	0.93	0.93	0.01
1		94.77	0.0106	0.92			
1		93.29	0.0107	0.94			
1		93.16	0.0107	0.94			
1		93.45	0.0107	0.94			
N ₂	10	1	475.44	0.0021	0.92	0.92	0.00
		1	475.04	0.0021	0.92		
		1	473.82	0.0021	0.92		
		1	474.21	0.0021	0.92		
		1	475.69	0.0021	0.92		
	20	1	235.44	0.0042	0.93	0.94	0.01
		1	231.96	0.0043	0.94		
		1	228.82	0.0044	0.96		
		1	231.01	0.0043	0.95		
		1	232.65	0.0043	0.94		
	30	1	152.64	0.0066	0.96	0.96	0.01
		1	150.36	0.0067	0.97		
		1	151.28	0.0066	0.96		
		1	151.98	0.0066	0.96		
		1	150.49	0.0066	0.97		
	40	1	117.71	0.0085	0.93	0.80	0.17
		1	117.97	0.0085	0.93		
		1	117.62	0.0085	0.93		
		1	177.09	0.0056	0.62		
		1	177.84	0.0056	0.62		
50	1	86.47	0.0116	1.01	1.02	0.00	
	1	85.83	0.0117	1.02			
	1	85.47	0.0117	1.02			
	1	86.13	0.0116	1.02			
	1	86.07	0.0116	1.02			

Table C22 30%DEA/10%LIX/SR/CA

membrane thickness :

211

micron

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	38.84	0.0257	11.27	11.25	0.06
		1	38.61	0.0259	11.33		
		1	39.03	0.0256	11.21		
		1	38.96	0.0257	11.23		
		1	39.11	0.0256	11.19		
	20	1	11.94	0.0838	18.33	18.27	0.19
		1	12.03	0.0831	18.19		
		1	12.1	0.0826	18.08		
		1	11.78	0.0849	18.58		
		1	12.05	0.0830	18.16		
	30	1	6.94	0.1441	21.02	21.58	0.34
		1	6.71	0.1490	21.74		
		1	6.68	0.1497	21.84		
		1	6.69	0.1495	21.81		
		1	6.78	0.1475	21.52		
	40	1	4.82	0.2075	22.70	22.68	0.27
		1	4.87	0.2053	22.47		
		1	4.79	0.2088	22.84		
		1	4.89	0.2045	22.37		
		1	4.75	0.2105	23.03		
50	1	3.76	0.2660	23.28	23.44	0.26	
	1	3.79	0.2639	23.09			
	1	3.69	0.2710	23.72			
	1	3.73	0.2681	23.47			
	1	3.7	0.2703	23.66			
CH ₄	20	1	561.28	0.0018	0.39	0.39	0.00
		1	560.08	0.0018	0.39		
		1	557.56	0.0018	0.39		
		1	560.17	0.0018	0.39		
		1	558.98	0.0018	0.39		
	30	1	273.86	0.0037	0.53	0.53	0.00
		1	274.08	0.0036	0.53		
		1	275.12	0.0036	0.53		
		1	272.51	0.0037	0.54		
		1	273.64	0.0037	0.53		
	40	1	175.48	0.0057	0.62	0.62	0.00
		1	174.29	0.0057	0.63		
		1	176.2	0.0057	0.62		
		1	176.81	0.0057	0.62		
		1	174.69	0.0057	0.63		
	50	1	122.14	0.0082	0.72	0.72	0.01
		1	120.87	0.0083	0.72		
		1	121.44	0.0082	0.72		
		1	120.06	0.0083	0.73		
		1	122.96	0.0081	0.71		
N ₂	10	1	594.21	0.0017	0.74	0.74	0.00
		1	593.23	0.0017	0.74		
		1	595.16	0.0017	0.74		
		1	594.96	0.0017	0.74		
		1	593.75	0.0017	0.74		
	20	1	280.47	0.0036	0.78	0.78	0.01
		1	276.91	0.0036	0.79		
		1	287.23	0.0035	0.76		
		1	282.14	0.0035	0.78		
		1	278.64	0.0036	0.79		
	30	1	183.87	0.0054	0.79	0.79	0.00
		1	184.46	0.0054	0.79		
		1	185.82	0.0054	0.79		
		1	183.15	0.0055	0.80		
		1	184.32	0.0054	0.79		
	40	1	136.48	0.0073	0.80	0.80	0.00
		1	137.51	0.0073	0.80		
		1	137.69	0.0073	0.79		
		1	138.09	0.0072	0.79		
		1	136.87	0.0073	0.80		
50	1	115.67	0.0086	0.76	0.75	0.00	
	1	115.92	0.0086	0.76			
	1	116.08	0.0086	0.75			
	1	116.77	0.0086	0.75			
	1	116.14	0.0086	0.75			

Table C24 cellulose acetate

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	10	20.9	0.4785	209.40	215.58	7.09
		10	19.59	0.5105	223.40		
		10	20.48	0.4883	213.69		
		10	20.57	0.4769	208.70		
		10	19.65	0.5089	222.72		
	20	10	8.68	1.1521	252.10	259.71	5.03
		10	8.31	1.2034	263.32		
		10	8.35	1.1976	262.06		
		10	8.29	1.2053	263.06		
		10	8.51	1.1751	257.13		
	30	10	4.87	2.0534	299.55	298.84	3.37
		10	4.86	2.0576	300.16		
		10	4.82	2.0747	302.66		
		10	4.97	2.0121	293.52		
		10	4.89	2.0450	298.32		
	40	100	30.48	3.2808	324.77	322.92	2.67
		100	30.47	3.2819	324.88		
		100	30.54	3.2744	324.13		
		100	30.71	3.2563	322.34		
		100	31.08	3.2175	318.50		
	50	100	24.93	4.0112	351.09	358.26	5.49
		100	24.73	4.0437	353.93		
		100	24.04	4.1597	364.09		
		100	24.27	4.1203	360.64		
		100	24.21	4.1305	361.54		
	60	100	20.31	4.9237	359.13	361.13	1.76
		100	20.07	4.9826	363.43		
		100	20.27	4.9334	359.84		
		100	20.21	4.9480	360.91		
		100	20.13	4.9677	362.34		
	70	100	16.55	6.0423	377.76	377.45	5.07
		100	16.43	6.0864	380.52		
		100	16.62	6.0168	376.17		
		100	16.91	5.9137	369.72		
		100	16.32	6.1275	383.09		
	80	100	14.85	6.7340	368.38	372.18	4.01
		100	14.61	6.8446	374.43		
		100	14.87	6.7249	367.89		
		100	14.67	6.8166	372.90		
		100	14.5	6.8966	377.28		
90	100	11.89	8.4104	370.02	361.98	5.21	
	100	12.12	8.2508	363.00			
	100	12.29	8.1367	357.98			
	100	12.33	8.1103	356.82			
	100	12.15	8.2305	362.10			
100	100	11.98	8.3472	365.31	372.33	5.23	
	100	11.58	8.6356	377.93			
	100	11.84	8.4459	369.63			
	100	11.77	8.4962	371.83			
	100	11.61	8.6133	376.95			

Table C25 30%PEG/10%NaX/SR

Gas	P (psia)	vol (ml)	time (sec)	Flow rate (ml/sec)	Permeance (GPU)	Average of Permeance (GPU)	STDEV of Permeance
CO ₂	10	1	26.67	0.0375	16.41	16.47	0.15
		1	26.67	0.0375	16.41		
		1	26.45	0.0378	16.55		
		1	26.84	0.0373	16.31		
		1	26.21	0.0382	16.70		
	20	1	12.31	0.0812	17.78	17.62	0.53
		1	12.58	0.0795	17.39		
		1	12.99	0.0770	16.85		
		1	12.28	0.0814	17.82		
		1	11.99	0.0834	18.25		
	30	1	8.17	0.1224	17.86	17.71	0.10
		1	8.24	0.1214	17.70		
		1	8.27	0.1209	17.64		
		1	8.22	0.1217	17.75		
		1	8.29	0.1206	17.60		
	40	1	5.63	0.1776	19.43	19.41	0.10
		1	5.63	0.1776	19.43		
		1	5.68	0.1761	19.26		
		1	5.6	0.1786	19.54		
		1	5.65	0.1770	19.36		
	50	1	4.44	0.2252	19.71	19.38	0.29
		1	4.5	0.2222	19.45		
		1	4.52	0.2212	19.36		
		1	4.63	0.2160	18.90		
		1	4.5	0.2222	19.45		
	60	1	3.84	0.2604	18.99	18.94	0.26
		1	3.88	0.2577	18.80		
		1	3.77	0.2653	19.35		
		1	3.91	0.2558	18.65		
		1	3.86	0.2591	18.90		
	70	1	3.38	0.2959	18.50	18.51	0.14
		1	3.37	0.2967	18.55		
		1	3.41	0.2933	18.33		
		1	3.34	0.2994	18.72		
		1	3.39	0.2950	18.44		
	80	1	2.98	0.3356	18.36	18.36	0.21
		1	2.94	0.3401	18.61		
		1	2.96	0.3378	18.48		
		1	3.03	0.3300	18.05		
		1	2.99	0.3344	18.30		
	90	1	2.67	0.3745	18.21	17.67	0.33
		1	2.76	0.3623	17.62		
		1	2.76	0.3623	17.62		
		1	2.81	0.3559	17.30		
		1	2.76	0.3623	17.62		
100	1	2.45	0.4082	17.86	17.83	0.16	
	1	2.43	0.4115	18.01			
	1	2.45	0.4082	17.86			
	1	2.49	0.4016	17.58			
	1	2.45	0.4082	17.86			

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1. Soontraratpong, J., Rirksomboon, T., Osuwan, S, and Kulprathipanja, S. (2004, November 8-12) Mixed Matrix Membranes for CO₂/CH₄ separation. Poster presented at AICHE Annual 2004 Meeting, Austin, Texas, USA.