Permeability and Diffusion Data

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A. INTRODUCTION

The transmission of molecules through polymer films is named "permeability". There are many dimensions and units found in the literature for the general expression "permeability". In this paper the permeability coefficient is used. It has the dimension

$$P = \frac{(\text{quantity of permeant}) \times (\text{film thickness})}{(\text{area}) \times (\text{time}) \times (\text{pressure drop across the film})}$$

and is the best definition for permeability.

The permeability coefficient, in a strict sense, is not only a function of the chemical structure of the polymer. It also varies with the morphology of the polymer and depends on many physical factors such as density, crystallinity, and orientation. However, the chemical structure of a polymer can be considered to be the predominant factor which controls the magnitude of the permeability coefficient.

The following general trends in permeability, as related to some influencing factors, may be useful for the proper interpretation of the tables:

Density can be regarded as a measure of the free volume between the molecules of the polymer structure. In general, the higher the density, the lower is the permeability.

Crystallinity of a semicrystalline polymer reduces the permeability significantly compared to the value of the corresponding amorphous polymer; i.e., the higher the degree of crystallinity, the lower the permeability. The crystallinity and the density of a polymer are strongly related. The higher the crystallinity the higher is the density of a given polymer.

Molecular mass of a polymer has been found to have little effect on the permeability of polymers, except at a very low range of molecular masses.

Orientation of polymer molecules reduces the permeability.

Crosslinking decreases the permeability, especially for higher degrees of crosslinking and for large molecular size permeants.

The method and degree of vulcanization has a significant effect on the permeability of elastomers.

Plasticizers increase the permeability.

Humidity increases the permeability of some hydrophilic polymers.

Liquid permeants have the same permeabilities as their corresponding saturated vapors, though higher permeabilities may occur especially if parts of the polymer are being dissolved.

Solution cast films have variable permeabilities depending upon the kind of solvent used and the drying technique. Poor solvents tend to yield films of higher permeability.

Fillers, usually inorganic fillers, decrease the permeability; however, the effect is complicated by the type, shape, and amount of filler and its interaction with the polymer.

Thickness of film does not, in principle, affect the permeability coefficient, the diffusion coefficient, and the solubility coefficient. In practice, different values may be obtained from films of variable thickness, which in turn may be due to differences in drawing, orientation, and crystallinity.

If a permeant does not interact with the polymer under investigation, the permeability coefficient is characteristic for the permeant–polymer system. This is the case with the permeation of many gases, such as H_2, He, N_2, O_2, and CO_2, through many polymers. On the other hand, if a permeant interacts with the polymer, the permeation coefficient is no longer a constant, and may depend on the special conditions of the measurement and the history of the polymer film. In such cases, a single value of the permeability coefficient does not represent the characteristic permeability of the polymer, and it is necessary to know the dependency of the permeability coefficient on all possible variables in order to obtain the complete profile of the permeability of the polymer.

In these cases, the transmission rate, which has the dimension

$$Q = \frac{(\text{quantity of permeant})}{(\text{area}) \times (\text{time})}$$

is often used for practical purposes. Since the transmission rate, Q, includes neither the pressure of the permeant nor the thickness of the polymer in its dimension, it is necessary to know either the pressure or the concentration of the permeant and the thickness of the polymer under the conditions of measurement.

For both P and Q, the quantity of permeant can be expressed by mass, moles, or gaseous volume at standard temperature and pressure. These can readily be converted from one unit into another.

The preferred SI unit of the permeability coefficient used in this book is

$$\text{unit of } P: \frac{\text{cm}^3(273.15\,\text{K};\ 1.013 \times 10^5\,\text{Pa}) \times \text{cm}}{\text{cm}^3 \times \text{s} \times \text{Pa}}$$

where (273.15 K; 1.013×10^5 Pa) means standard temperature and pressure (STP). Therefore permeability coefficients given in this paper are in the range of 10^{-11} – 10^{-16} $\text{cm}^3 \times \text{cm}/\text{cm}^2 \times \text{s} \times \text{Pa}$ for many polymers and permeants.

The mostly used units and their conversion factors are listed in Table B.

The permeation of molecules through flawless polymers occurs by the steps of dissolution of a permeant in the polymer and diffusion of the dissolved permeant. The product of the diffusion coefficient D and the solubility coefficient S is referred to as the permeability coefficient.

$$P = D \times S$$

Units of D and S used in these tables are

$$\text{unit of } D: \frac{\text{cm}^2}{\text{s}}$$

$$\text{unit of } S: \frac{\text{cm}^2(273.15\,\text{K};\ 1.013 \times 10^5\,\text{Pa})}{\text{cm}^3 \times \text{Pa}}$$

The solubility coefficients cited in the following tables are often calculated by

$$S = \frac{P}{D}$$

The temperature dependence of the permeability coefficient P, the diffusion coefficient D, and the solubility coefficient S can be represented by

$$P = P_0 \times \exp(-E_P/RT)$$
$$D = D_0 \times \exp(-E_D/RT)$$

and

$$S = S_0 \times \exp(-E_S/RT)$$

Consequently

$$E_P = E_D + E_S$$

where E_P is the activation energy of permeation, E_D the activation energy of diffusion, and E_S the heat of solution. P_0, D_0, and S_0 are the pre-exponential factors. Values of E_P, E_D, and E_S are given in kJ/mol in the following tables. R is the gas constant (8.3144×10^{-3} kJ/K mol); T is the temperature in K. In the following tables the temperature range is given in which P_0, E_P, E_D, and E_S are relevant, as far as the authors have reported it. The permeability coefficient can be determined for a given temperature by means of the pre-exponential factor P_0 and the activation energy of permeation E_P. In the following tables, permeability, diffusion, and solubility coefficients are listed for many polymers. The pre-exponential factor P_0, the activation energy of permeation E_P, the activation energy of diffusion E_D, and the heat of solution E_S are also given. The pre-exponential factors D_0 and S_0 can be determined by the following equations:

$$D_0 = D \times \exp(E_D/RT)$$
$$S_0 = S \times \exp(E_S/RT)$$

B. CONVERSION FACTORS FOR VARIOUS UNITS OF THE PERMEABILITY COEFFICIENT

From	Multiplication factors to obtain P in: $\frac{[cm^3][cm]}{[cm^2][s][cm\ Hg]}$	$\frac{[cm^3][cm]}{[cm^2][s][Pa]}$	$\frac{[cm^3][cm]}{[m^2][day][atm]}$
$\frac{[cm^3][cm]}{[cm^2][s][cm\ Hg]}$	1	7.5×10^{-4}	6.57×10^{10}
$\frac{[cm^3][mm]}{[cm^2][s][cm\ Hg]}$	10^{-1}	7.5×10^{-5}	6.57×10^{9}
$\frac{[cm^3][cm]}{[cm^2][s][atm]}$	1.32×10^{-2}	9.87×10^{-6}	8.64×10^{8}
$\frac{[cm^3][mil]}{[cm^2][day][atm]}$	3.87×10^{-14}	2.90×10^{-17}	2.54×10^{-3}
$\frac{[in^3][mil]}{[100in^2][day][atm]}$	9.82×10^{-12}	7.37×10^{-15}	6.45×10^{-1}
$\frac{[cm^3][cm]}{[m^2][day][atm]}$	1.52×10^{-11}	1.14×10^{-14}	1
$\frac{[cm^3][cm]}{[m^2][day][bar]}$	1.54×10^{-11}	1.16×10^{-14}	1.01
$\frac{[cm^3][cm]}{[cm^2][s][Pa]}$	1.33×10^{3}	1	8.75×10^{13}

C. TABLES

TABLE 1. PERMEABILITY COEFFICIENTS, DIFFUSION COEFFICIENTS, AND SOLUBILITY COEFFICIENTS OF POLYMERS

Units used in the tables are as follows: P, P_0 in cm^3 (273.15 K; 1.013×10^5 Pa) × cm/(cm^2 × s × Pa); D in cm^2/s; S in cm^3(273.15 K; 1.013×10^5 Pa)/(cm^3 × Pa); E_P, E_D, E_S in kJ/mol; T in °C; (273.15 K; 1.013×10^5 Pa) means standard temperature and pressure (STP).

Polymer	Permeant	T	P (×10^{13})	D (×10^6)	S (×10^6)	Temp. range	P_0 (×10^7)	E_P	E_D	E_S	Refs.
1.1. POLY(ALKANES)											
Poly(ethylene) LLDPE	C_2H_4O	30	68.9	0.031	225						80
Poly(ethylene)	H_2	25	7.4	0.474	1.58						49
density 0.914 g/cm^3, LDPE	D_2	25	6.6	0.476	1.38						49
	He	25	3.7	6.8	0.0544	5–60	4.62	34.8	24.7	10.1	16
	O_2	25	2.2	0.46	0.472	5–60	66.5	42.7	40.2	2.5	16
	Ar	25	2.1	0.36	0.571	5–60	174	45.2	42.3	2.9	16
	Ne	25	0.48	2.42	0.020						49
	Kr	25	2.15	0.169	1.28						49
	Xe	25	4.01	0.069	5.82						49
	CO_2	25	9.5	0.372	2.54	5–60	62.0	38.9	38.5	0.4	16

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
	CO	25	1.1	0.332	0.336	5–60	154	46.5	39.8	6.7	16
	N_2	25	0.73	0.320	0.228	5–60	329	49.4	41.5	7.9	16
	CH_4	25	2.2	0.193	1.13	5–60	425	47.3	45.6	1.7	16
	C_2H_6	25	5.1	0.068	7.55	5–60	985	47.3	53.6	−6.3	16
	C_3H_4	25	32	0.105	30.2	5–60	209	38.9	49.8	−10.9	16
	C_3H_6	25	11	0.058	18.8	5–60	459	43.5	52.3	−8.8	16
	C_3H_8	25	7.1	0.0322	21.3	5–60	1170	46.9	55.7	−8.8	16
	SF_6	25	0.13	0.0135	0.951	5–60	4050	59.9	62.0	−2.1	16
	H_2S	20	27.0								5
	NH_3	20	21.0								5
	CH_3Br	20	110								37
	C_2H_4O	30	75			0–60					37
	H_2O	25	68			10–90	48.8	33.5			21
density 0.964 g/cm^3, HDPE	He	25	0.86	3.07	0.028	5–60	0.137	29.7	23.4	6.3	16
	O_2	25	0.30	0.17	0.18	5–60	0.423	35.1	36.8	−1.7	16
	Ar	25	1.30	0.12	1.1	5–60	5.23	37.7	38.9	−1.2	16
	CO_2	25	0.27	0.12	0.22	5–60	0.0506	30.1	35.6	−5.5	16
	CO	25	0.15	0.096	0.15	5–60	1.15	39.3	36.8	2.5	16
	N_2	25	0.11	0.093	0.15	5–60	0.991	39.7	37.7	2.0	16
	CH_4	25	0.29	0.057	0.51	5–60	3.76	40.6	43.5	−2.9	16
	C_2H_6	25	0.44	0.015	3.0	5–60	13.3	42.7	52.3	−9.6	16
	C_3H_4	25	3.0	0.025	12	5–60	1.89	33.1	47.3	−14.2	16
	C_3H_6	25	0.87	0.011	8.2	5–60	5.68	38.9	52.3	−13.4	16
	C_3H_8	25	0.404	0.0049	8.3	5–60	28.5	44.8	56.9	−12.1	16
	n-C_4H_{10}	40		0.02					62.3		64
	n-C_5H_{12}	25		0.0033					76.6		64
	n-C_6H_{14}	0		0.000075							64
	SF_6	25	0.0063	0.0016	0.39	5–60	29.5	55.2	62.8	−7.6	16
	H_2S	20	6.5								5
	NH_3	20	8.0								5
	H_2O	25	9.0								21
Poly(ethylene) HDPE	C_2H_4O	30	21.4	0.021	97.5						80
Poly(ethylene) (Hizex 7000F)											
Isotropic density 0.943 g/cm^3	He	25	1.33	3.50	0.0379						74
draw ratio 8 0.958	He	25	1.46	3.20	0.0457						74
9 0.957	He	25	1.44	3.55	0.0406						74
10 0.958	He	25	0.885	2.38	0.0372						74
12 0.960	He	25	0.407	1.69	0.0241						74
14.5 0.962	He	25	0.278	1.14	0.0244						74
20.5 0.966	He	25	0.129	0.632	0.0204						74
Poly(ethylene) (Hizex 7000F)											
draw ratio 1.0 density 0.945 g/cm^3	N_2	25	0.2	0.094	0.217						99
	O_2	25	0.76	0.196	0.395						99
	CO_2	25	3.2	0.148	2.16						99
6.6 0.954	He	25	1.1	3.3	0.0346						99
6.4	N_2	25	0.11	0.075	0.138						99
	O_2	25	0.34	0.099	0.346						99
	CO_2	25	1.4	0.080	1.82						99
11.8 0.959	He	25	0.37	1.5	0.0247						99
	O_2	25	0.074	0.032	0.237						99
	CO_2	25	0.28	0.02	1.41						99
12.0 0.959	He	25	0.3	1.7	0.0188						99
	O_2	25	0.10	0.0459	0.197						99
17.6	He	25	0.12	0.54	0.0217						99
	O_2	25	0.012	0.0055	0.217						99
	CO_2	25	0.045	0.0035	1.29						99
20.2	He	25	0.11	0.48	0.0237						99
	O_2	25	0.15	0.0065	0.168						99
Poly(ethylene-hexene-1) copolymer (Rigidex 002-55)											
Isotropic density 0.943 g/cm^3	He	25	1.11	3.27	0.0340						74
draw ratio 7 0.955	He	25	0.23	3.32	0.0278						74
8.5 0.958	He	25	0.878								74
9.5 0.959	He	25	0.773								74
10 0.960	He	25	0.695								74
11 0.961	He	25	0.515								74
13 0.963	He	25	0.257								74
16.5 0.964	He	25	0.206								74
Poly(ethylene-hexene-1) copolymer (Rigidex 002-55)											
draw ratio 1.0 density 0.945 g/cm^3	N_2	25	0.179	0.0945	0.188						99
	O_2	25	0.662	0.185	0.357						99
	CO_2	25	3	0.132	2.27						99
6.5	N_2	25	0.059	0.0411	0.148						99
	O_2	25	0.0522	0.0696	0.289						99
	CO_2	25	1.0	0.056	1.78						99

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
11.7	He	25	0.242	1.2	0.0197						99
	O_2	25	0.044	0.0203	0.218						99
	CO_2	25	0.18	0.0113	1.58						99
14.7	He	25	0.14	0.713	0.0197						99
	O_2	25	0.025	0.0148	0.167						99
17.6	He	25	0.097	0.57	0.0168						99
	O_2	25	0.0098	0.0048	0.207						99
	CO_2	25	0.034	0.0025	1.32						99
Poly(ethylene-*co*-propylene) 40/60 amorphous	He	24.4	24.0	16.5	0.146	0–50	1.56	27.6	15.0	12.6	25
31.0 CH_3-groups per 100 carbons	Ne	24.4	9.0	4.5	0.20	0–50	2.48	31.8	28.5	3.3	25
	Ar	24.4	9.8	1.06	0.93	0–50	46.6	39.6	37.1	2.5	25
	N_2	24.4	3.7	0.67	0.545	0–50	167	43.8	45.8	−2.0	25
26.5 CH_3-groups per 100 carbons	He	24.1	21.8	17.9	0.121	0–50	1.93	28.1	24.8	3.3	25
	Ne	24.1	8.5	5.3	0.16	0–50	4.89	32.7	31.9	0.8	25
	Ar	24.1	11.0	1.3	0.83	0–50	46.7	37.8	42.0	−4.2	25
	N_2	24.1	4.1	0.94	0.44	0–50	97.5	42.1	42.9	−0.8	25
21.5 CH_3-groups per 100 carbons	He	26.6	16.0	9.4	0.17	0–50	2.37	29.7	27.0	2.7	25
	Ne	26.6	6.9	3.5	0.20	0–50	5.67	34.1	31.9	2.2	25
	Ar	26.6	9.2	1.06	0.87	0–50	27.2	37.2	39.6	−2.4	25
	N_2	26.6	3.7	0.79	0.46	0–50	54.2	41.2	44.0	−2.8	25
Poly(propylene)	He	20	0.28	19.5		20–70	0.153	32.2			13
density 0.907 g/cm^3	H_2	20	31.0	2.1		20–70	224	38.5			13
crystallinity 50%	N_2	30	0.33			20–70	1280	55.7			19
	O_2	30	1.7			20–70	278	47.7			19
	CO_2	30	6.9			20–70	24.0	38.1			19
	H_2O	30	51.0			10–90	900	42.3			19,21
	CH_3Br	30	15.0			0–50	1.56×10^6	64.2			19
	H_2S	20	2.4								5
	NH_3	20	6.9								5
(Trespaphan GND)	H_2O	23	15.8			10–50	0.249	23.8			73
density 0.8871 g/cm^3	He	33	10.6			30–55	0.631	28			47
crystallinity 43%	O_2	33	1.68			30–55	117	46			47
	N_2	33	0.424			30–55	1010	55			47
	CO_2	33	5.43			30–55	173	44			47
density 0.8931 g/cm^3	He	33	8.98			30–55	0.534	28			47
crystallinity 50%	O_2	33	1.48			30–55	103	46			47
	N_2	33	0.355			30–55	11500	55			47
	CO_2	33	4.64			30–55	148	44			47
density 0.8998 g/cm^3	He	33	7.7			30–55	0.458	28			47
crystallinity 58%	O_2	33	1.28			30–55	89.4	46			47
	N_2	33	0.306			30–55	732	55			47
	CO_2	33	4.05			30–55	129	44			47
density 0.9016 g/cm^3	He	33	8.69			30–55	0.236	26			47
crystallinity 60%	O_2	33	1.78			30–55	11.8	40			47
	N_2	33	0.494			30–55	34.5	46			47
Poly(propylene)	C_2H_4O	30	0.9	0.0022	45						80
1.2. POLY(STYRENES)											
Poly(styrene)	O_2	25	1.9								42
	H_2O	25	1350								42
biaxially oriented	He	25	14.0								41
	H_2	25	17.0								41
	O_2	25	2.0								41
	N_2	25	0.59								41
	CO_2	25	7.9								41
	H_2O	25	840	0.14							27
	H_2O	23	717			10–50	0.000028	−7.79			73
ultradrawn											
draw ratio 1.0	CO_2	25	6.0	0.0024	248						72
1.8	CO_2	25	4.35	0.0019	233						72
3.1	CO_2	25	2.18	0.00075	293						72
4.4	CO_2	25	1.13								72
5.0	CO_2	25	0.75	0.00046	158						72
Poly(styrene-*co*-styrenesulfonic acid) Na^+-polysalt											
sulfonated with 0 mol% SO_3^-	H_2	23	18.5								83
(Polystyrene)	N_2	23	0.368	0.055	0.67						83
	O_2	23	2.18	0.12	2.0						83
	CO_2	23	10.58	0.054	19.5						83
	CH_4	23	0.585	0.011	5.3						83
sulfonated with 15.2 mol% SO_3^-	H_2	23	10.13								83
	N_2	23	0.0975	0.0042	2.3						83
	O_2	23	0.743	0.021	3.6						83
	CO_2	23	3.53	0.0091	39.8						83
	CH_4	23	0.150	0.0026	5.8						83

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
sulfonated with 27.5 mol% SO_3^-	H_2	23	5.85								83
	N_2	23	0.0465	0.0012	4.1						83
	O_2	23	0.443	0.0080	5.5						83
	CO_2	23	2.18	0.0027	80.6						83
	CH_4	23	0.0443	0.00096	4.7						83
Poly(styrene-*co*-styrenesulfonic acid) Mg^{2+}-polysalt											
sulfonated with 15.2 mol% SO_3^-	H_2	23	7.20								83
	N_2	23	0.0563	0.0069	0.83						83
	O_2	23	0.510	0.028	1.8						83
	CO_2	23	2.25	0.0078	28.6						83
	CH_4	23	0.0525	0.0025	2.1						83
sulfonated with 27.5 mol% SO_3^-	H_2	23	5.18								83
	N_2	23	0.0270	0.0051	0.53						83
	O_2	23	0.315	0.017	1.9						83
	CO_2	23	1.65	0.0037	44.6						83
	CH_4	23	0.0255	0.0026	0.98						83
1.3. POLY(METHACRYLATES)											
Poly(methyl methacrylate)	H_2	35	2.78								88
	He	35	5.70								88
	Ar	35	0.0158								88
	N_2	35	6.15								88
	O_2	34	0.116								51
	O_2	35	0.0653								88
	CO_2	35	2.33								88
	CH_4	35	0.00263								88
	H_2O	23	480								73
Poly(methyl methacrylate) + (cellulose acetate butyrate) + (silicone) – Blend 50/40/10	O_2	34	4.52								51
Poly(methyl methacrylate) + (Styrene/acrylonitrile) – Blend											
80/20	CO_2	35	0.435								88
50/50	CO_2	35	0.938								88
20/80	CO_2	35	1.58								88
Poly(methyl acrylate) + Poly(epichlorohydrin) – Blend	He	35	7.95	7.88	0.101						77
100/0	Ar	35	0.383	0.0513	0.747						77
	N_2	35	0.140	0.0385	0.365						77
	CH_4	35	0.176	0.0121	1.46						77
75/25	He	35	6.78	7.15	0.0945						77
	Ar	35	0.410	0.0595	0.689						77
	N_2	35	0.144	0.0442	0.326						77
	CH_4	35	0.221	0.0167	1.32						77
50/50	He	35	5.59	6.54	0.0855						77
	Ar	35	0.443	0.0677	0.655						77
	N_2	35	0.159	0.0508	0.313						77
	CH_4	35	0.302	0.0242	1.25						77
25/75	He	35	4.61								77
	Ar	35	0.495	0.0792	0.625						77
	N_2	35	0.178	0.0595	0.299						77
	CH_4	35	0.411	0.0333	1.23						77
0/100	He	35	3.62	4.88	0.0743						77
	Ar	35	0.533	0.0918	0.580						77
	N_2	35	0.180	0.0655	0.275						77
	CH_4	35	0.493	0.0422	1.17						77
Poly(ethyl methacrylate)	He	25	5.18	42.5	0.0122	25–80	0.255	26.8	15.5	11.3	29
	Ne	25	2.28	1.5	0.152	25–80	0.242	28.7	23.9	4.8	29
	O_2	25	0.889	0.106	0.839	25–80	2.1	36.4	31.8	4.6	29
	Ar	25	0.433	0.0208	2.08	25–80	2.03	38.1	43.1	−5.0	29
	N_2	25	0.170	0.0301	0.565	25–80	2.18	40.6	42.7	−2.1	29
	CO_2	25	3.79	0.0336	11.3	25–80	0.435	28.9	33.1	−4.2	29
	Kr	25	0.287	0.0065	4.40	25–80	10.1	43.1	46.1	−3.0	29
	H_2S	25	2.88	0.0046	62.6	25–80	22.8	39.4	47.7	−8.3	29
	SF_6	25	0.0127	0.00023	5.62	25–80	0.885	44.8	64.5	−19.7	29
	H_2O	25	2380	0.102	2333	25–65	0.00555	2.1	36.4	−34.3	29
		65	2880	0.729	395	65–80	1.58	18.0	63.2	−45.2	29
Poly(2-hydroxyethyl-methacrylate) highly crosslinked	O_2[a]	34	2.72								51
	O_2[b]	34	5.43								51

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
1.4. POLY(NITRILES)											
Poly(acrylonitrile)	O_2	25	0.00015								42
	CO_2	25	0.00060								42
	H_2O	25	230								42
(Barex)	O_2	25	0.0041								42
		38	0.014								42
	CO_2	25	0.012								42
		38	0.022								42
	H_2O	25	490								42
		38	520								42
Poly(acrylonitrile-*co*-styrene) 86/14	O_2	25	0.0032								42
	CO_2	25	0.011								42
	H_2O	25	640								42
66/34	O_2	25	0.036								42
	CO_2	25	0.16								42
	H_2O	25	1500								42
57/43	O_2	25	0.14								42
	CO_2	25	0.27								42
	H_2O	25	1800								42
39/61	O_2	25	0.35								42
	CO_2	25	1.0								42
	H_2O	25	1900								42
Poly(acrylonitrile-*co*-methyl acrylate-*co*-butadiene) 79/15/6	O_2	25	0.0041								42
	CO_2	25	0.012								42
	H_2O	25	970								42
Poly(methacrylonitrile)	O_2	25	0.00090	0.0003	0.3						42
	CO_2	25	0.0024	0.0002	1.2						42
	H_2O	25	310								42
(Lopac)	O_2	25	0.0026								42
		38	0.0053								42
	CO_2	25	0.0081								42
		38	0.016								42
	H_2O	25	260								42
		38	270								42
Poly(methacrylonitrile-*co*-styrene) 97/3	O_2	25	0.0018								42
	CO_2	25	0.0059								42
	H_2O	25	370								42
82/18	O_2	25	0.0098	0.0026	0.38						42
	CO_2	25	0.038	0.0018	2.1						42
	H_2O	25	700								42
61/39	O_2	25	0.068								42
	CO_2	25	0.21								42
	H_2O	25	1300								42
53/47	O_2	25	0.12								42
	CO_2	25	0.38								42
	H_2O	25	1400								42
38/62	O_2	25	0.29								42
	CO_2	25	0.88								42
	H_2O	25	1600								42
18/82	O_2	25	0.81								42
	CO_2	25	2.4								42
	H_2O	25	1500								42
Poly(methacrylonitrile-*co*-styrene-*co*-butadiene) 88/7/5	O_2	25	0.0036								42
	CO_2	25	0.011								42
	H_2O	25	450								42
83/7/10	O_2	25	0.0052								42
	CO_2	25	0.015								42
	H_2O	25	500								42
78/7/15	O_2	25	0.0072								42
	CO_2	25	0.024								42
	H_2O	25	580								42
1.5. POLY(VINYLS)											
Poly(vinyl acetate)	He	10	4.95	6.46	0.0784	0–20	0.00134	13.2	17.4	−4.2	14
		30	9.44	9.55	0.101	25–40	2.23	31.2	22.4	8.8	14
	H_2	10	2.99	1.32	0.237	0–20	0.0023	15.7	21.6	−5.9	14
		30	6.84	2.63	0.254	25–40	10.4	41.7	31.4	10.3	14
	Ne	10	0.838	0.794	0.106	0–20	0.000111	11.5	30.8	−19.3	14
		30	1.97	1.66	0.118	25–40	14.1	39.8	35.4	4.4	14
	O_2	10	0.136	0.0178	0.766	0–20	0.00074	20.2	46.4	−26.2	14
		30	0.367	0.0562	0.637	25–40	1680	56.1	60.7	−4.6	14
	Ar	10	0.0569	0.00479	1.11	0–20	0.0471	32.1	47.6	−15.5	14
		30	0.143	0.0162	0.943	25–40	4950	61.2	69.1	−7.9	14
	Kr	10	0.0172	0.000602	2.78	0–20	0.00826	30.8	60.7	−29.9	15
		30	0.0582	0.00295	1.96	25–40	7.71×10^{5}	76.2	81.2	−5.0	15

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
	CH_4	25	0.0237	0.0017	1.39	25–40	0.72×10^{7}	82.7	80.8	1.9	15
	CO_2	35	1.52	0.00747	20.4						86
Poly(vinyl alcohol)	He[c]	20	0.00075								10
	H_2[c]	25	0.00672								28
	D_2[c]	100	0.0134								57
	N_2[c]	14	0.0001								11
	N_2[d]	14	0.248	0.045	0.53						11
	O_2[c]	25	0.00665								28
	O_2[c]	23	0.00005								59
	CO_2[c]	25	0.00924								28
	CO_2[d]	25	65.0								28
	H_2S[c]	25	0.0052								28
	C_2H_4O[c]	0	0.0015								37
	H_2O	25	5.25								98
Poly(vinyl benzoate)	H_2	25	6.55	1.93	0.34	20–60	0.0055	16.7	21.9	−5.2	65
		70	18.3	6.39	0.29	60–85	0.251	27.2	24.5	2.7	65
	He	25	6.67	6.17	0.11	20–60	0.00345	15.5	16.9	−1.3	65
		70	17.1	16.1	0.11	60–85	0.458	29.1	22.4	6.7	65
	Ne	25	1.51	1.08	0.14	20–60	0.00137	16.9	23.2	−6.3	65
		70	4.28	3.83	0.11	60–85	0.758	34.5	28.6	5.9	65
	Ar	25	0.358	0.033	1.08	20–60	0.0020	21.4	31.6	−10.1	65
		35	0.459	0.0491	0.93						86
		70	1.24	0.181	0.69	60–85	0.863	38.4	38.1	0.29	65
	Kr	25	0.192	0.0059	3.25	20–60	0.00188	22.8	38.4	−15.5	65
		70	0.712	0.049	1.45	60–85	2.565	43.1	50.7	−7.7	65
	Xe	25	0.071	0.00064	11.1	20–60	0.00723	28.6	46.0	−17.5	65
		70	0.43								65
	N_2	25	0.124	0.026	0.48	20–60	0.00104	22.4	33.0	−10.6	65
		70	0.463	0.158	0.29	60–85	1.26	42.3	45.2	−2.9	65
	O_2	25	0.715	0.079	0.91	20–60	0.00060	16.7	25.1	−8.5	65
		70	2.11	0.309	0.68	60–85	2.76	40.2	30.5	9.8	65
	CO_2	25	4.17	0.020	20.9	20–60	0.00020	9.6	32.9	−23.4	65
		35	4.74	0.030	16.2						86
		70	8.06	0.117	6.9	60–85	0.734	32.6	45.2	−12.5	65
Poly(vinyl butyral)	H_2O	25	608								98
Poly(vinyl-*p*-isopropylbenzoate)	He	25	8.93	15.5	0.0578	20–67	0.590	27.5	18.4	9.1	86
		80	49.9	51.9	0.096	67–95	0.537	27.3	23.5	3.7	86
	Ne	25	3.88	2.72	0.0585	20–67	0.00251	16.0	17.1	−1.1	86
		80	13.9	8.71	0.160	67–95	1.09	33.1	23.4	9.6	86
	Ar	25	1.90	0.165	1.15	20–67	0.00131	16.2	27.5	−11.3	86
		80	7.67	1.11	0.691	67–95	11.6	41.8	39.7	2.1	86
	Kr	25	0.940	0.0388	3.91	20–67	0.000248	13.8	32.2	−18.3	86
		80	6.25	0.393	1.61	67–95	40.6	46.1	47.3	−1.3	86
	Xe	25	0.00942	0.00579	16.5	20–67	0.00000289	14.2	36.1	−22.0	86
		80	4.62	0.0898	5.14	67–95	534.8	54.5	61.5	−7.0	86
	O_2	25	2.44	0.279	0.0546	20–67	0.00180	16.4	26.8	−10.4	86
		80	12.4	1.948	0.637	67–95	6.92	38.9	37.4	1.4	86
	N_2	25	0.647	0.117	0.550	20–67	0.000878	17.9	29.3	−11.4	86
		80	2.99	0.874	0.348	67–95	19.4	46.1	42.4	3.6	86
	CO_2	25	15.7	0.0760	20.6	20–67	0.000110	4.8	30.4	25.5	86
		80	32.9	0.638	5.17	67–95	3.57	34.0	43.9	−9.9	86
	CH_4	25	1.32	0.0462	2.84	20–67	0.000512	14.8	33.1	−18.3	86
		80	5.65	0.478	1.163	67–95	58.7	47.4	48.1	−0.6	86
Poly(vinyl-*m*-methylbenzoate)	Ar	35	0.642	0.0738	0.870						86
	CO_2	35	5.05	0.0361	14.0						86
Poly(vinyl chloride)	He	25	1.5	2.8	0.055	25–80	0.212	29.9	20.7	9.2	32
unplasticized	H_2	25	1.3	0.5	0.26	25–80	1.46	34.5	34.5	0	32
	Ne	25	0.29	0.25	0.12	25–80	0.274	34.1	31.5	2.6	32
	N_2	25	0.0089	0.0038	0.23	25–80	9380	69.0	61.9	7.1	32
	Ar	25	0.0086	0.0012	0.75	25–80	6.28	57.8	51.5	6.3	32
	Kr	25	0.0060	0.00041	0.54	25–70	24.2	55.3	62.8	−7.5	32
		80	0.14			75–90	8.85×10^{5}	86.6	128.5	−41.9	32
	O_2	25	0.034	0.012	0.29	25–80	179	55.8	54.6	1.2	32
	CO_2	25	0.12	0.0025	4.7	25–90	930	56.8	64.6	−7.8	32
	CH_4	25	0.021	0.0013	1.7	25–85	7950	66.2	70.3	−4.1	32
	H_2O	25	206	0.024	870	25–80	2.04	22.9	41.8	−18.9	32
	H_2S	20	0.14	0.000046	310						5
	NH_3	20	3.7								5
	C_2H_4O	30	4.4	0.0013	330						80
unplasticized	He	35	2.52								75
(Pentaform Type TH 170/01)	N_2	35	0.00709	0.00188							75
	Ar	35	0.0277	0.00339							75
	CO_2	35	0.182	0.00145							75
	CH_4	35	0.00810								75

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
unplasticized	He	35	2.24								75
(CS 5760)	N_2	35	0.00501	0.00137							75
	Ar	35	0.0208	0.00242							75
	CO_2	35	0.138	0.00145							75
	CH_4	35	0.00638	0.000331							75
plasticized with tricresyl triphospate %											
0	H_2	27	1.8	0.48							45
5	H_2	27	1.4	0.456							45
10.2	H_2	27	1.3	0.422							45
15	H_2	27	1.3	0.444							45
20.1	H_2	27	1.6	0.473							45
30.8	H_2	27	2.1	1.56							45
40.0	H_2	27	2.7	2.25							45
0	CO	27	0.019	0.0023							45
5	CO	27	0.012	0.0021							45
10.2	CO	27	0.013	0.0016							45
15	CO	27	0.014	0.0025							45
20.1	CO	27	0.021	0.0029							45
30.8	CO	27	0.079	0.0054							45
40.0	CO	27	0.281	0.029							45
Poly(vinyl chloride)/Oligo(dimethylsiloxane)											
100/0	N_2	25	0.0226								85
	O_2	25	0.103								85
90/10	N_2	25	0.0281								85
	O_2	25	0.120								85
80/20	N_2	25	0.0316								85
	O_2	25	0.151								85
75/25	N_2	25	0.0359								85
	O_2	25	0.164								85
60/40	N_2	25	0.0656								85
	O_2	25	0.295								85
50/50	N_2	25	0.153								85
	O_2	25	0.678								85
40/60	N_2	25	0.320								85
	O_2	25	1.74								85
30/70	N_2	25	1.51								85
	O_2	25	3.83								85
Poly(vinyl chloride)-*g*-oligo(dimethylsiloxane)/Oligo(dimethylsiloxane)											
100/0	N_2	25	0.0269								85
	O_2	25	0.164								85
80/20	N_2	25	0.0271								85
	O_2	25	0.165								85
70/30	N_2	25	0.0431								85
	O_2	25	0.254								85
60/40	N_2	25	0.0609								85
	O_2	25	0.413								85
50/50	N_2	25	0.120								85
	O_2	25	0.795								85
40/60	N_2	25	0.417								85
	O_2	25	2.43								85
30/70	N_2	25	1.01								85
	O_2	25	4.99								85
Poly(vinyl flouride)	H_2	35	0.41								96
	He	35	0.98								96
	N_2	35	0.0068								96
	O_2	35	0.030								96
	CO_2	35	0.20								96
	CH_4	35	0.0075								96
Poly(vinylidene chloride)	O_2	35	0.00038								96
Poly(vinylidene chloride) (Saran)	He	34	0.233								10
	N_2	30	0.000706			0–90	900	70.3			37
	O_2	30	0.00383			0–90	825	66.6			37
	CO_2	30	0.0218			0–90	24.8	51.5			37
	CH_3Br	30	0.00218								37
	H_2S	30	0.027	9.6×10^{-5}	27.6	30–75	1.58×10^{5}	74.5			8
	H_2O	25	7.0			10–60	863	46.1			21
Poly(vinylidene chloride-*co*-vinyl chloride) 88/12 plasticized with acetyltributyl citrate (%)											
0.5	H_2O	30	1.38								50
2.7	H_2O	30	3.07								50

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
4.9	H_2O	30	4.77								50
7.2	H_2O	30	7.38								50
Poly(vinyl cyclohexanecarboxylate)	He	25	9.69	7.33	0.148	15–52	0.0158	18.3	16.3	0.25	81
	He	70	33.5	20.3	0.166	52–85	0.547	27.7	23.7	4.4	81
	O_2	25	1.30	0.122	1.08	15–52	0.00302	19.2	30.9	−11.7	81
	O_2	70	6.50	0.772	0.835	52–85	7.26	39.7	41.1	−0.34	81
	Ar	25	0.851	0.0670	1.27	15–52	0.0115	23.6	34.6	−11.1	81
	Ar	35	1.17	0.106	1.10						86
	Ar	70	4.75	0.570	0.934	52–85	20.2	43.5	43.5	−0.011	81
	N_2	25	0.256	0.0421	0.609	15–52	0.00690	25.3	35.6	-11.1	81
	N_2	70	1.82	0.368	0.492	52–85	60.4	49.4	46.9	1.8	81
	CO_2	25	5.05	0.0254	20.0	15–52	0.00233	15.2	37.5	−22.3	81
	CO_2	70	21.4	0.270	8.36	52–85	6.68	36.1	47.7	−11.7	81
1.6. *FLUORINE CONTAINING POLYMERS*											
Poly(tetrafluoroethylene)	H_2	25	7.4			20–130	0.0415	21.4			23
	H_2	25	7.25	0.147	4.94						49
	N_2	25	1.0	0.088	1.2	20–130	0.0202	24.4	29.9	−5.5	23
	O_2	25	3.2	0.0152	2.1	20–130	0.00698	19.1	26.3	−7.2	23
	CO_2	25	7.5	0.095	9.2	20–130	0.00248	14.0	28.6	−14.6	23
	NO_2	25	12.0	0.0037	320	20–130	0.00087	10.7	58.6	−47.9	23
	N_2O_4	25	28.0	0.025	110	20–130	9.7×10^{-6}	−2.1			23
	D_2	25	7.48	0.116	6.42						49
	T_2	25	6.19	0.052	11.9						49
	CH_4	25	0.56	0.023	2.46						49
	He	25	9.0	0.811	1.09						49
	Ne	25	2.69	0.251	1.09						49
	Ar	25	1.50	0.056	2.66						49
	Kr	25	0.73	0.015	4.83						49
	Xe	25	0.30	0.004	7.40						49
	H_2O	38	6								98
	CH_4	90	3.85	0.221	1.74	40–195	0.273	33.7	34.7	−1.0	53
	C_2H_6	90	2.15	0.0763	2.81	40–195	0.251	35.2	36.2	−1.0	53
	C_3H_8	90	0.96	0.0251	3.87	40–195	0.923	41.6	44.8	−3.2	53
	n-C_4H_{10}	90	0.878	0.0187	4.69	40–195	1.22	42.7	51.5	−8.8	53
	i-C_4H_{10}	90	0.345	0.0086	4.03	40–195	4.64	49.6	58.1	−8.5	53
(Hostaflon PFA)	He	23	33.0			20–100	0.0119	14.5			73
	O_2	22	3.17			20–90	0.0386	23.1			73
	N_2	23	0.92			20–100	0.105	28.7			73
	CO_2	24	10.0			20–100	0.0236	19.2			73
	CH_4	25	0.79			20–100	0.292	31.8			73
	SO_2	24	2.11			5–100	0.0425	24.5			73
	Cl_2	23	1.35			20–100	0.0259	24.3			73
	HCl	22	2.04			20–80	0.122	27.0			73
	H_2O	23	13.4			10–80	0.0797	21.4			73
Poly(tetrafluorethylene-*co*-hexafluoropropene) (Teflon FEP)	N_2	25	1.19	0.0948	1.25	20–80	0.273	30.6	38.5	−7.9	24
	O_2	25	3.68	0.184	2.02	20–80	0.109	25.5	34.7	−9.2	24,67
	CO_2	25	9.53	0.105	9.08	20–80	0.0443	20.9	36.6	−15.7	24
	CH_4	90	9.98	0.491	2.15	40–195	1.09	35.0	41.3	−6.3	53,55
	C_2H_6	90	6.23	0.140	4.37	40–195	1.22	36.8	53.8	−17.0	53,55
	C_3H_8	90	3.11	0.0489	6.38	40–195	6.30	43.9	59.5	−15.6	53,55
	n-C_4H_{10}	90	2.18	0.0278	7.8	40–195	134	54.2	65.0	−10.8	53,55
	i-C_4H_{10}	90	0.855	0.0146	5.86	40–195	4200	67.4	77.8	−10.4	53,55
	CH_3Cl	25	0.763	0.00667	11.5	40–120	0.945	34.8	50.1	−15.3	55
	C_6H_6	25	0.263	2.45×10^{-4}	107	40–120	122	49.5	69.1	−19.6	55
	H_2O	25	12.8			25–60	0.494	26.2	56.4	−30.2	56,66
		70	37.3			60–85	1.58×10^{-7}	−15.6	16.5	−32.1	56,66
Poly(tetrafluorethylene-*co*-ethylene) (Hostaflon ET)	He	23	4.23								54
	O_2	23	0.40								54
	N_2	23	0.137								54
	CO_2	23	1.49								54
	H_2O	23	2.8								54
	He	25	5.67			20–100	0.0557	22.8			73
	O_2	22	0.78			20–100	0.371	32.1			73
	N_2	23	0.25			5–100	0.0790	31.2			73
	CO_2	23	4.39			20–100	0.0562	23.3			73
	CH_4	23	0.23			20–100	0.326	34.9			73
	Cl_2	23	0.807			20–100	0.0349	26.3			73
	HCl	23	2.2			20–100	0.394	29.8			73
	SO_2	23	1.96			5–100	0.0137	21.8			73
	H_2O	25	74			20–55	0.000121	1.2			73
		80	115			55–95	0.0387	17.1			73
Poly(trifluorochloroethylene)	He	20	5.1					23.4			10
unplasticized	H_2	20	0.705					30.2			10
Kel-F 300 film of about	N_2	25	0.00375			25–75	150	59.9			20
30% crystallinity	O_2	40	0.030			0–80	4.35	46.9			20
	CO_2	40	0.158			40–80	24.8	49.4			20
	H_2O	25	0.218								37

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
	C_2H_2O	60	3.3								37
	CH_3Br	60	3.45								37
crystallinity 80%	N_2	25	0.00225			25–75	1.05	49.8			20
	O_2	40	0.0188			40–60	0.698	45.6			20
	CO_2	40	0.036			40–80	2.03	46.5			20
crystallinity 30%	N_2	50	0.413								20
plasticized[c]	O_2	30	0.42								20
	CO_2	50	5.63								20
Poly(trifluorochloroethylene-*co*-ethylene) (Halar)	He	23	4.0								54
	O_2	23	0.114								54
	N_2	23	0.0457								54
	CO_2	23	0.457								54
	H_2O	23	2.8								54
Poly(vinyl fluoride) (Tedlar)	He	23	0.347								54
	N_2	23	0.0012								54
	O_2	23	0.0139								54
	CO_2	23	0.069								54
	H_2O	23	10.1								54
Poly(vinyl fluoride) (Kynar)	He	35	1.29	1.87							78
	H_2	35	0.404	0.336							78
	Ar	35	0.0323	0.00985	0.394						78
	N_2	35	0.0167	0.00716	0.234						78
	O_2	35	0.0620	0.0172							78
	CH_4	35	0.0150	0.00294	0.457						78
	CO_2	35	0.388	0.00566	7.21						78
1.7. POLY(DIENES)											
Poly(butadiene)	H_2	25	31.6	9.6	0.326	25–50	2.15	27.6	21.3	6.3	35
	N_2	25	4.84	1.1	0.444	25–50	4.91	34.3	30.1	4.2	35
	O_2	25	14.3	1.5	0.957	25–50	2.27	29.7	28.5	1.2	35
	CO_2	25	104	1.05	9.87	25–50	0.683	21.8	30.6	−8.8	35
cis-1.4	He	24	24.5	15.7	0.156	0–45	0.0855	20.3	17.3	2.9	25
	Ne	24	14.4	6.55	0.220	0–45	0.096	21.8	17.4	4.4	25
	Ar	24	30.8	4.06	0.758	0–45	0.084	19.4	21.3	−1.9	25
	N_2	24	14.4	2.96	0.488	0–45	0.078	21.3	25.0	−3.7	25
Poly(butadiene-*co*-acrylonitrile)	He	25	12.7	15.5	0.0819	25–50	1.24	28.5	17.6	10.9	35
80/20 (Perbunan 18)	H_2	25	18.9	6.43	0.296	25–50	3.52	30.1	26.0	4.1	35
	N_2	25	1.89	0.51	0.375	25–50	34.9	41.5	35.6	5.9	35
	O_2	25	6.15	0.79	0.77	25–50	230	36.0	33.9	2.1	35
	CO_2	25	47.6	0.425	11.2	25–50	6.43	29.3	38.5	−9.2	35
73/27 (Perbunan, German)	He	25	9.2	11.7	0.0789	25–50	1.24	29.3	21.8	7.5	35
	H_2	25	11.9	4.5	0.267	25–50	7.43	33.1	28.9	4.2	35
	N_2	25	0.8	0.25	0.316	25–50	180	47.7	43.5	4.2	35
	O_2	25	2.9	0.43	0.671	25–50	37.3	40.6	38.5	2.1	35
	CO_2	25	23.2	0.19	12.2	25–50	20.0	33.9	44.8	−10.9	35
	C_2H_2	25	18.7	0.0764	24.5	25–50	282	41.0	51.5	−10.5	35
	C_3H_8	50	58.5	0.141	41.5						35
68/32 (Hycar OR 25)	He	25	7.4	11.2	0.0661	25–50	1.9	30.9	21.8	9.1	35
	H_2	25	8.85	3.85	0.227	25–50	8.97	34.3	29.3	5.0	35
	N_2	25	0.454	0.152	0.296	25–50	473	51.5	49.0	2.5	35
	O_2	25	1.76	0.28	0.632	25–50	85.6	43.9	43.1	0.8	35
	CO_2	25	13.9	0.107	13.0	25–50	55.5	37.7	50.2	−12.5	35
61/39 (Hycar OR 15)	He	25	5.13	7.92	0.0592	25–50	2.23	32.2	23.0	9.2	35
	H_2	25	5.35	2.43	0.217	25–50	14.9	36.8	31.8	5.0	35
	N_2	25	0.177	0.064	0.276	25–50	2330	57.8	53.2	4.6	35
	O_2	25	0.721	13.6	0.533	25–50	444	50.2	45.6	4.6	35
	CO_2	25	5.59	0.038	14.7	25–50	272	43.9	56.1	−12.2	35
Poly(butadiene-*co*-styrene)	He	24	17.2	15.7	0.110	0–50	4.79	26.8	23.7	3.1	25
92/8 (Ameripol 1502)	Ne	24	7.28	5.47	0.133	0–50	0.908	29.2	29.4	−0.2	25
	Ar	24	9.53	1.39	0.686	0–50	7.88	33.7	33.3	0.4	25
	N_2	24	3.83	1.05	0.365	0–50	8.63	36.3	36.0	0.3	25
80/20 (Hycar 2001)	He	24	10.1	16.0	0.0628	0–50	1.41	29.5	18.0	11.5	25
	Ne	24	3.76	4.23	0.0885	0–50	0.56	29.5	25.7	3.8	25
	Ar	24	3.37	58.0	0.581	0–50	19.2	42.2	41.3	0.9	25
	N_2	24	1.28	42.8	0.30	0–50	23.8	41.6	42.2	−0.6	25
Poly(butadiene) hydrogenated crystallinity 29%, Hydropol density 0.894 g/cm^3	He	25	11.8	15.1	0.0781	5–60	17.2	35.2	24.7	10.5	16
	O_2	25	8.49	1.2	0.708	5–60	128	41.0	38.9	2.1	16
	Ar	25	8.29	0.96	0.864	5–60	292	43.1	40.2	2.9	16
	CO_2	25	36.3	0.91	3.99	5–60	85.8	36.4	36.8	−0.4	16
	CO	25	4.64	0.82	0.566	5–60	324	44.8	37.3	7.5	16
	N_2	25	3.00	0.74	0.405	5–60	489	46.9	39.4	7.5	16
	CH_4	25	9.77	0.54	1.81	5–60	942	45.6	44.0	1.6	16
	C_2H_6	25	25.0	0.24	10.4	5–60	543	41.9	49.4	−7.5	16
	C_3H_4	25	169	0.31	54.5	5–60	340	36.0	45.2	−9.2	16
	C_3H_6	25	62.2	0.20	31.1	5–60	680	40.2	48.2	−8.0	16
	C_3H_8	25	40.5	0.12	33.8	5–60	1680	43.5	52.3	−8.8	16
	SF_6	25	0.849	0.056	1.52	5–60	7790	56.9	60.3	−3.4	16

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
Poly(chloroprene) (Neoprene G)	H_2	25	10.2	3.8	0.286	15–50	8.80	33.9	27.6	6.3	33,36
	O_2	25	2.96	0.38	0.740	15–50	54.7	41.5	39.4	2.1	33,36
	N_2	25	0.88	0.24	0.355	15–50	224	44.4	43.1	1.3	33,36
	Ar	25	2.84	0.16							36
	CO_2	25	19.2	0.23	8.19	15–50	2499	35.6	45.2	−9.6	33,36
	CH_4	25	2.47								33
	H_2O	25	683								31
	NH_3	25			86.8						33
	SO_2	25			176						33
(Neoprene W)	H_2O	23	837			23–60	4.04×10^{11}	83.3			52
	H_2O[f]	23	5130			23–60	2.4×10^{6}	49.2			52
(Neoprene)	He	35	15.0	60.4	0.0247						90
	H_2	35	20.7	9.33	0.221						90
	D_2	35	20.0	10.7	0.188						90
	O_2	35	6.62	1.01	0.656						90
	N_2	35	2.23	0.533	0.419						90
Poly(dimethylbutadiene)	He	25	10.8			25–50	0.735	27.6			35,58
(Methyl rubber)	H_2	25	12.8	3.9	0.326	25–50	9.40	33.5	31.4	2.1	35
	N_2	25	0.355	0.079	0.454	25–50	2010	55.7	51.9	3.8	35
	O_2	25	1.58	0.14	1.13	25–50	303	47.3	46.5	0.8	35
	CO_2	25	5.63	0.063	8.98	25–50	917	46.9	53.6	−6.7	35,33
	CH_4	25	0.622			25–50	50300	62.3			58
Poly(ethylene-*co*-propylene-*co*-diene)	H_2O	23	157			23–60	6.84×10^{8}	71.7			52
Poly(isobutene-*co*-isoprene) 98/2	H_2O[f]	23	367			23–60	745000	52.8			52
(Butyl rubber)	He	25	6.32	5.93	0.109	25–50	2.34	31.8	24.3	7.5	35
	H_2	25	5.43	1.52	0.355	25–50	12.8	36.4	33.9	2.5	35
	N_2	25	0.243	0.045	0.543	25–50	349	52.3	50.7	1.6	35
	O_2	25	0.977	0.081	1.20	25–50	68.3	44.8	49.8	−5.0	35
	CO_2	25	3.89	0.0578	6.71	25–50	71.9	41.5	50.2	−8.7	35
	C_2H_2	25	1.26	0.0203	6.22	25–50	407	48.6	53.6	−5.0	35
	C_3H_8	50	10.3	0.0224	46.4						35
	H_2O	37.5	82.5								12
Poly(isoprene), amorphous	He	25		21.6					19.7		16
(Natural rubber)	O_2	25	17.6	1.73	1.02	20–50	2.38	29.3	33.5	−4.2	16,35
	Ar	25	17.2	1.36	1.26	20–50	9.15	32.7	33.1	−0.4	16
	CO_2	25	115	1.25	9.20	20–50	0.755	21.8	34.3	−12.5	16,35
	CO	25	11.8	1.35	0.874	20–50	3.16	31.0	31.0	0	16
Poly(isoprene)	N_2	25	7.11	1.17	0.608	20–50	12.2	35.6	33.5	2.1	16,35
	CH_4	25	22.7	0.89	2.55	20–50	6.08	31.0	36.4	−5.4	16
	C_2H_6	25		0.40					42.7		16
	C_3H_4	25	415	0.50	83.5	20–50	3.76	22.6	37.7	−15.1	16
	C_3H_6	25	154	0.31	49.7	20–50	17.7	28.9	42.7	−13.8	16
	C_3H_8	25	126	0.21	60.0	20–50	1.34	23.0	46.5	−23.5	16,35
	SF_6	25	2.70	0.115	2.35	20–50	4.62	35.6	50.2	−14.6	16
	C_2H_2	25	74.5	0.467	16.0	25–50	17.0	30.6	39.8	−9.2	35
	n-C_4H_{10}	50	526								58
	n-C_5H_{12}	50	1240								58
	H_2O	25	1720								31, 98
trans-	H_2	25	10.9	5.0	0.227	15–40	296	42.3	31.8	13.0	34
(Vulcanized purified gutta percha)		50	106	21	0.493	50–70	0.582	23.0	26.4	−0.4	34
	O_2	25	4.64	0.7	0.661	15–40	2560	49.8	38.5	13.8	34
		50	56.3	5.3	1.05	50–70	0.197	21.8	26.8	−2.1	34
	N_2	25	1.62	0.5	0.326	15–40	1560	52.3	41.0	13.8	34
		50	23.7	4.2	0.562	50–70	0.316	25.5	28.1	0.4	34
	CO_2	25	26.7	0.47	5.52	15–40	217	39.3	41.0	0.8	34
		50	281	4.1	6.81	50–70	0.0671	14.7	28.1	−10.5	34
	H_2O	25	379								31
Poly(isoprene-*co*-acrylonitrile) 74/26	He	25	5.85	8.01	0.0731	25–50	2.17	31.8	20.5	11.3	35
	H_2	25	5.58	2.47	0.227	25–50	26.2	38.1	31.0	7.1	35
	N_2	25	0.136	0.045	0.306	25–50	13500	62.8	60.7	2.1	35
	O_2	25	0.642	0.092	0.701	25–50	1330	53.2	50.7	2.5	35
	CO_2	25	3.26	0.031	10.6	25–50	4690	52.3	60.3	−8.0	35
Poly(isoprene-*co*-methacrylonitrile) 74/26	H_2	25	10.2	3.55	0.286	25–50	8.80	33.9	28.9	5.0	35
	N_2	25	0.449	0.123	0.365	25–50	1090	53.6	48.6	5.0	35
	O_2	25	1.77	0.24	0.740	25–50	209	46.1	40.2	5.9	35
	CO_2	25	10.7	0.091	11.8	25–50	273	42.3	51.1	−8.8	35
Poly(isoprene) hydrochloride	He	20	14.3								10
(Pliofilm FM-1)	N_2	30	0.113								37
	O_2	30	40.5								37
	CO_2	30	0.91			10–60	1.43	36.0			37,43
	H_2S	30	0.075	0.0002	38.5	30–60	403000	73.7			8
	C_2H_4O	0	548								37
	CH_3Br	60	25.5								37

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
(Pliofilm NO)	H_2O	25		4100		25–60			58.6		39
Poly(methyl-1-pentenylene)	He	25	75.8								41
	H_2	25	102								41
	N_2	25	5.87	0.55	1.07						41
	O_2	25	24.2	1.01	2.40						41
	CO_2	25	69.5	684	0.0102						41
Poly(2-methyl-1,3-pentadiene-*co*-4-methyl-1,3-pentadiene 85/15	H_2	25	32.0			25–50	5.08	29.7			35
	N_2	25	2.06	0.30	0.691	25–50	336	46.9	46.5	0.4	35
	O_2	25	7.52	0.555	1.36	25–50	59.6	39.4	41.0	−1.6	35
	CO_2	25	33.8			25–50	41.9	34.8			35
1.8. POLY(XYLYLENES)											
Poly(*p*-2,6-dichloroxylylene)	H_2O	25	4.97	0.00594	84.6	30–80	0.0129	19.5	36.0	−16.5	48
Poly(chloro-*p*-xylylene) (parylene C)	He	25	1.41	0.103	0.391	10–80		21.7	14.6	7.1	84
	H_2	25	0.717	0.0675	0.670	10–80		24.1	18.5	5.6	84
	N_2	25	0.00626	0.00178	0.0863	10–80		31.3	30.1	1.2	84
	O_2	25	0.0358	0.00351	0.567	10–80		29.5	32.5	−3.0	84
	CO_2	25	0.105	0.00164	4.62	10–80		27.8	51.3	−23.4	84
1.9. POLY(OXIDES)											
Poly(oxymethylene)	CO_2	25	1.35	0.014	9.64	25–100	0.462	31.4	49.0		38
	H_2O	25	683	0.027	2530	25–100	0.129	13.0			38
grafted with 2.8% butadiene	CO_2	25	3.83	0.044	8.69	25–100	0.095	25.1	38.5		38
	H_2O	25	998	0.070	1430	25–100	0.0126	6.3			38
(Hostaform)	O_2	23	0.057								73
	CO_2	23	1.28								73
	H_2O	23	422			23–60	0.129	14.1			73
Poly(oxy-2,6-dimethyl-1,4-phenylene)	He	25	58.5								41
	H_2	25	84.6								41
	N_2	25	2.86								41
	O_2	25	11.9								41
	CO_2	25	56.8	0.0601	94.6						41
	H_2O	25	3045	0.17	1797						40
Poly(phenylene oxide) brominated											
0% Br[a]	CO_2	35	38	0.17	21.7						100
	CH_4	35	2.2	0.021	10.6						100
36% Br	CO_2	35	38	0.16	23.7						100
	CH_4	35	2.0	0.016	11.8						100
91% Br	CO_2	35	51	0.20	25.4						100
	CH_4	35	2.6	0.02	13.1						100
106% Br	CO_2	35	81	0.30	27.2						100
	CH_4	35	4.7	0.033	14.3						100
1.10. POLY(ESTERS), POLY(CARBONATES)											
Poly(oxybutyleneoxyterephthaloyl), amorphous	He	25	1.28	0.13	0.888						44
	Ne	25	0.237	0.022	0.997						44
	Ar	25	0.078	0.0040	1.97						44
	CO_2	25	0.217	0.0062	3.46						44
Poly(oxycarbonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene) (Lexan)	He	25	7.5			25–125	0.0248	20.1			22
	H_2	25	9.0	0.64	1.38	25–175	0.0816	22.6	20.9	1.7	22
	Ne	100	10.9								22
	Ar	25	0.6	0.015	4.15	25–125	0.00544	22.6	25.1	−2.5	22
		175	32.3	0.53	6.12	125–175	70.2	54.4			22
	O_2	25	1.05	0.021	5.03	0–125	0.00252	19.3	32.2	−12.9	22
		175	22.5			125–175	0.0919	31.0			22
	CO_2	25	6.0	0.0048	124	25–100	0.00365	15.9	37.7	−21.8	22
	SF_6	25	4.88×10^{-6}	1.0×10^{-7}	4.94	25–125	0.0118	53.6	83.7	−30.1	22
		175	0.075			125–175	3.21×10^{7}	125.6			22
	H_2O	25	1050	0.68					26.0		22
	N_2	25	0.225			0–125	0.00559	25.1			22
		175	14.3			125–175	1.09	41.9			22
Poly(oxyethyleneoxyisophthaloyl)	O_2	30	0.012	0.0029	0.41						60
Poly(oxyethyleneoxyterephthaloyl), amorphous	He	25	2.37	3.1	0.077	20–60	0.0199	21.3	19.2	−1.1	17,18
	Ar	25	0.0217	0.0024	0.79	20–60	0.00319	28.9	48.2	−15.1	17,18
	N_2	25	0.0108	0.0019	0.55	20–60	0.00025	26.4	47.7	−23.9	17,18
	O_2	25	0.0444	0.0045	0.98	20–60	0.227	37.7	48.6	−14.7	17,18
	CH_4	25	0.0070	0.00030	2.3	20–60	0.00021	24.7	51.1	−27.2	17,18
	CO_2	25	0.227	0.00083	28.0	20–60	0.0232	27.6	52.3	−28.5	17,18
crystallinity 40%	He	25	1.09	2.0	0.052	20–80	0.00308	19.7	20.1	0.9	17,18
		90	6.3			80–130	0.0266	25.5	27.6	0.9	17,18
	N_2	25	0.00513	0.0013	0.45	20–80	0.00275	32.7	44.0	−18.4	17,18
		90	0.068			80–130	20.6	59.0	58.6	0	17,18

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
	O_2	25	0.0257	0.0035	0.72	20–80	0.0122	32.2	46.1	−13.0	17,18
		90	0.31			80–130	0.744	44.4	50.7	0	17,18
	CH_4	25	0.00257	0.00013	2.0	20–80	0.00719	36.8	52.3	−22.2	17,18
		90	0.091			80–130	63.2	61.5	67.0	−12.9	17,18
	CO_2	25	0.118	0.00057	20.0	20–80	0.000197	18.4	50.2	−31.4	17,18
		90	1.0			80–130	22.2	51.1	64.5	−19.7	17,18
(Mylar A)	H_2	25	0.448								57
	D_2	25	0.073								57
	N_2	25	0.0038			−25–80	0.000945	30.8			37
	O_2	25	0.030			−25–80	0.000026	16.8			37
	CH_3Br	25	0.013			25–90	0.0163	34.8			37
	C_2H_4O	25	0.084			25–90	0.000534	21.7			37
	H_2O	25	98			10–60	0.00032	2.9			21
(Hostaphan)	H_2S	20	0.14	0.000071	195						5
	NH_3	20	1.1								5
	N_2	20	0.0034								61
	O_2	23	0.014								72
	O_2	30	0.042	0.0065	0.62						60
	H_2O	23	114			10–40	0.00012	0.1			73
Poly(ethylene terephthalate)	H_2O	25	113								98
Poly(ethylene terephthalate-*co*-isophthalate) 50/50	O_2	30	0.019	0.0035	0.49						60
Poly(ethylene terephthalate-*co*-2,6-naphthalene dicarboxylate) 50/50	O_2	30	0.031	0.0048	0.61						60
Poly(oxyterephthaloyloxymethylene-1,4-cyclohexylenemethylene)	O_2	30	0.19	0.014	1.3						60
Poly(tetramethylene adipate) diol	O_2	35	0.0975	0.076	0.1275						76
molecular weight 1050	CO_2	35	0.525	0.027	1.95						76
density 1.20 g/cm^3	CO	35	0.0278	0.039	0.07125						76
	N_2	35									76
	CH_4	35	0.0353	0.027	0.1275						76
	H_2O	23	3900	0.041	9525						76
molecular weight 1510	O_2	35	0.563	0.16	0.3525						76
density 1.19 g/cm^3	CO_2	35	4.8	0.057	8.25						76
	CO	35	0.195	0.074	0.2625						76
	N_2	35	0.113	0.053	0.2100						76
	CH_4	35	0.383	0.058	0.6600						76
	H_2O	23	5925	0.055	10875						76
molecular weight 2100	O_2	35	1.5	0.39	0.375						76
density 1.18 g/cm^3	CO_2	35	15	0.13	6.53						76
	CO	35	0.9	0.11	0.750						76
	N_2	35	0.6	0.22	0.270						76
	CH_4	35	1.2	0.17	0.750						76
	H_2O	23	7425	0.078	9525						76
Poly(carbonate) (Lexan)	H_2O	25	1050								98
Poly(carbonate)	CO_2	35	4.5	0.0209	14.5						100
	CH_4	35	0.20	0.0046	4.0						100
Poly(carbonate-sulfone) (diphenyl carbonate + 1,10-decanediol)	CO_2	25	9.5								95
(diphenyl carbonate + 1,4-bis(3-hydroxypropylsulfonyl)butane	CO_2	25	0.035								95
Poly(tetrabutylene carbonate)	CO_2	35	3.17	0.0166	19.1						100
	CH_4	35	0.0945	0.0013	7.24						100
Poly(tetrachlorine carbonate)	CO_2	35	5.00	0.0253	19.6						100
	CH_4	35	0.168	0.0022	7.61						100
Poly(tetramethylene hexafluoro carbonate)	CO_2	35	82.5	0.24	32.6						100
	CH_4	35	3.45	0.0348	9.58						100
Poly(tetramethylene carbonate)	CO_2	35	13.2	0.061	21.5						100
	CH_4	35	0.60	0.0081	7.37						100
Poly(tetramethylene carbonate) diol	O_2	35	0.105	0.029	0.368						76
molecular weight 1150	CO_2	35	0.675	0.012	5.40						76
density 1.29 g/cm^3	CO	35	0.0525	0.010	0.525						76
	N_2	35	0.0308	0.019	0.165						76
	CH_4	35	0.0375	0.008	0.473						76
	H_2O	23	825	0.012	7223						76

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
molecular weight 1570	O_2	35	0.143	0.054	0.263						76
density 1.27 g/cm^3	CO_2	35	1.35	0.017	7.50						76
	CO	35	0.105	0.033	0.315						76
	N_2	35	0.0660	0.050	0.105						76
	CH_4	35	0.105	0.019	0.540						76
	H_2O	23	2100	0.020	10575						76
molecular weight 3070	O_2	35	0.308	0.072	0.473						76
density 1.21 g/cm^3	CO_2	35	2.48	0.026	9.75						76
	CO	35	0.143	0.043	0.345						76
	N_2	35	0.0900	0.026	0.345						76
	CH_4	35	0.0975	0.015	0.675						76
	H_2O	23	1875	0.030	6143						76
Poly(hexamethylene carbonate) diol	O_2	35	0.188	0.022	0.825						76
molecular weight 1040	CO_2	35	1.05	0.022	6.98						76
density 1.29 g/cm^3	CO	35	0.0450	0.015	0.300						76
	N_2	35	0.0450	0.017	0.263						76
	CH_4	35	0.0375	0.0041	0.825						76
	H_2O	23	825	0.013	6825						76
molecular weight 1320	O_2	35	0.225	0.026	0.825						76
density 1.25 g/cm^3	CO_2	35	2.03	0.029	7.05						76
	CO	35	0.150	0.015	0.375						76
	N_2	35	0.0825	0.037	0.225						76
	CH_4	35	0.0675	0.012	0.563						76
	H_2O	23	1050	0.015	7230						76
molecular weight 1500	O_2	35	0.623	0.12	0.525						76
density 1.20 g/cm^3	CO_2	35	2.85	0.038	7.50						76
	CO	35	0.225	0.056	0.450						76
	N_2	35	0.173	0.076	0.225						76
	CH_4	35	0.165	0.019	0.900						76
	H_2O	23	1575	0.017	923						76
molecular weight 2380	O_2	35	1.65	0.19	0.825						76
density 1.18 g/cm^3	CO_2	35	11.3	0.21	5.33						76
	CO	35	0.750	0.14	0.525						76
	N_2	35	0.570	0.17	0.338						76
	CH_4	35	0.825	0.11	0.750						76
	H_2O	23	3450	0.070	4973						76
molecular weight 2860	O_2	35	2.18	0.22	0.975						76
density 1.18 g/cm^3	CO_2	35	9.00	0.27	3.38						76
	CO	35	0.975	0.23	0.450						76
	N_2	35	0.900	0.24	0.360						76
	CH_4	35	1.20	0.12	0.975						76
	H_2O	23	4200	0.076	5595						76
Poly(pentamethylene-hexamethylene carbonate) diol	O_2	35	0.825	0.079	1.05						76
molecular weight 2170	CO_2	35	7.50	0.089	8.25						76
density 1.18 g/cm^3	CO	35	0.443	0.074	0.600						76
	N_2	35	0.278	0.079	0.353						76
	CH_4	35	0.480	0.038	1.28						76
	H_2O	23	2475	0.034	7215						76
Poly(dipropylene glycol carbonate) diol	O_2	35	0.398	0.081	0.488						76
molecular weight 3010	CO_2	35	2.70	0.035	7.50						76
density 1.19 g/cm^3	CO	35	0.135	0.033	0.405						76
	N_2	35	0.0825	0.040	0.210						76
	CH_4	35	0.105	0.021	0.495						76
	H_2O	23	2025	0.019	10800						76
Poly(dipropylene glycol)poly(propylene glycol carbonate) diol	O_2	35	0.975	0.23	0.420						76
molecular weight 2020	CO_2	35	7.28	0.061	12.0						76
density 1.16 g/cm^3	CO	35	0.585	0.16	0.375						76
	N_2	35	0.278	0.13	0.218						76
	CH_4	35	0.570	0.048	1.20						76
	H_2O	23	3000	0.020	15000						76
Poly(triethylene glycol carbonate) diol	O_2	35	0.263	0.079	0.330						76
molecular weight 2580	CO_2	35	3.15	0.050	6.30						76
density 1.20 g/cm^3	CO	35	0.143	0.063	0.225						76
	N_2	35	0.0825	0.074	0.113						76
	CH_4	35	0.150	0.037	0.405						76
	H_2O	23	9750	0.034	25500						76

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
Poly(hexamethylene carbonate pentamethylene ester) diol	O_2	35	1.50	0.24	0.630						76
molecular weight 2470	CO_2	35	20.3	0.16	12.8						76
density 1.17 g/cm^3	CO	35	0.750	0.24	0.315						76
	N_2	35	0.600	0.18	0.330						76
	CH_4	35	1.28	0.14	0.900						76
	H_2O	23	655	0.11	59250						76
1.11. POLY(SILOXANES)											
Poly(oxydimethylsilylene) with 10%	He	0	175	41	0.424	−40–25	0.0946	14.3	8.0	6.3	2,41
filler Scantocel CS,	Ne	0	143	16.1	0.888	−40–0	0.0543	13.5	8.4	5.1	2
vulcanized silicon rubber	Ar	0	413	12.2	3.36	−40–0	0.0606	9.8	10.3	−0.5	2
	Kr	0	765	8.0	9.67	−40–0	0.0134	6.5	12.2	−5.7	2
	Xe	0	1910	4.8	39.4	−40–0	0.00781	3.2	14.0	−10.8	2
	H_2	0	348	47.0	0.73	−40–25	0.145	13.7	9.3	4.4	2,41
	N_2	0	170	8.5	2.00	−40–25	0.0197	10.8	11.3	−0.5	2,41
	O_2	0	367	12.0	3.06	−40–25	0.0169	8.7	9.0	−0.3	2,41
	CO_2	25	2430								41
	C_3H_8	25	319	12.0	2.4	0–70	0.00401	6.3	11.3	−5.0	46
	n-C_4H_{10}	0	14600	2.4	608	−40–0			14.2		2
	H_2O	35	32300			35–65	0.0303				3
Poly(dimethyl siloxane)	H_2	35	705								82
	He	35	420								82,94
	N_2	35	353								82
	O_2	35	695								82,94
	CO_2	35	3489								82,94
	CH_4	35	1002								82,94
	C_2H_4	35	2738								82
	C_2H_6	35	3150								82
	C_3H_8	35	6338								82
	H_2S	35	6413								82
	NH_3	35	9015								82
Poly(methyl ethyl siloxane)	He	35	172								94
	O_2	35	234								94
	CO_2	35	1130								94
	CH_4	35	356								94
Poly(methyl propyl siloxane)	He	35	191								94
	O_2	35	287								94
	CO_2	35	1727								94
	CH_4	35	428								94
Poly(methyl octyl siloxane)	H_2	35	233								82
	He	35	99.8								82,94
	N_2	35	65.3								82
	O_2	35	144								82,94
	CO_2	35	695								82,94
	CH_4	35	236								82,94
	C_2H_4	35	608								82
	C_2H_6	35	720								82
	C_3H_8	35	1493								82
	H_2S	35	1470								82
	NH_3	35	2213								82
Poly(triflouropropyl siloxane)	H_2O	25	16050								98
Poly(triflouropropyl methyl siloxane)	He	35	185								94
	O_2	35	163								94
	CO_2	35	1041								94
	CH_4	35	151								94
Poly(phenyl methyl siloxane)	He	35	25.5								94
	O_2	35	24.0								94
	CO_2	35	179								94
	CH_4	35	27.0								94
Poly(dimethyl silmethylene)	He	35	73.5								94
	O_2	35	75.8								94
	CO_2	35	412								94
	CH_4	35	97.5								94
Poly(silethylene siloxane)	He	35	204								94
	O_2	35	296								94
	CO_2	35	1412								94
	CH_4	35	448								94
Poly(silhexylene siloxane)	He	35	146								94
	O_2	35	199								94
	CO_2	35	980								94
	CH_4	35	296								94

Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
Poly(siloctylene siloxane)	He	35	131								94
	O_2	35	178								94
	CO_2	35	899								94
	CH_4	35	270								94
Poly(meta-silphenylene siloxane)	He	35	63.0								94
	O_2	35	55.5								94
	CO_2	35	389								94
	CH_4	35	79.5								94
Poly(para-silphenylene siloxane)	He	35	24.5								82, 94
	N_2	35	2.40								82
	O_2	35	8.21								82,94
	CO_2	35	38.3								82,94
	CH_4	35	7.65								82,94
	C_2H_4	35	15.0								82
	C_2H_6	35	11.3								82
	C_3H_8	35	19.5								82
	H_2S	35	141								82
	NH_3	35	223								82
1.12. POLY(AMIDES), POLY(IMIDES)											
Poly(iminoadipoyliminohexamethylene) (Nylon 66)											
undrawn	CO_2	5	0.018	0.00018	9.97						4
	CO_2	25	0.052	0.00083	6.32						4
drawn	CO_2	5	0.023	0.00018	12.8						4
	CO_2	25	0.071	0.00048	14.8						4
Poly(imino-1-oxohexamethylene) (Nylon 6)	He	20	0.398					36.4			10
	N_2	30	0.00713			0–90	1.05	46.9			37
	O_2	30	0.0285			0–90	0.975	43.5			37
	CO_2	20	0.066			0–90	1.2	40.6			37
	H_2O	25	0.139								20
	H_2S	30	0.255	0.00047	55.7	0–80	2400	58.2			8
	NH_3	20	0.878								5
	CH_3Br	60	0.63			60–80	137	53.2			37
Poly(imino-1-oxoundecamethylene) (Nylon 11)	He	30	1.46	3.5	0.0424	10–50	0.0827	27.6	22.2	5.4	1
	H_2	30	1.34	0.984	0.136	20–60	0.342	31.4	29.7	1.7	1
	Ne	30	0.26	0.437	0.0592	20–60	0.30	35.2	32.7	2.5	1
	Ar	40	0.143	0.0372	0.385	40–60	1.38	41.9	44.8	−2.9	1
	CO_2	40	0.754	0.0191	3.94	40–60	0.338	33.9	51.9	−18.0	1
Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c′]dipyrrole-2,6[1H,3H]-diyl-1,4-phenyleneoxy-1,4-phenylene) (Kapton)	O_2	160	1.7	0.168		135–240	0.00028	18.4	31.0	−12.6	67
	H_2O	30	431	0.0018	21400	30–80	0.00026	−1.28	42.0	−43.2	68
Poly(2,2′-bis(*p*-trimellitoxyphenyl) propane dianhydride-*co*-3,3′-dimethyl-benzidine)	H_2	30	4.85	0.396	1.22						104
	N_2	30	0.0384	0.00222	1.73						104
	O_2	30	0.304	0.0106	2.87						104
Poly(2,2′-bis(*p*-trimellitoxyphenyl) propane dianhydride-*co*-4,4′-diaminodiphenyl ether)	H_2	30	3.62	0.329	1.10						104
	N_2	30	0.0363	0.00206	1.76						104
	O_2	30	0.233	0.00878	2.65						104
Poly(2,2′-bis(*p*-trimellitoxyphenyl) propane dianhydride-*co*-4,4′-diaminodiphenyl methylene)	H_2	30	3.49	0.289	1.21						104
	N_2	30	0.0343	0.00187	1.83						104
	O_2	30	0.220	0.00736	2.99						104
Poly(2,2′-bis(*p*-trimellitoxyphenyl) propane dianhydride-*co*-benzidine)	H_2	30	0.542	0.0536	1.01						104
	N_2	30	0.00485	0.000327	1.49						104
	O_2	30	0.0344	0.00167	2.06						104
Poly(2,2′-bis(*p*-trimellitoxyphenyl) propane dianhydride-*co*-3,3′,4,4′-tetraaminodiphenyl ether)	H_2	30	5.52	0.402	1.37						104
	N_2	30	0.0439	0.00223	2.32						104
	O_2	30	0.326	0.0102	3.19						104
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*m*,*m*′-diaminodiphenyl methylene)	O_2	25	0.0235								105
	CO_2	25	0.0340								105
	H_2O	25	291								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*m*,*p*′-diaminodiphenyl methylene)	O_2	25	0.0578								105
	H_2O	25	573								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*p*,*p*′-diaminodiphenyl methylene)	O_2	25	0.140								105
	CO_2	25	0.324								105
	H_2O	25	984								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*p*,*p*′-diaminodiphenyl ether)	O_2	25	0.0927								105
	CO_2	25	0.357								105
	H_2O	25	719								105

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-benzidine)	O_2	25	0.00668								105
	CO_2	25	0.0234								105
	H_2O	25	94.4								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*p*-phenylenediamine)	O_2	25	0.0103								105
	H_2O	25	231								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*m*-phenylenediamine)	O_2	25	0.0308								105
	CO_2	25	0.0882								105
	H_2O	25	804								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-diaminodiphenyl sulfide)	O_2	25	0.0992								105
	CO_2	25	0.307								105
	H_2O	25	787								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*m,m*′-diaminobenzophenone)	O_2	25	0.0219								105
	CO_2	25	0.0807								105
	H_2O	25	428								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*m,p*′-diaminobenzophenone)	O_2	25	0.0450								105
	CO_2	25	0.0887								105
	H_2O	25	521								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*p,p*′-diaminobenzophenone)	O_2	25	0.0451								105
	CO_2	25	0.132								105
	H_2O	25	599								105
Poly(3,3′,4,4′-benzophenone tetracarboxylic dianhydride-*co*-*p,p*′-diaminostilbene)	O_2	25	0.00214								105
	CO_2	25	0.00692								105
Poly(pyromellitic dianhydride-*co*-benzidine)	O_2	25	0.00451								105
	CO_2	25	0.00790								105
	H_2O	25	131								105
Poly(pyromellitic dianhydride -*co*-*m,m*′-diaminobenzophenone)	O_2	25	0.0260								105
	H_2O	25	727								105
Poly(pyromellitic dianhydride -*co*-p,p′-diaminobenzophenone)	O_2	25	0.110								105
	CO_2	25	0.135								105
	H_2O	25	1009								105
Poly(pyromellitic dianhydride -*co*-*p,p*′-diaminodiphenyl ether)	O_2	25	0.242								105
	CO_2	25	1.36								105
	H_2O	25	1882								105
Poly(pyromellitic dianhydride -*co*-*p,p*′-diaminodiphenyl sulfide)	O_2	25	0.336								105
	H_2O	25	1882								105
Poly(pyromellitic dianhydride -*co*-*p,p*′-diaminodiphenyl methylene)	O_2	25	0.368								105
	CO_2	25	1.32								105
	H_2O	25	1582								105
1.13. POLY(URETHANES)											
Poly(2-methyl-2-dimethylaminomethylpropylenehexa methylene dicarbamate) (Poly(NPM-HMDI))	N_2	25	0.00975								91
	O_2	25	0.0645								91
Poly(2-methyl-2-dimethylaminomethyl-1,3-propylene-diphenylmethane-4,4′-dicarbamate) (Poly(NPM-MDI))	N_2	25	0.0105								91
	O_2	25	0.0675								91
Poly(urethane-sulfone) (tolylene diisocyanate + 1,10-decanediol)	CO_2	25	0.23								95
(tolylene diisocyanate + 1,3-bis(3-hydroxypropylsulfonyl)propane)	CO_2	25	0.0064								95
(tolylene diisocyanate + 1,4-bis(3-hydroxypropylsulfonyl)butane)	CO_2	25	0.0038								95
1.14. POLY(SULFONES)											
Poly(sulfone)	CO_2	35	4.20	0.020	20.7						100
	CH_4	35	0.19	0.0034	5.60						100
Poly(tetramethylsulfone)	CO_2	35	15.8	0.064	24.7						100
	CH_4	35	0.71	0.0079	9.14						100

Polymer	Permeant	T	P (×10[13])	D (×10[6])	S (×10[6])	Temp. range	P_0 (×10[7])	E_P	E_D	E_S	Refs.
Poly(dimethylsulfone)	CO_2	35	1.58	0.0094	16.8						100
	CH_4	35	0.0525	0.0010	5.09						100
Poly(tetramethylhexafluorosulfone)	CO_2	35	54	0.14	39.5						100
	CH_4	35	2.25	0.016	14.6						100
1.15. POLY(ARYL ETHER ETHER KETONE)											
Poly(aryl ether ether ketone)	He	25	5.24			25-75	17.2				101
		55	9.90								101
		75	14.0								101
	O_2	25	0.41			25-75	18.7				101
		55	0.82								101
		75	1.21								101
	CO_2	25	2.03			25-75	13.8				101
		55	3.40								101
		75	4.54								101
semicrystalline (30%)	H_2O	5		0.0017							102
		20		0.0053							102
		35		0.0082							103
		40		0.0152							102
		50		0.0190							103
		60		0.0356							102
		65		0.0390							103
		80		0.0660							103
		95		0.133							103
1.16. CELLULOSE AND DERIVATIVES											
Cellulose hydrate	He[c]	20	0.000375					41.4			10
(Cellophane)	H_2[c]	25	0.00472								28
	N_2[c]	25	0.0024								28
	O_2[c]	25	0.0016								28
	CO_2[c]	25	0.00353								28
	SO_2[c]	25	0.00129								28
	H_2S[c]	25	0.0086								28
	H_2S	45	0.0045	1.6×10^{-6}	276	45-60	2.1×10^6	89.6			8
	NH_3[c]	25	0.0118								28
	H_2O	25	18900								7
	H_2[h]	25	0.012								28
	N_2[h]	25	0.00507								28
	O_2[h]	25	0.00536								28
	CO_2[h]	25	0.00974								28
	H_2[i]	25	0.0244								28
	N_2[i]	25	0.00559								28
	O_2[i]	25	0.00665								28
	CO_2[i]	25	0.0539								28
	H_2[d]	25	0.0598								28
	N_2[d]	25	0.0138								28
	O_2[d]	25	0.0087								28
	CO_2[d]	25	0.192								28
	NH_3[d]	25	133								28
	SO_2[d]	25	28.4								28
	H_2S[d]		0.425								28
Cellulose acetate	He	20	10.2								10
	H_2	20	2.63								10
		35	11.2								87
	N_2[j]	30	0.21			- 25-60	0.00975	27.1			37
		35	0.173								87
	O_2[j]	30	0.585			- 25-60	0.00375	20.9			37
		35	0.788								87
	CO_2[j]	30	17.3				0.0218	18.0			37
		35	4.47								87
	H_2O	25	4130			10-60	0.0053	0			21
	H_2O[j]	25	5500			10-60	0.0053	0			21
	H_2S	30	2.63	0.0010	266	0-60	0.000668	20.5			8
	H_2S[j]	30	4.58	0.0022	207	0-60	0.00188	21.4			8
	CH_4	35	0.154								87
	C_3H_4O[j]	30	30.0								37
	CH_3Br[j]	30	4.2								37
Cellulose acetobutyrate	O_2	34	3.56								51
Cellulose nitrate	He	25	5.18	0.431	1.2						9
	H_2	20	1.5					23.8			10
	N_2	25	0.087	0.0193	0.45						9
	O_2	25	1.46	0.15	0.975						9
	Ar	25	0.0825	0.00753	1.05						9
	CO_2	25	1.59	0.0221	7.2						9
	SO_2	25	1.32	0.0018	73.3						9
	NH_3	25	42.8	0.00786	544						9
	H_2O	25	4720	0.0262	18000						9

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Polymer	Permeant	T	P ($\times 10^{13}$)	D ($\times 10^{6}$)	S ($\times 10^{6}$)	Temp. range	P_0 ($\times 10^{7}$)	E_P	E_D	E_S	Refs.
	C_2H_6	25	0.0473	0.00013	36.2						9
	C_3H_8	25	0.0063	0.000021	29.6						9
Ethyl cellulose	He	25	40.1	2.21	1.8						9
	H_2	20	65.3								10
	N_2	25	3.32	0.233	1.43						9
	O_2	25	11.0	0.639	1.73						9
	Ar	25	7.65	0.403	1.88						9
	CO_2	25	84.8	0.565	15.0						9
	SO_2	25	198	0.0734	270						9
	NH_3	25	529	0.146	363						9
	H_2O	25	6700	0.0286	23400						9
	C_2H_6	25	6.9	0.019	36.3						9
	C_2H_6	30	10.0								79
	C_2H_6	40	10.3								79
	C_2H_6	50	12.2								79
	C_2H_6	60	14.9								79
	C_2H_6	70	20.1								79
	C_3H_8	25	2.78	0.00293	94.7						9
	C_3H_8	30	4.73								79
	C_3H_8	40	5.32								79
	C_3H_8	50	6.36								79
	C_3H_8	60	9.05								79
	C_3H_8	70	10.8								79
	n-C_4H_{10}	25	2.9	0.00146	199						9
	n-C_4H_{10}	30	4.20								79
	n-C_4H_{10}	40	6.30								79
	n-C_4H_{10}	50	7.43								79
	n-C_4H_{10}	60	9.77								79
	n-C_4H_{10}	70	11.4								79
	n-C_5H_{12}	25	2.78	0.00138	201						9
	n-C_6H_{14}	25	5.75	0.00124	462						9
(Ethocel 610)	C_2H_4O[j]	30	308								37

[a] Thickness 0.29 mm.
[b] Thickness 0.84 mm.
[c] Relative humidity 0%.
[d] Relative humidity 100%.
[e] Plasticizer was low-molecular-weight polytrifluorochloroethylene.
[f] 3.5% aqueous sodium chloride solution (simulated sea water).
[g] The % bromination refers to 100 times the number of bromine atoms per repeat unit.
[h] Relative humidity 43%.
[i] Relative humidity 76%.
[j] Plasticized.

TABLE 2. PERMEABILTY COEFFICIENTS OF SIX DIFFERENT FLUORINATED HYDROCARBONS THROUGH POLYMERS[a]

Polymer	$CFCl_3$ (24.5°C)	CF_2Cl_2 (20°C)	CF_3Cl (20°C)	$CHFCl_2$ (20°C)	CHF_2Cl (20°C)	CF_2Cl–CF_2Cl (20°C)	N_2 (20°C)
Poly(ethylene) low density	37.5	152	2.03	1.88	0.795	0.212	0.914
high density	9.75	30	0.673	0.374	0.106	0.0683	0.219
high density, drawn	3.38	4.35	0.326	0.161	0.0266	0.0336	0.133
Poly(propylene)	4.88	137	0.132	0.00338	0.0018	0.00728	0.151
Poly(vinyl chloride) (Genotherm UG), unplasticized	0.697	0.00668	0.00585	0.0016	0.0016	0.00503	0.0247
Poly(vinyl chloride) (Guttagena T52), plasticized	656	63.8	1.88	0.359	0.185	0.054	0.0649
Poly(oxyethyleneoxyterephthaloyl) [Poly(ethylene terephthalate)] (Hostaphan)	0.00188	0.00135	0.0016	0.00135	0.00165	0.0039	0.00343
Poly(imino-1-oxohexamethylene) (Supronyl S)	0.0315	0.0329	0.0111	0.00623	0.00803	0.00923	0.0075
Poly(imino-1-oxohexamethylene) (Supronyl N), plasticized	52.5	3.6	0.254	0.00473	0.00143	0.00225	0.0133

[a] Ref. 61; P in $cm^3 \times cm/(cm^2 \times s \times Pa) \times 10^{-13}$.

TABLE 3. PERMEABILITY COEFFICIENTS OF VARIOUS ORGANIC COMPOUNDS THROUGH LOW-DENSITY POLY(ETHYLENE)[a]

Permeant	0°C	21.1°C	54.4°C	73.9°C
Acetaldehyde	1.34	2.36		
Acetanilide		0.008	0.16	1.34
Acetic acid	0.14	1.22	25.9	119

Permeant	0°C	21.1°C	54.4°C	73.9°C
Acetic anhydride	0.051	0.32	11.6	83.7
Acetone	0.55	2.67	72.3	295
Allyl alcohol	0.063	0.57	9.04	54.2
Amyl acetate	0.22	3.42	106	430
i-Amyl alcohol		0.078		
i-Amyl propionate		3.9		
n-Amyl propionate		11.8		
Aniline	0.098	0.67	23.4	116
Benzaldehyde	0.15	2.67	81.0	417
Benzene	17.7	173	1770	5400
Benzoic acid		0.028	2.24	14.2
Benzyl alcohol		0.16		
n-Butyl acetate		5.9		
n-Butyl alcohol	0.04	0.18	8.02	59
s-Butyl alcohol	0.05	0.24	14.8	109
t-Butyl alcohol	0.02	0.10	10.6	92.8
Butyraldehyde	0.35	3.93	229	393
n-Butyric acid	0.075	1.89	39.3	228
Camphor		0.12	8.5	63.7
Carbon tetrachloride	20	240	3080	17700
Chloroacetic acid		0.12	5.9	23.6
m-Chloroaniline		0.63		
Chlorobenzene	22.7	179	1730	8300
Chloromaleic anhydride		0.28		
p-Chlorotoluene	11.8	119	1640	7300
Cyclohexane	12.4	98.7	1470	5900
Decane	3.7	28.0	480	1620
1,2-Dibromoethane		55.0		
Dibutyl ether	4.4	33.6	582	1230
Dibutyl phthalate			5.7	10.9
o-Dichlorobenzene		60.9		
Diethylene glycol				0.30
Diethyl ether	18.9	123	3140	11800
Diethyl oxalate		0.28		
Dipentene	5.9	50.3	798	3190
Ethyl acetate	0.75	6.5	149	669
Ethyl alcohol		0.28		
Ethylene glycol				0.50
Ethylene glycol monobutyl ether		0.26	13.8	70.8
Ethyl formate		5.9		
Ethyl mercaptan	10.2	157	3931	15700
Ethyl propionate		9.8		
Formaldehyde		0.21		
Formamide		0.20		
Formic acid	0.10	0.26	4.7	20.0
Furfuryl alcohol		0.09		
Glycerin			0.14	0.63
n-Heptane	19.1	106	1040	3200
n-Heptene		106		
n-Heptyl acetate		7.1		
Heptyl alcohol		0.39		
n-Hexane	18.9	138	3540	11800
Hydroquinone			0.02	0.14
Methyl acetate		5.5		
Methyl alcohol	0.1	0.48	10.9	39.3
Methyl ethyl ketone	1.45	4.95	128	550
Methylcyclohexane		108		
Nitrobenzene	0.15	1.93	39.3	165
Nitroethane	0.38	1.06	25.1	113
Nitromethane		0.83		
Octadecane		0.71		
Octyl alcohol	0.039	0.20	10.1	73.9
Oxalic acid			0.08	0.09
i-Pentane	18.9	106	1970	7860
n-Pentane	38.1	206	5900	23600
Phenol	0.04	0.2	9.4	47.1

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Permeant	0°C	21.1°C	54.4°C	73.9°C
n-Propyl alcohol	0.03	0.2	8.8	66.0
i-Propylamine	0.90	16.0	275	1260
Tetradecane	0.67	5.7	159	393
Tetradecene		4.7		
Toluene	22.7	199	2270	11300
1,1,1-Trichloroethane		102		
o-Xylene	14.2	101	1420	6530
p-Xylene	33.7	191	1890	6410

[a] Ref. 62; P in g × mm/(m² × d).

TABLE 4. PERMEABILITY COEFFICIENTS AND DIFFUSION COEFFICIENTS OF AN EQUIMOLAR MIXTURE OF VARIOUS COMPOUNDS (1.25 M EACH) THROUGH HIGH-DENSITY POLY(ETHYLENE)[a]

	P		D ($\times 10^6$)	
Permeant	22°C	50°C	22°C	50°C
1,1,2-Trichlorethane (0.167 g/ml)	2.4	8.8	0.0142	0.0833
1,2-Dichloroethane (0.124 g/ml)	3.3	14.6	0.0225	0.114
Methylene chloride (0.106 g/ml)	5.3	5.9	0.0889	
Styrene (0.130 g/ml)	2.7	10.0	0.0500	0.167
Benzene (0.098 g/ml)	3.1	10.0	0.0417	0.361
Toluene (0.098 g/ml)	3.3	10.2	0.0722	0.417
Naphthalene (0.160 g/ml)	0.73	4.4		0.0333
2-Methyl naphthalene (0.178 g/ml)	0.49	2.7		0.0203

[a] Ref. 92; P in g × mm/(m² × d) and D in cm²/s.

TABLE 5. PERMEABILITY COEFFICIENTS OF VARIOUS ORGANIC COMPOUNDS THROUGH HIGH-DENSITY POLY(ETHYLENE) AND POLY(PROPYLENE)[a]

	High-density poly(ethylene)		Poly(propylene)	
Permeant	22.8°C	48.9°C	22.8°C	48.9°C
Acetic acid	0.39	2.36		
Acetone	0.67	3.9	0.28	8.84
n-Butyl ether	6.6	43.6		
Carbon tetrachloride	32	260	181	1100
n-Decane	7.3	39	22	153
Dipentene	7.6	54	29.5	161
Ethyl acetate	1.7	18.5	5.8	55
Methanol	0.1	2.0	0.08	1.5
Toluene	39	196	142	770

[a] Ref. 62; P in g × mm/(m² × d).

TABLE 6. PERMEABILITY COEFFICIENTS OF VARIOUS ORGANIC COMPOUNDS THROUGH IRRADIATION CROSSLINKED LOW-DENSITY POLY(ETHYLENE)[a]

	Poly(ethylene) unirradiated (crystallinity 58%)					Poly(ethylene) irradiated with 260 kGy (electron irradiation)				
Permeant	T (°C)	P $\left(\frac{g \times mm}{m^2 \times d}\right)$	Temp. range (°C)	P_0 $\left(\frac{g \times mm}{m^2 \times d}\right)$	E_P $\left(\frac{kJ}{mol}\right)$	T (°C)	P $\left(\frac{g \times mm}{m^2 \times d}\right)$	Temp. range (°C)	P_0 $\left(\frac{g \times mm}{m^2 \times d}\right)$	E_P $\left(\frac{kJ}{mol}\right)$
Acetic acid	21.1	1.27	20–75	1.108×10^{13}	72.9	21.1	1.55	20–75	2.783×10^{12}	68.8
Amyl acetate	21.1	3.80	20–75	2.016×10^{15}	83.0	21.1	5.03	20–75	3.269×10^{14}	77.9
Aniline	21.1	0.70	20–75	6.088×10^{14}	84.0	21.1	0.81	20–75	2.315×10^{14}	81.1
Benzaldehyde	21.1	2.76	20–75	6.375×10^{14}	80.7	21.1	3.36	20–75	4.513×10^{14}	79.6
Benzene	21.1	181	20–75	1.083×10^{13}	60.8	21.1	207	20–75	1.677×10^{12}	55.2

Permeant	Poly(ethylene) unirradiated (crystallinity 58%)					Poly(ethylene) irradiated with 260 kGy (electron irradiation)				
	T (°C)	P $\left(\frac{g \times mm}{m^2 \times d}\right)$	Temp. range (°C)	P_0 $\left(\frac{g \times mm}{m^2 \times d}\right)$	E_P $\left(\frac{kJ}{mol}\right)$	T (°C)	P $\left(\frac{g \times mm}{m^2 \times d}\right)$	Temp. range (°C)	P_0 $\left(\frac{g \times mm}{m^2 \times d}\right)$	E_P $\left(\frac{kJ}{mol}\right)$
Dibutyl ether	21.1	37.1	20–75	3.051×10^{13}	67.0	21.1	45.2	20–75	7.153×10^{12}	63.1
Ethyl acetate	21.1	9.39	20–75	6.831×10^{14}	78.2	21.1	11.4	20–75	1.797×10^{14}	74.4
n-Heptane	21.1	110	20–75	1.756×10^{12}	57.5	21.1	120	20–75	5.55×10^{11}	54.4
Methyl alcohol	21.1	0.43	20–75	1.160×10^{13}	75.7	21.1	0.49	20–75	7.843×10^{12}	74.0
Methyl ethyl ketone	21.1	5.03	20–75	3.195×10^{14}	77.7	21.1	5.86	20–75	4.310×10^{14}	78.1
n-Propyl alcohol	21.1	0.20	20–75	3.195×10^{15}	91.2	21.1	0.36	20–75	1.639×10^{14}	82.6
o-Xylene	21.1	116	20–75	8.599×10^{13}	67.0	21.1	120	20–75	6.676×10^{12}	60.4

[a] Ref. 63.

TABLE 7. PERMEABILITY COEFFICIENTS OF GASES THROUGH IRRADIATION CROSSLINKED LOW-DENSITY POLY(ETHYLENE)[a]

Gas	Irradiation Dose[b] (kGy)	T (°C)	D ($\times 10^6$) (cm^2/s)	P ($\times 10^{13}$) ($cm^3 \times cm/cm^2 \times s \times Pa$)	E_D (kJ/mol)	E_P (kJ/mol)
He	0	40	3.5	82.5	20.7	26.0
	200	40			22.5	27.7
	500	40		78.8	26.3	28.1
N_2	0	40	0.52	18.0		28.1
	100	40		17.3		
	200	40		15.0		30.1
	500	40		12.8		31.3
CH_4	0	40	0.35	47.3	28.5	40.3
	200	40	0.33	44.3	30.1	40.7
	500	40	0.31	36.8	33.5	41.1
C_2H_6	0	40	0.18	82.5	34.5	41.0
	200	40	0.16	78.0	37.6	43.4
	500	40	0.15	69.0	39.8	45.9
C_3H_8	0	40	0.05	142	50.0	45.3
	200	40	0.04	112	54.7	48.1
	500	40	0.03	90	55.6	50.3

[a] Ref. 71.
[b] Films were irradiated in acetylene atmosphere; dose rate was 6.15 kGy/h.

TABLE 8. PERMEABILITY COEFFICIENTS OF CHEMICALLY CROSSLINKED POLY(OXYPROPYLENE)[a]

Polymer	Molecular mass of poly(oxypropylene) between crosslinks	Permeability coefficient for 23°C ($\times 10^{13}$)	
		H_2	CO
Poly(oxypropylene), crosslinked with stoichiometric quantities of tris (*p*-isocyanatophenylthiophosphate) (Desmodur RF)	425	2.86	0.0608
	725	7.26	0.65
	1025	18.80	2.93
	2000	28.73	7.65
	3000	44.10	12.60

[a] Refs. 69 and 70; P in $cm^3 \times cm/(cm^2 \times s \times Pa)$.

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TABLE 9. PERMEABILITY COEFFICIENTS OF GASES THROUGH VARIOUS ELASTOMERS[a]

Elastomer		Permeation coefficient									
		N_2		O_2		CO_2		H_2		He	
		20°C	80°C	20°C	80°C	20°C	80°C	20°C	80°C	20°C	80°C
NBR	shore 70	0.172	5.39	0.639	10.8	6.11	61.1	3.25	27.2	2.56	25.6
NBR	shore 60	0.161	6.11	0.75	16.1	6.11	83.3	3.75	47.2	2.33	33.1
NBR	shore 50	0.231	6.39	0.722	13.6	4.08	28.6	4.58	38.3	2.31	20.6
NEM	shore 70	0.275	4.78								
SBR	shore 52	0.583	10.8	2.14	24.2	13.1	77.8	6.67	48.6	4.31	28.9
NR	shore 66	1.72	33.9	5.06	55.6	35.6	239	9.17	86.1	4.53	34.7
CR	shore 42	0.611	12.8	1.31	30.6	6.94	75.0	5.00	61.1	3.42	26.4
VMQ	shore 50	128	331	286	528			225	583	156	444
ECO	shore 65	0.169	3.25								
FKM	shore 70	0.172	4.75	0.306	7.22	3.53	61.1	2.58	41.7	4.89	48.1
ACM	shore 70	0.694	13.3	2.58	18.6	27.8	52.8	10.6	80.6	6.39	43.1
EPDM	shore 68	2.08	22.5	6.11	42.2	12.8	48.1	15.6	86.1	10.0	61.1
CIIR	shore 68	0.119	2.22	0.242	4.08	1.42	24.4	1.92	26.1	2.28	20.0
CSM	shore 70	0.144	3.92	0.494	7.78	3.47	16.7	2.94	20.8	2.97	26.4
AU	shore 94	0.286	4.72								

[a] Ref. 89; P in 10^{-13} cm^3 × cm/(cm^2 × s × Pa).

TABLE 10. PERMEABILITY COEFFICIENTS OF GASES THROUGH VARIOUS COMMERCIAL ELASTOMERS AT 35°C[a]

Elastomer tradename	He			H_2			D_2			O_2			N_2		
	P^b	D^c	S^d	P^b	D^c	S^d	P^b	D^c	S^d	P^b	D^c	S^d	P^b	D^c	S^d
Hypalon® 40	6.6	6.31	0.10	8.25	2.65	0.31	7.65	2.32	0.33	1.78	2.04	0.87	0.473	0.10	0.48
Hypalon® 45	8.63	10.3	0.08	11.7	4.84	0.24	11.2	5.35	0.21	3.15	4.86	0.65	0.960	0.34	0.28
Viton® E60	22.9	8.10	0.28	7.95	1.87	0.42	750	1.79	0.42	1.71	1.39	1.23	0.638	0.06	0.99
Viton® GF	32.9	18.3	0.18	16.4	3.45	0.47	15.7	2.78	0.56	3.15	3.86	0.82	1.60	0.13	1.24
Hydrin® 100 w/filler	1.13	0.73	0.15	1.05	0.23	0.47	1.20	0.18	0.67	0.233	0.03	0.73	0.113	0.008	1.43
Hydrin® 100	4.13	5.26	0.08	6.68	2.92	0.23	6.60	2.93	0.23	0.788	0.17	0.47	0.330	0.09	0.36
Kraton® G1652	34.0	19.9	0.17	51.5	12.3	0.42	48.2	10.1	0.48	20.0	1.92	1.04	7.35	1.18	0.62
Kraton® FG	34.7	22.4	0.15	50.2	11.6	0.43	44.9	9.68	0.46	18.4	1.43	1.29	6.47	0.98	0.66
Kraton® KG VTEOS	33.8	20.5	0.16	52.3	13.3	0.39	47.7	9.93	0.48	19.1	1.81	1.06	7.43	1.14	0.65

[a] Ref. 90.
[b] P in 10^{-13} cm^3 × cm/(cm^2 × s × Pa).
[c] D in 10^{-6} cm^2/s.
[d] S in 10^{-6} cm^3/(cm^3 × Pa).

TABLE 11. PERMEABILITY, DIFFUSION AND SOLUBILITY COEFFICIENTS OF ALKANES THROUGH SANTOPRENE™ (BLEND OF ETHYLENE–PROPYLENE COPOLYMER AND ISOTACTIC POLY(PROPYLENE))[a]

Alkane	T^b	P^c	D^d	S^e	Temp. range	E_P[f]	E_D	E_S
n-Pentane	25	1.51	6.07	0.25				
n-Hexane	25	1.11	2.88	0.39	25–70	13.86	12.87	0.99
	40	1.48	3.83	0.39				
	55	1.85	4.63	0.40				
n-Heptane	25	1.39	3.22	0.43	25–70	8.64	8.23	0.41
	40	1.67	3.74	0.45				
	55	2.13	4.72	0.45				
	70	2.12	4.82	0.44				
n-Octane	25	1.03	1.83	0.56	25–70	14.10	12.89	1.21
	40	1.38	2.36	0.58				
	55	1.73	2.88	0.60				
	70	2.18	3.64	0.60				

Alkane	T^b	P^c	D^d	S^e	Temp. range	$E_P{}^f$	E_D	E_S
n-Nonane	25	0.82	1.69	0.49	25–70	16.65	15.12	1.53
	40	1.13	2.23	0.51				
	55	1.50	2.87	0.52				
	70	1.99	3.79	0.53				
n-Decane	25	0.67	1.34	0.50	25–70	14.86	12.67	2.19
	40	0.87	1.78	0.49				
	55	1.13	2.10	0.54				
	70	1.47	2.67	0.55				
n-Dodecane	25	0.37	0.78	0.47	25–70	20.80	18.30	2.51
	40	0.52	1.04	0.50				
	55	0.76	1.44	0.53				
	70	1.10	2.05	0.54				
n-Tetradecane	25	0.28	0.62	0.45	25–70	19.48	17.41	2.07
	40	0.34	0.69	0.49				
	55	0.55	1.08	0.51				
	70	0.75	1.49	0.50				
n-Hexadecane	25	0.17	0.34	0.50	25–70	20.04	19.43	0.61
	40	0.27	0.55	0.49				
	55	0.38	0.74	0.51				
	70	0.49	0.97	0.51				
2,2,4-Trimethylpentane	25	0.56	1.66	0.34	25–70	12.67	11.19	1.48
	40	0.76	2.07	0.37				
	55	0.89	2.40	0.37				
	70	1.12	3.05	0.37				
Cyclohexane	25	0.85	0.90	0.94	25–70	17.43	14.70	2.74
	40	1.27	1.27	1.00				
	55	1.82	1.74	1.05				
	70	2.08	1.90	1.09				
1,2,3,4-Tetrahydronaphthalene	25	0.49	0.56	0.88	25–70	17.81	13.69	4.12
	40	0.74	0.80	0.93				
	55	0.92	0.93	0.99				
	70	1.29	1.19	1.08				

[a] Ref. 93.
[b] T and Temp. range in °C.
[c] P in 10^{-6} cm^3 × cm/(cm^2 × s).
[d] D in 10^{-6} cm^2/s.
[e] S in cm^3/cm^3.
[f] E_P, E_D and E_S in kJ/mol.

TABLE 12. PERMEABILITY, DIFFUSION AND SOLUBILITY COEFFICIENTS OF ESTERS THROUGH POLY(EPICHLOROHYDRIN) (ECO)[a]

Alkane	T^b	P^c	D^d	S^e	Temp. range	$E_P{}^f$	E_D	E_S
Methyl acetate	25	0.998	0.712	1.40	25–50	16.25	18.21	−1.94
	40	1.450	1.069	1.36				
	50	1.640	1.246	1.32				
(Ethyl acetate)	25	0.765	0.561	1.36	25–60	12.48	14.78	−2.30
	44	0.985	0.779	1.26				
	60	1.304	1.052	1.24				
(*n*-Butyl acetate)	25	0.346	0.295	1.17	25–60	14.34	15.02	−0.68
	44	0.480	0.418	1.15				
	60	0.636	0.559	1.14				
(Iso-amyl acetate)	25	0.317	0.267	1.19	25–60	15.99	17.34	−1.35
	44	0.486	0.420	1.16				
	60	0.621	0.554	1.12				
(Methyl salicylate)	25	0.146	0.071	2.06	25–60	31.15	31.15	0.10
	44	0.327	0.155	2.11				
	60	0.546	0.263	2.08				

[a] Ref. 97.
[b] T and Temp. range in °C.
[c] P in 10^{-6} cm^3 × cm/(cm^2 × s).
[d] D in 10^{-6} cm^2/s.
[e] S in cm^3/cm^3.
[f] E_P, E_D and E_S in kJ/mol.

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