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Good news re gas permeability of gases (relevance is for radon)

I checked my "Guide to Plastics" & confirmed that permeabilities of TEFLON & TEDLAR are indeed correct, or at least, that they agree with the DuPont spec sheets that we have.

The listed permeabilities are for water vapour (as g*mil/100 sq. in/atm) and CO2, H2, N2, O2 (as cc*mil/100sqin/atm @stp). I would think that radon would extrapolate 2 orders of magnitude less...although the transport mechanisms are different for noble gases than for reactive gases. Also, there are vast differences for water vapour cf gases: for some plastics the transmission is lower for the former & higher for the latter than for others.

Anyway, TEFLON is much like polyethylene & gas permeabilities are quite high. On the other hand, TEDLAR has some of the lowest gas permeabilities (~2 orders less than TEFLON or polyethylene).

Polyester is ~twice as high as TEDLAR, but it absorbs 0.8% water. Non-plasticized PVC is 2-3 times as high as TEDLAR & doesn't swell; plasticized PVC is 1-3 orders higher!

Other plasics, especially like cellophane are up to an order LESS in gas permeability than TEDLAR, but behave quite poorly in water. Some other plastics are either opaque and / or have poor forming (such as heat sealing) properties.

HOWEVER, the REALLY INTERSTING case is for oriented polypropylene: it's permeability is normally 1-2 orders higher than TEDLAR; however, when it's coated with SARAN (awfully thin too), it drops to the same level, or even less than TEDLAR!!!

SARAN coating is still reasonably impermeable to water & doesn't absorb, swell or get damaged by water; however, it is susceptible to attack by inorganic solvents, so handling & cleaning has to be done very carefully.

(I can't find anything on parylene; I sort of recall that it's similar to SARAN, but I can't be sure).

Anyway, if SARAN is as good as claimed, and if permeability of Radon extrapolates in a similar manner, then LESS than 1mil would be needed to reduce even the long-lived isotope of Rd by 1-2 orders of magnitude. Also, having the PMT's coated improves their safety factor against implosions damage forming a chain reaction. Also, having SARAN right on the surface of the PMT's won't hurt the photon collection efficiency, as long as it stays stuck, otherwise, there would be multiple refraction layers: water=1.34 to Saran=1.5? to water to glass=1.5. (Teflon wouldn't matter in this regard as it's the same as water).

I still think that some proper measurements need to be made in order to get realistic permeabilities for Rd....at least they should be based on extrapolatiosn based on the other, stable noble gases

TABLE I (*)

plastic	water absorption %in 24hr	water vapour g*mil	CO2 cc*mil	H2 cc*mil	N2 cc*mil	O2 cc*mil	He cc*mil
			100 sq. in. * 24 hr * atm @ 25C				
cellophane	45-115	0.4-134	0.4-6.0	1.2-2.2	0.5-1.6	0.2-5.0	
TEFLON	<0.001	0.4	1670	2200	320	750	
PTFE	nil	0.025-0.055	16-40	230-330	2.5	7-15	
TEDLAR	<0.5	0.6-3.7	11	58	0.25	3	150
acrylic-S	0.3-0.4	1.2	---	---	---	---	
acrylic-A	1.4-1.6	8(3mil)	---	---	---	---	
acrylic-B	0.7	8(3mil)	---	---	---	---	
polycarbonate	0.35	11.0	1057	1600	50	300	
polyester	<0.8	1.7-1.8	15-20	100	0.7-1.0	6.0-8.0	
Nylon-12	0.25	0.07	156-336	--	13-18	52-92	
polythene(low)	<0.01	1.0-1.5	2700	1950	180	500	
polythene(med)	<0.01	0.7	2500	1950	315	535	
polythene(hi)	nil	0.3	580	---	42	185	
EVA	<0.01	14	6000	---	400	840	
polyimide	2.9	5.4	45	250	6	25	

C3H6 (extr.)	<0.005	0.7	800	1700	48	240
C3H6 (biax)	<0.005	.35-.45	370	---	---	120
C3H6 (b.saran)	<0.005	.35-.45	---	---	<1-5	<1
polystyrene	0.04-0.06	7-10	900	---	---	350
VCA(non-plast)	negl.	4	40-70	---	7-10	15-20
VCA(plast)	negl.	5-8	70-800	---	10-60	20-150
VCVC	negl.	0.2-0.8	12(50%RH)	---	---	2.4(50%RH)
PVC(non-plast)	negl.	1-3	20-50 (50%)	---	---	5-20(50%)
PVC(plast)	negl.	6-30	100-3000(50%)	---	---	30-2000(50%)
PVC(NP-solvent)	negl.	4-5	20-30	3-10	1-10	8-30
PVC(P-solvent)	negl.	6-10	30-1900	10-150	10-70	30-160
rubber HCl	5	.02-.6	300-13500	---	---	40-2250

(TEFLON=FEP fluoro plastic)
(PTFE =polytrifluorochloro-ethylene copolymer)
(TEDLAR=polyvinyl fluoride)
(C3H6=polypropylene, extrusion cast or biaxially oriented, or b.o.+saran coated)
(VCA =vinyl chloride-acetate copolymer)
(VCVC=vinylidene chloride-vinly chloride copolymer)
(PVC =polyvinyl chloride, calendered or solvent cast)
(rubber HCL= rubber hydrochloride)

All the above plastics have an "excellent" water resistance rating except for acrylics, polycarbonate and nylon-12, which are only "good".

(* from "Guide to Plastics", by editors of "Modern Plastics Encyclopedia", McGraw-Hill)

Cheers!

Ron