Material Properties

Properties	Units	ASTM Test Method	ABS	Acetal	CPVC	G10-FR4	Halar® (ECTFE)
Molded/Machined	_____		Both	Both	Machined	Machined	Both
Dielectric Strength	V/mil	D-149	812.8	500	1250	400	2,000
Elongation at yield at fail	%	D-638	5 15	 60	NR NR		5 250-260
Flexural Modulus at yield	10^3psi Mpa	D-790	350-400 2,413-2757	375 2,585	360 2,480	270 1,862	170-325 1,172-2,240
Flexural Strength	10^3psi Mpa	D-790	9.9-11.8 68-81	13 90	14.5-17 100-117	65 448	7 48.3
Izod impact strength notched	ft-lb/in joules/	D-256	4 214	1.3 69	1.5 80	12 641	No Break
Maximum Service Temperature	°F °C	D-648	176 80	180 82	200 93	285 140	292 144
Melting Point	°F °C	D-789	450-500 232-260	347 175	395 201		464 240
Rockwell Hardness	R, M scales	D-785	R105	R120	R117-122	M110	R90
Specific Gravity	_____	D-792	1.05	1.42	1.55	1.82	1.68
Tensile Strength at yield	psi mpa	D-638	6,500 44.8	8,800-9,500 61-66	7,600 52	38,000 262	4,200-4,300 29-30
Thermal conduc-tivity	Btu-in/ hr-ft-°F W/m-k	C-177	.96-2.16 .14-.31	1.6 .23	.96 .14	2 .288	1.09 .16
UL Flammability	_____	UL 94	HB	HB	V-0	HB	V-0
Water absorption	%/24hr.	D-570	.3	.21	.03	.1	

Properties	Units	ASTM Test Method	Isoplast 301	Isoplast 101, 40% lgf	IXEF® 1521	Kynar® (PVDF)	Polycarbon-ate (Lexan®)
Molded/Machined	_____			Molded	Molded	Both	Both
Dielectric Strength	V/mil	D-149			762	260	125
Elongation at yield at fail	%	D-638	5.1 140	6 160	 2	 50-250	100 100
Flexural Modulus at yield	10^3psi Mpa	D-790	189 1,303	261 1,800	2,901 20,000	170-325 1,172-1,750	375 2,585
Flexural Strength	10^3psi Mpa	D-790	14.1 97	360 248	41.3 285	6.5-9 45-62	12 83
Izod impact strength notched	ft-lb/in joules/m	D-256	2.4 128	.6 32	1.78 95	20-80 1,068-4,270	13 694
Maximum Service Temperature	°F °C	D-648			248 120	300 150	475 246
Melting Point	°F °C	D-789	446-482 230-250	428-473 220-245	518 270	330 165	
Rockwell Hardness	R, M scales	D-785	R123	R116		R79-83	R118
Specific Gravity	_____	D-792	1.2	1.19		1.75	1.2
Tensile Strength at yield	psi mpa	D-638	10,000 69	27,000 186	27,600 190	5,000-7,000 34-48	10,500 72
Thermal conduc-tivity	Btu-in/hr-ft-°F W/m-k	C-177			2.78 .4	1.09 .16	1.35 .19
UL Flammability	_____	UL 94			V-0	V-0	
Water absorption	%/24hr.	D-570	.19	.17	.15		.02

Properties	Units	ASTM Test Method	Noryl® (PPE)	Nylon 6/6	Nylon 46	PCTFE	PEEK
Molded/Machined	_____		Both	Both	Molded	Machined	Both
Dielectric Strength	V/mil	D-149	500	1,500		500	
Elongation at yield at fail	%	D-638	 25	 4-6	 40	 150	 50
Flexural Modulus at yield	10^3psi Mpa	D-790	330 2,275	410 2,826	435 3,000	185-255 1,276-1,758	595 4,099
Flexural Strength	10^3psi Mpa	D-790	13.5 93	17 117	21.8 150	8.5 59	25 170
Izod impact strength notched	ft-lb/in joules/	D-256	3.5 187	.55-1 29-53	19 1,000	7.6 406	1.6 85
Maximum Service Temperature	°F °C	D-648	221 105	220 104		300 150	480 249
Melting Point	°F °C	D-789	310 154	500-509 260-265	167 75	410-420 210-215	640 338
Rockwell Hardness	R, M scales	D-785	R119	M96	90 Shore D	75-80 Shore D	R126
Specific Gravity	_____	D-792	1.08	1.14		2.1	
Tensile Strength at yield	psi mpa	D-638	9,200 63.4	1,200-1,300 83-85	14,503 100	4,600-5,725 32-40	14,500 100
Thermal conduc-tivity	Btu-in/ hr-ft-°F W/m-k	C-177		1.5-1.7 .22-.25	1.53 .22	1.4-1.5 .2-.22	
UL Flammability	_____	UL 94	V-1	HB	27 V-2	VE-0	
Water absorption	%/24hr.	D-570	.007	.6-1.2	2.3	0	.15

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Properties	Units	ASTM Test Method	PEEK, 30% glass filled	PES®	PFA®	Polycar-bonate	Poly-ethylene (LDPE)
Molded/Machined	_____		Both	Both	Both	Both	Both
Dielectric Strength	V/mil	D-149	482	660		380-399	460-700
Elongation at yield at fail	% 	D-638	 2.2	5.5 50-100	 300	100-130 135	100 400
Flexural Modulus at yield	10^3psi Mpa	D-790	1,495 10,310	420 2,895	90 625	340 2,344	29 199
Flexural Strength	10^3psi Mpa	D-790	34 233	16 111		14 97	1.5 10
Izod impact strength notched	ft-lb/in joules/	D-256	1.8 96	1.6 85	No Break	17 908	No Break
Maximum Service Temperature	°F °C	D-648	480 249	356 180	300 150	212 100	160 71
Melting Point	°F °C	D-789	633 334		590 310	284 140	244 118
Rockwell Hardness	R, M scales	D-785	R124, M103	R127	64 Shore D	R118	45 Shore D
Specific Gravity	_____	D-792	1.49	1.37	2.12-2.17	1.2	.92
Tensile Strength at yield	psi mpa	D-638	22,800 157	12,000 83	4,000 28	9,000 62	1,400 1.5
Thermal conduc-tivity	Btu-in/ hr-ft-°F W/m-k	C-177	1.4 .2	1.13 .16	1.7 .25	1.35 .19	
UL Flammability	_____	UL 94	V-0	V-0	V-0	V-2	HB
Water absorption	%/24hr.	D-570	.11	1.85		.15	<.01

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Properties	Units	ASTM Test Method	Poly-ethylene (HDPE)	UHMW PE	Poly-propylene	Poly-sulfone	Poly-urethane
Molded/Machined	_____		Both	Machined	Both	Both	Molded
Dielectric Strength	V/mil	D-149	1,270	2,300	650	425	300-500
Elongation at yield at fail	%	D-638		 400	18 150	6 45	 100-1000
Flexural Modulus at yield	10^3psi Mpa	D-790	200 1,379	88 606	150 1,034	390 2,689	10-100 68-689
Flexural Strength	10^3psi Mpa	D-790		3.5 24	7 48	15 103	.7-4.5 5-31
Izod impact strength notched	ft-lb/in joules/	D-256	3 160	No Break	2 107	1.3 69	6 320
Maximum Service Temperature	°F °C	D-648	248 120	180 82	212 100	300 149	150 65
Melting Point	°F °C	D-789	266 130	275 136	340 171	630 332	367 186
Rockwell Hardness	R, M scales	D-785	Shore D 60-	62 Shore D	R85	R120	R119
Specific Gravity	_____	D-792	.95		.9	1.24	1.03-1.5
Tensile Strength at yield	psi mpa	D-638	4,550 31	5,800 40	4,000 28	10,200 70	1,750-10,000 12-69
Thermal conduc-tivity	Btu-in/hr-ft-°F W/m-k	C-177	2.43 .35	2.84 .41	.81 .12	1.8 .26	
UL Flammability	_____	UL 94	HB	HB	HB	V-1	HB
Water absorption	%/24hr	D-570	<.01	<.01	.01	.3	.2-1.5

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Properties	Units	ASTM Test Metho	PVC	RADEL® R-5500 NT	Rexolite®	Ryton® PPS, 40% glass	Santoprene®
Molded/Machined	_____		Both	Both	Machined	Both	Molded
Dielectric Strength	V/mil	D-149	1,413	380	500	385	810
Elongation at yield at fail	%	D-638	 25	7.2 60-120	 3	 2	 330
Flexural Modulus at yield	10^3psi Mpa	D-790	420 2,896	350 2,410	18 124	1,000 6,895	
Flexural Strength	10^3psi Mpa	D-790	13 86	13.2 91	18 124	23 159	
Izod impact strength notched	ft-lb/in joules/	D-256	1.3 69	13 690	1.2 64	1 53	
Maximum Service Temperature	°F °C	D-648	140 60	410 210	212 100	450 232	275 135
Melting Point	°F °C	D-789	360 182	680 360			
Rockwell Hardness	R, M scales	D-785	R115	M80	R110-120	R125	80 Shore A
Specific Gravity	_____	D-792	1.37	1.29	1.05		.96
Tensile Strength at yield	psi mpa	D-638	7,450 51	10,100 70	10,500 72	13,000 89	680 4.69
Thermal conduc-tivity	Btu-in/ hr-ft-°F W/m-k	C-177	.96 .14		1.23 .177	2.1 .3	
UL Flammability	_____	UL 94	V-0	V-0		V-0	HB
Water absorption	%/24hr	D-570	.05	.37	.08	.02	

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Properties	Units	ASTM Test Method	Teflon (PTFE)	Torlon® 4301(PAI)	ULTEM 1000®	ULTEM 2300®	Vespel®
Molded/Machined	_____		Machined	Both	Both	Both	Machined
Dielectric Strength	V/mil	D-149	600	580	830	770	560
Elongation at yield at fail	%	D-638	 210	 10	7-8 80	 3	 7.5
Flexural Modulus at yield	10^3psi Mpa	D-790	100 689	600 4,136	500 3,447	850 5,860	450 3,102
Flexural Strength	10^3psi Mpa	D-790	No Break	24 165	20 138	27 186	16 110
Izod impact strength notched	ft-lb/in joules/	D-256	3 160	2 107	.5 27	1 53	.8 43
Maximum Service Temperature	°F °C	D-648	500 260	500 260	340 171	340 171	500 260
Melting Point	°F °C	D-789	621 327		338 170		
Rockwell Hardness	R, M scales	D-785	R15	M120	R125	R127	
Specific Gravity	_____	D-792	2.2	1.41	1.27	1.51	1.43
Tensile Strength at yield	psi mpa	D-638	3,000 21	18,000 124	15,200 105	17,000 117	12,500 86
Thermal conduc-tivity	Btu-in/ hr-ft-°F W/m-k	C-177	1.7 .25	1.8 .26	.85 .12	1.56 .22	2 .29
UL Flammability	_____	UL 94	V-0	V-0	V-0	V-0	V-0
Water absorption	%/24hr.	D-570	<.01	.4	.25	.18	.24

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Chemical Resistance Data

	Acetaldeyde	Acetone	Alcohols Isopropyl	Alcohols, Methyl	Ammonia Gas	Amyl Acetate	Aniline	Benzene
ABS	D	D	C		D	D	D	D
Acetal	A	B	A	A	D	B	A	A
CPVC	D	D	C	A	A	D	D	D
G10-FR4	A	C	A	C	A	A	A	A
ECTFE	C	A	A	A	A	B	A	A
Isoplast		D	A	C	A	D	A	A
IXEF		A						A
PVDF		D	A	A			C	C
PC	D	C	A	B	D	D	D	D
PPE		D	A		B	D	D	D
Nylon	B	A	B		C	B	C	A
PCTFE	A	A			A	A	A	A
PEEK	A	B	A	A	A	A	A	A
PES		D	A		C	B	A	A
HD/LD-PE	C	A	A	A	A	D	A	D
PFA	A	A	A	A	A	A	A	A
PSU	A	B	B	A	A	D	D	D
PU	D	D	D	D	D	D	D	D
PVC	D	D	A	A	A	D	D	D
PPSU		A	A	B		B		B
Rexolite®			A	A				C
Ryton PPS®	A	A	A	A	A	A	A	A
Santoprene®	B	B	B	A	A	D	A	C
PTFE	A	A	A	A	A	A	A	A
PAI	A	A	A		C	A	A	A
Ultem®	D	C	A	B	C	D		C
UHMW-PE	A	A	A	A		A	A	B
Vespel®	A	A	A	B	C	A	C	A

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C - Moderate attack of appreciable absorption. Material will have limited life.
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	Benzene Sulphate Aq.	Boric Acid Aq.	Butyric Acid	Calcium Hypo-chlorite	Carbon Tetra-chloride	Chloral Hydrate	Chlorine Aq.	Chloru-sulphonic Acid aq.
ABS			D		D			
Acetal		A	D	D	A		D	D
CPVC		A	D	B	C	A	A	D
G10-FR4		A	A	A	C		B	C
ECTFE	A	A	A	A	A	A	A	A
Isoplast		A	D	A	A		C	D
IXEF								
PVDF	B	A	A		A			D
PC		A	D	C	D		C	C
PPE		A	D	A	D		C	D
Nylon	D	A	B	D	A	D	D	D
PCTFE		A			A		A	A
PEEK	A	A	A	A	A	A	A	A
PES		A			A			
HD/LD-PE	A	A	D	A	D	D	C	D
PFA		A					A	A
PSU		A		B	A		D	
PU		A	D	D	D			D
PVC		A	A	A	C	A	A	C
PPSU		A		A	B		A	
Rexolite®					C			
Ryton PPS®	A	A	A	A	A		D	D
Santoprene®		A	A	A	D		C	D
PTFE	A	A	A	A	A	A	A	A
PAI	C			A	A		D	A
Ultem®					A		D	
UHMW-PE	C	A			A			
Vespel®		A	A	B	A		A	C

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	Chloro -form	Chromic Acid Aq.	Citric Acid	Cresylic Acid	Cyclohexanol	Cyclohexananone	Diesel Oil
ABS	D	B	B			D	A
Acetal	A	D	B	D	A	A	D
CPVC	D	A	A	A	D	D	A
G10-FR4		C	A	A			A
ECTFE	A	A	A	A	A	A	A
Isoplast	D	A	A		B	D	A
IXEF							
PVDF	B	B	A	A		A	A
PC	D	C	A	D	C	D	A
PPE	D	D	A		D	D	D
Nylon	D	C	C	D	B	A	A
PCTFE	A	A	A	A			A
PEEK	A	A	A	A	A	A	A
PES	D		A		D	D	A
HD/LD-PE	C	A	A	D	D	D	A
PFA	A	A	A	A			A
PSU	D	D	A		A	D	A
PU	D	D	A	D		D	C
PVC	D	A	A	A	D	D	A
PPSU	D		A		B	C	
Rexolite®	C						
Ryton PPS®	A	B	A		A	A	A
Santoprene®	C	A	A	B	D	D	D
PTFE	A	A	A	A	A	A	A
PAI	A	A	A	A	A	A	A
Ultem®	D	A	A		A	A	A
UHMW-PE		A	A		A	A	A
Vespel®	A	C	A				

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	Ether, Diethyl	Ethyl Acetate	Ethylene Dichloride	Ethylene Glycol Aq.	Ferrous Chloride Aq.	Fluorine	Fluosilicic Acid Aq.	Formaldehyde Aq.
ABS	D	D	D	A	A	A	A	B
Acetal	A	A	B	B	D	D	A	A
CPVC	D	D	D	A	A	A	A	A
G10-FR4		A	A	A	A	D	C	A
ECTFE	A	A	A	A	A	A	A	A
Isoplast	C	D	A	A	A	D	A	A
IXEF								B
PVDF		A		A	A			A
PC	D	D	D	C	D	C	A	C
PPE		A	D	A	A		A	A
Nylon	A	A	B	B	C	D	D	B
PCTFE		D				A		A
PEEK	A	A	A	A	A	D	A	A
PES		D						A
HD/LD-PE		C	C	D	A	C	C	A
PFA						A		A
PSU	A	D		A				B
PU	A	A	D	B	B	D	D	C
PVC		D	D	A	A	A		A
PPSU	A	B	C	A	A			A
Rexolite®								
Ryton PPS®	A	A	A	A	A	D	A	A
Santoprene®	B	A	C	A	A	D	A	A
PTFE	A	A	A	A	A	D	A	A
PAI	A	A	A	A	A	A	C	A
Ultem®	A	C	D	C				A
UHMW-PE	A	A		A		C	A	A
Vespel®		A	A	A		C	C	A

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	Gasoline Unleaded	Glycerine	Heptane	Hydrobromic Acid	Hydrochloric Acid	Hydrofluoric Acid	Hydrogen Per-oxide .5%
ABS	D	A	D	A	B	C	A
Acetal	A	A	A	D	C	D	D
CPVC	C	A	A	A	A	C	A
G10-FR4	A	A	A	A	B	B	D
ECTFE	A	A	A	A	A	A	A
Isoplast	A	A	A	A	A	D	A
IXEF	A						
PVDF		A	A	A	A	A	B
PC	A	A	C		D	D	A
PPE	D	A	B	B	A	D	A
Nylon	A	A	A	D	D	C	C
PCTFE		A		A	A	A	A
PEEK	A	A	A	D	A	D	A
PES	A	A	A		A		A
HD/LD-PE		A	A		A	B	A
PFA		A		A	A	A	A
PSU	A	A	A	A	A	B	A
PU		D		D	D	D	B
PVC		A	A	A	A	A	A
PPSU	A	A	A		A	A	A
Rexolite®					A		
Ryton PPS®	A	A	A	A	A	D	A
Santoprene®	C	A	C	B	B	D	A
PTFE	A	A	A	A	A	A	A
PAI	A	A	A	A	A	A	
Ultem®	A	B	D		A	C	B
UHMW-PE	A	A	A	A	A	A	A
Vespel®	A	A	A	A	A	A	

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	Hydrogen Peroxide Aq. 3%	Hydrogen Sulphide Aq.	Hydro-quinone	Iodine (in Alcohol)	Iodine (in Pot. Iodine) Aq.	Lactic Acid Aq. (10%)	Linseed Oil	Lubricating Oil (Petro-leum)
ABS	A	B	D		D	D	A	B
Acetal	D	C	A	D	D	B	A	A
CPVC	A	A	A		D	A	A	A
G10-FR4	B	A			A	A		
ECTFE	A	A	A	A	A	A	A	A
Isoplast	A	A	A		D	A	A	A
IXEF								
PVDF	B	A		B		A	A	A
PC	A	A	A	D	D	A	A	B
PPE	A	A		A	C	A	A	D
Nylon	D	B	B	D	D	C	A	A
PCTFE	A	A				A		A
PEEK	A	A	A	A	A	A	A	A
PES	A	A			C	A	A	B
HD/LD-PE	A	A		D	D	A	D	C
PFA	A	A				A		A
PSU	A					A	A	A
PU	B	D			D	B	B	B
PVC	A	A	A			A	A	A
PPSU	A	A				A	A	A
Rexolite®								
Ryton PPS®	A	A				A	B	A
Santoprene®	A	A	A	A	A	A	B	D
PTFE	A	A	A		A	A	A	A
PAI						A	A	A
Ultem®	D					B		A
UHMW-PE	A	A		A	A	A	A	A
Vespel®	B	A		A		A	A	A

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	Lye (Sodium Hydrox-ide)	Mercuric Chloride	Methyl Chloride	Methyl Ethyl Ketone	Methylene Chloride	Mineral Oils	Napthalene	Nitric Acid Aq. 10%	Oxalic Acid Aq.
ABS	A	B	D	D	D	A	D	B	A
Acetal	D	B	C	B	B	A	A	D	C
CPVC	A	D	D	D		A	D	A	A
G10-FR4	A	A	A	B	A	A	A	A	A
ECTFE	A	A	A	A	A	A	A	A	A
Isoplast	A	A	A	D	D	A	A	B	A
IXEF					A				
PVDF	A			D	D	A	C	B	C
PC	D	A	D	D	D	C	D	A	A
PPE	B	A	D	D	D	A	D	A	A
Nylon	A	C	C	A	C	A	A	D	C
PCTFE		A				A	D	A	A
PEEK	B	A	A	A	A	A	A	A	A
PES	A			D	D			A	A
HD/LD-PE	A	A	A	D	C	B	B	A	A
PFA		A			A	A	A	A	A
PSU	A	A	A	B	D	A	D	A	A
PU	B	A	D	D		A	B	D	D
PVC	B	A	A	D	D	A	D	A	A
PPSU	A			C	D	A	B	A	A
Rexolite®								A	
Ryton PPS®	A	A	B	A	A	A	A	A	A
Santoprene®	A	A	D	B	D	D	C	A	A
PTFE	A	A	A	A	A	A	A	A	A
PAI	D		A	A	A	A		A	
Ultem®	A			D	D	C	A	A	
UHMW-PE	A	A	A	A	D	A	A	A	A
Vespel®	C	B			A	A	A	C	A

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B - Slight attack by absorption. Some swelling and a small reduction in mechanical properties likely.
C - Moderate attack of appreciable absorption. Material will have limited life.
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	Perchloric Acid Aq.	Phenol Aq.	Phos-phoric Acid Aq.	Phthalic Acid Aq.	Propane Gas	Salicylic Acid	Sea Water	Sodium Hypo-chlorite 15% Cl	Sodium Nitrate Aq.
ABS		D	C	B		A		B	A
Acetal	C	D	C	C	A	D	A	C	A
CPVC	A	A	A	B	A		A	A	A
G10-FR4		C	B		A		A	A	A
ECTFE	A	A	A	A	A	A		A	A
Isoplast	A	D	A	A			A	A	A
IXEF									
PVDF	A	C	A	B		A			A
PC		B	A		C	A	A	A	C
PPE		D	A		A		A	A	A
Nylon	D	D	D	B	A	A	A	D	C
PCTFE	A	A	A	A			A		
PEEK	A	D	A	A	D	A	A	A	A
PES									
HD/LD-PE	B	A	A		D	D		A	A
PFA	A	A	A	A			A		
PSU			A	A	B			A	
PU	D	D	D		C		D	D	B
PVC	A	C	A		A			A	A
PPSU	A		A		A			A	
Rexolite®									
Ryton PPS®		A	A		A		A	B	A
Santoprene®	D	A	A		C	A	A	B	A
PTFE	A	A	A	A	A	A	A	A	A
PAI			A					A	
Ultem®	C	D	A					B	A
UHMW-PE	A	B	A	A	A	A		A	A
Vespel®	C	A	A	A	A	A		C	A

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	Styrene (Monomer)	Sulphuric Acid Aq. 2%	Toluene	Trans-former Oil	Trichlorethylene	Trisodium Phosphate	Turpentine	Urea
ABS		B	D	A	D	B	D	B
Acetal	A	D	A	A	D	A	A	A
CPVC	D	A	D	A	D	A	A	A
G10-FR4	A	A	B		A		A	
ECTFE	A	A	A	A	A	A	A	A
Isoplast	A	A	A		D	A	A	A
IXEF			A		A			
PVDF		B	B	A	A			
PC	D	A	D	A	D	A	D	D
PPE	A	A	D	A	D	A	D	A
Nylon	A	C	A	A	C	A	B	A
PCTFE		A	D		D			
PEEK	A	A	A	A	A	A	A	A
PES		A	D		D			A
HD/LD-PE		A	D	B	D	A	D	A
PFA		A			A			A
PSU		A	D	A	A		C	
PU	D	A	D	A	D	B	D	B
PVC		A	D	A	D			
PPSU			B	A			A	A
Rexolite®	C	A	C					
Ryton PPS®	A	A	A		A	A	A	A
Santoprene®	C	A	D	D	D	A	D	A
PTFE	A	A	A	A	A	A	A	A
PAI		A	A	A	A		A	
Ultem®	A	A	D		A		D	
UHMW-PE		A	B	A	B		B	A
Vespel®	A	A	A		A	C		B

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	Vegetable Oils	Water, Fresh	Xyelene	Xylenol
ABS	B	A	D	
Acetal	A	A	A	
CPVC		A	D	
G10-FR4	A	A	A	
ECTFE	A	A	A	
Isoplast		A	A	
IXEF				
PVDF		A	A	A
PC	A	A	A	D
PPE	A	A	B	D
Nylon	A	A	A	A
PCTFE	A	A	D	
PEEK	A	A	A	A
PES		A	D	
HD/LD-PE		A	D	
PFA	A	A		
PSU	A	A	D	D
PU	A	A	D	
PVC		A	D	
PPSU	A	A	B	
Rexolite®			C	
Ryton PPS®		A	A	A
Santoprene®	A	A	D	
PTFE	A	A	A	
PAI	A	A	A	A
Ultem®	A	A	C	A
UHMW-PE	A	A	A	
Vespel®		B		

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