REB Research & Consulting
Hydrogen Separations and Membrane Reactors

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REB Polymeric Membranes November 13, 2022

These membranes are polydimethyl siloxane; silicone, 55μ thick, 0.0055cm. The permeability of this material is understood to be the following, as measured in Barrer (10^{-10}cc•cm/cm^2*s•cm-Hg).

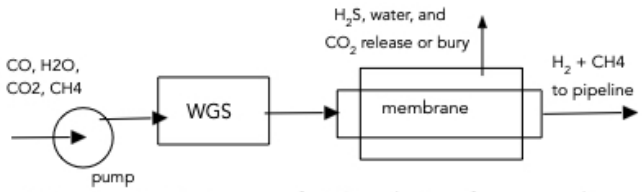
To get good separation, pick the right membrane size and use a good pressure difference between inside and out. To get a purer through-membrane gas, use a relatively small membrane area or more flow; to get a purer retentate gas, use a relatively larger membrane and less flow. For the 1000 cm^2 membranes, typical flows should be 2-5 slpm. For this module, and a partial pressure drop of 1 atm (15 psi, 76 cmHg) across the membrane, expect a through-flow of 0.83 slpm for a gas with 1000 Barrer permeability. If you need help choosing a membrane size, contact us. Some amount of consulting comes free with the membrane.

Max pressure = 60 psig for the material within the membrane tubes. The shell can withstand only about 40 psig. The maximum temperature is about 60°C. This is a polycarbonate shell, some solvents dissolve polycarbonate.

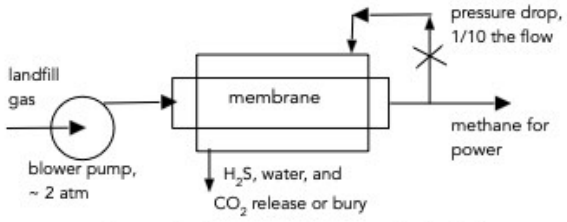
Gas	Formula	Permeability @25°C x 10^{-10}cc•cm/cm^2*s•cm-Hg
Nitrogen	N2	280
Carbon monoxide	CO	340
Oxygen	O2	600
Nitric oxide	NO	600
Argon	Ar	600
Hydrogen	H2	650
Helium	He	350
Methane	CH4	950
Ethylene	C2H4	1350
Ethane	C2H6	2500
Carbon dioxide	CO2	3250
Propane	C3H8	4100
Nitrous oxide	N2O	4350
Acetone	C3H6O	5860
Ammonia	NH3	5900

Gas	Formula	Permeability @25°C x 10^{-10}cc•cm/cm^2*s•cm-Hg
Nitrogen dioxide	NO2	7500
Octane	n-C8H18	8600
Butane	n-C4H10	9000
Toluene	C7H8	9130
Hexane	n-C6H14	9400
Hydrogen sulfide	H2S	10000
Benzene	C6H6	10800
Methanol	CH3OH	13900
Sulfur dioxide	SO2	15000
Pentane	n-C5H12	20000
Water	H2O	36000
Methyl Siloxane L2	..OSi(CH2)2O..	43700
Methyl Siloxane D5	..OSi(CH2)2O..	64300
Carbon disulfide	CS2	90000

The process diagrams below show how these membranes might be used to help upgrade syngas or landfill gas, or to increase the fuel efficiency of a solid oxide fuel cell.



REB suggestion: Basic process for H2 production, if we remove less CO, this can be used to make methanol.



Basic membrane distillation used to upgrade landfill gas.