Craftech Industries'

High Performance Plastics Materials Guide

craftech®
INDUSTRIES, INC.

Craftech Industries, 2013
8 Dock Street, Hudson, NY 12534
Website: www.craftechind.com
Blog: info.craftechind.com/blog
E-mail: info@craftechind.com
Phone: 518-828-5001 or 800-833-5130
Fax: 518-828-9468

Material Summaries

ABS—Acrylonitrile Butadiene Styrene is a copolymer made by polymerizing styrene and acrylonitrile in the presence of polybutadiene. The styrene gives the plastic a shiny, impervious surface. The butadiene, a rubbery substance, provides resilience even at low temperatures. A variety of modifications can be made to improve impact resistance, toughness, and heat resistance. ABS is used to make light, rigid, molded products such as piping, musical instruments, golf club heads, automotive body parts, wheel covers, enclosures, protective headgear, and toys including Lego bricks.

Acetal (Delrin®, Celcon®)—Acetal is a thermoplastic polymer manufactured by the polymerization of formaldehyde. Sheets and rods made of this material possess high tensile strength, creep resistance and toughness. Acetal is used in precision parts requiring high stiffness, low friction and excellent dimensional stability. Acetal has high abrasion resistance, high heat resistance, good electrical and dielectric properties, and low water absorption. Many grades are also UV resistant.

CPVC—CPVC resin is made by the chlorination of PVC resin and is used primarily to produce piping. CPVC shares many properties with PVC, including low conductivity and excellent corrosion resistance at room temperatures. The extra chlorine in its structure also makes it more corrosion resistant than PVC. Whereas PVC begins to soften at temperatures over 140°F, CPVC is useful to temperatures of 180°F. Like PVC, CPVC is fire-retardant. CPVC is readily workable and can be used in hot water pipes, chlorine pipes, sulfuric acid pipes, and high-pressure electric cable sheaths.

Halar (ECTFE)—A copolymer of ethylene and chlorotrifluoroethylene, Halar® is a semi-crystalline melt processable partially fluorinated polymer. Halar® ECTFE is particularly suitable for use as a coating material in protection and anti-corrosion applications thanks to its unique combination of properties. It offers high impact strength, chemical and corrosion resistance over a wide temperature range, high resistivity and a low dielectric constant. It also has excellent cryogenic properties.

G10—G10 is an electrical-grade, dielectric fiberglass laminate epoxy resin system combined with a glass fabric substrate. G10 offers excellent chemical resistance, flame ratings and electrical properties under both dry and humid conditions. It also features high flexural, impact, mechanical and bond strength at temperatures up to 130°C. G10 is suitable for structural, electronic, and electrical applications as well as pc boards.

Isoplast®—Originally developed for medical use, Isoplast is available in long glass fiber-filled grades. Isoplast combines the toughness and dimensional stability of amorphous resins with the chemical resistance of crystalline materials. The long fiber reinforced grades are strong enough to replace some metals in load bearing applications. Isoplast is also sea water and UV resistant, making it ideal for underwater applications.

Ixef® Polyarylamide (PARA)—IXEF® provides a unique combination of strength and aesthetics, making it ideal for complex parts that require both overall strength and a smooth, beautiful surface. IXEF® compounds typically contain 50-60% glass fiber reinforcement, giving them remarkable strength and rigidity. What makes them unique is that even with high glass loadings, the smooth, resin-rich surface delivers a high-gloss, glass-free finish that is ideal for painting, metallization or producing a naturally reflective shell. In addition, IXEF® PARA is an extremely high-flow resin so it can readily fill walls as thin as 0.5 mm, even with glass loadings as high as 60%.

Kynar® PVDF—PVDF resins are used in the power, renewable energies, and chemical processing industries for their excellent resistance to temperature, harsh chemicals and nuclear radiation. PVDF is also used in the pharmaceutical, food & beverage and semiconductor industries for its high purity and availability in a multitude of forms. It can also be used in the mining, plating and metal preparation industries for its resistance to hot acids of a wide range of concentrations. PVDF is also used in the automotive and architectural markets for its chemical resistance, excellent weatherability and resistance to UV degradation.

LCP —Liquid crystal polymers are high-melting-point thermoplastic materials. LCP exhibits natural hydrophobic properties that limit moisture absorption. Another natural trait of LCP is its ability to withstand significant doses of radiation without degradation of physical properties. In terms of chip packaging and of electronic components, the LCP materials exhibit low coefficient of thermal expansion (CTE) values. Its major uses are as electrical and electronic housings because of its high temperature and electrical resistance.

Noryl® (PPE) —The Noryl® family of modified PPE resins consists of amorphous blends of PPO polyphenylene ether resin and polystyrene. They combine the inherent benefits of PPO resin, such as affordable high heat resistance, good electrical properties, excellent hydrolytic stability and the ability to use non-halogen FR packages, with excellent dimensional stability, good process ability and low specific gravity. Typical applications for Noryl® PPE resins include pump components, HVAC, fluid engineering, packaging, solar heating parts, cable management, and mobile phones. It also molds beautifully.

Nylon 6/6—Nylon 6/6 is a general-purpose nylon that can be both molded and extruded. Nylon 6/6 has good mechanical properties and wear resistance. It has a much higher melting point and higher intermittent use temperature than cast Nylon 6. It is easy to dye. Once dyed, it exhibits superior colorfastness and is less susceptible to fading from sunlight and ozone and to yellowing from nitrous oxide. It is frequently used when a low cost, high mechanical strength, rigid and stable material is required. It is one of the most popular plastics available. Nylon 6 is much more popular in Europe while Nylon 6/6 is hugely popular in the USA. Nylon can also be molded quickly and in very thin sections, as it loses its viscosity to a remarkable degree when molded. Nylon does not withstand moisture and watery environments well.

Nylon 46—Nylon 46 is primarily used in higher temperature ranges where stiffness, creep resistance, continuous heat stability and fatigue strength are required. Therefore Nylon 46 is suitable for high quality applications in plant engineering, the electrical industry and in automotive applications under the hood. It is more expensive than Nylon 6/6 but it is also a vastly superior material which withstands water much better than Nylon 6/6 does.

PCTFE—PCTFE, formerly called by its original trade name, KEL-F, has higher tensile strength and lower deformation under load than other fluoropolymers. It has a lower glass transition temperature than other fluoropolymers. Like most or all other fluoropolymers it is inflammable. PCTFE really shines in cryogenic temperatures, as it retains its flexibility down to -200°F or more. It does not absorb visible light but is susceptible to degradation caused by exposure to radiation. PCTFE is resistant to oxidation and has a relatively low melting point. Like other fluoropolymers, it is frequently used in applications that require zero water absorption and good chemical resistance.

PEEK—PEEK (Polyetheretherketone) is a high strength alternative to fluoropolymers with an upper continuous-use temperature of 250°C (480°F). PEEK exhibits excellent mechanical and thermal properties, chemical inertness, creep resistance at high temperatures, very low flammability, hydrolysis resistance, and radiation resistance. These properties make PEEK a preferred product in the aircraft, automotive, semiconductor, and chemical processing industries. PEEK is used for wear and load bearing applications such as valve seats, pump gears, and compressor valve plates.

PES —Ultrason® PES (polyethersulfone) is a transparent, heat resistant, high performance engineering thermoplastic. PES is a strong, rigid, ductile material with excellent dimensional stability. It has good electrical properties and chemical resistance. PES can withstand prolonged exposure to elevated temperatures in air and water. PES is used in electrical applications, pump housings, and sight glasses. The material can also be sterilized for use in medical and food service applications. Along with some other plastics such as Ultem® (polyetherketone), it is relatively transparent to radiation.

Teflon® (PTFE)—PTFE is a synthetic fluoropolymer of tetrafluoroethylene. It is hydrophobic and is used as a non-stick coating for pans and other cookware. It is very non-reactive and is often used in containers and pipework for reactive and corrosive chemicals. PTFE has excellent dielectric properties and a high melting temperature. It has low friction and can be used for applications where sliding action of parts is needed, such as plain bearings and gears. PTFE has a wide variety of other applications including coating bullets and use in medical and laboratory equipment. Given its many uses, which include everything from an additive to coatings, to its uses for gears, fasteners and more, it is, along with nylon, one of the most widely used polymers.

Polycarbonate (PC, Lexan®)—Amorphous polycarbonate polymer offers a unique combination of stiffness, hardness and toughness. It exhibits excellent weathering, creep, impact, optical, electrical and thermal properties. Available in many colors and effects, it was originally developed by GE Plastics, now SABIC Innovative Plastics. Because of its extraordinary impact strength, it is the material for helmets of all kinds and for bullet-proof glass substitutes. It is, along with nylon and Teflon®, one of the most popular plastics.

Polyethylene (PE)—Polyethylene can be used for film, packaging, bags, piping, industrial applications, containers, food packaging, laminates, and liners. It is high impact resistant, low density, and exhibits good toughness and good impact resistance. It can be used in a wide variety of thermoplastics processing methods and is particularly useful where moisture resistance and low cost are required.

Polyurethane—Solid Polyurethane is an elastomeric material of exceptional physical properties including toughness, flexibility, and resistance to abrasion and temperature. Polyurethane has a broad hardness range from eraser soft to bowling ball hard. Urethane combines the toughness of metal with the elasticity of rubber. Parts made from urethane elastomers often outwear rubber, wood and metals 20 to 1. Other polyurethane characteristics include extremely high flex-life, high load-bearing capacity and outstanding resistance to weather, ozone, radiation, oil, gasoline and most solvents.

Polypropylene—Polypropylene is a thermoplastic polymer used in a wide variety of applications including packaging, textiles (e.g. ropes, thermal underwear and carpets), stationery, plastic parts and reusable containers, laboratory equipment, loudspeakers, automotive components, and polymer banknotes. A saturated addition polymer made from the monomer propylene, it is rugged and unusually resistant to many chemical solvents, bases and acids.

Polysulfone—This high-performance thermoplastic resin is noted for its ability to resist deformation under load in a broad range of temperature and environmental conditions. It can be effectively sanitized with standard sterilization techniques and cleaning agents, remaining tough and durable in water, steam and chemically harsh environments. This stability makes this material ideal for applications in the medical, pharmaceutical, aircraft and aerospace, and food processing industries, as it can be irradiated and autoclaved.

PVC—PVC is commonly used for wire & cable appliances, medical/healthcare appliances, tubing, cable jacketing, and automotive appliances. It has good flexibility, is flame retardant, and has good thermal stability, a high gloss, and low (to no) lead content. The neat homopolymer is hard, brittle and difficult to process but it becomes flexible when plasticized. Polyvinyl chloride molding compounds can be extruded, injection molded, compression molded, calendered, and blow molded to form a huge variety of products, either rigid or flexible depending on the amount and type of plasticizers used. Due to its wide use as indoor and inground wastewater piping, thousands and thousands of tons of PVC is produced every year.

Radel R-5000®—Radel R-5000® is a transparent polyphenylsulfone which offers exceptional hydrolytic stability, and toughness superior to other commercially available, high-temperature engineering resins. This resin also offers high deflection temperatures and outstanding resistance to environmental stress cracking. It is used for automotive, dental, and food service applications as well as hospital goods and medical appliances.

Rexolite®—Rexolite® is a rigid and translucent plastic produced by cross-linking polystyrene with divinylbenzene. It is used to make microwave lenses, microwave circuitry, antennae, coaxial cable connectors, sound transducers, TV satellite dishes and sonar lenses.

Ryton® (PPS)—Polyphenylene Sulfide (PPS) offers the broadest resistance to chemicals of any high performance engineering plastic. According to its product literature, it has no known solvents below 392°F (200°C) and is inert to steam, strong bases, fuels and acids. However, there are some organic solvents which will force it to soften and craze. Minimal moisture absorption and a very low coefficient of linear thermal expansion, combined with stress-relieving manufacturing, make PPS ideally suited for precise tolerance machined components.

Santoprene®—Santoprene® thermoplastic vulcanizates (TPVs) are high-performance elastomers that combine the best attributes of vulcanized rubber – such as flexibility and low compression set – with the processing ease of thermoplastics. In consumer and industrial product applications, the combination of Santoprene TPV properties and ease of processing delivers improved performance, consistent quality and lower production costs. In automotive applications, the light weight of Santoprene TPVs contributes to improved efficiency, fuel economy and reduced costs. Santoprene also offers numerous benefits in appliance, electrical, construction, healthcare and packaging applications. It is often also used to overmold items such as toothbrushes, handles, etc.

Torlon® (PAI)—Torlon® polyamide-imide (PAI) is a high strength plastic with the highest strength and stiffness of any plastic up to 275°C (525°F). It has outstanding resistance to wear, creep, and chemicals, including strong acids and most organic chemicals, and is ideally suited for severe service environments. Torlon is typically used to make aircraft hardware and fasteners, mechanical and structural components, transmission and powertrain components, as well as coatings, composites, and additives. It may be injection molded but, like most thermoset plastics, it must be post-cured in an oven. Its relatively complicated processing makes this material expensive, stock shapes in particular.

UHMW—Ultra High Molecular Weight (UHMW) Polyethylene is often referred to as the world's toughest polymer. UHMW is a linear, ultra high-density polyethylene which has high abrasion resistance as well as high impact strength. UHMW is also chemical resistant and has a low coefficient of friction that makes it highly effective in a variety of applications. UHMW can be cross-linked, reprocessed, color-matched, machined and fabricated to meet most customer requirements. It is extrudable but not injection moldable. Its natural lubricity leads to extensive use for skids, gears, bushings, and other applications where sliding, meshing or other forms of contact are required, particularly in the papermaking industry.

Ultem 1000®, Ultem 2300®—Ultem® is a semi-transparent high temperature plastic material with extremely high strength and stiffness. Ultem® is resistant to hot water and steam and can withstand repeated cycles in a steam autoclave. Ultem® has outstanding electrical properties and one of the highest dielectric strengths of any commercially available thermoplastic material. It is often used instead of polysulfone when superior strength, stiffness, or temperature resistance is required. Ultem® is available in glass-filled grades with enhanced strength and stiffness. It is another plastic which finds many uses under the hood in trucks and autos. Ultem 1000® has no glass in it. Ultem 2300® is filled with 30% short glass fiber.

Vespel—Vespel is a high performance polyimide material. It is one of the highest performing engineering plastics currently available. Vespel will not melt and can operate continuously from cryogenic temperatures to 550°F (288°C) with excursions to 900°F (482°C). Vespel components consistently exhibit superior performance in a variety of applications requiring low wear and long life in severe environments. It can be used for rotary seal rings, thrust washers and discs, bushings, flanged bearings, plungers, vacuum pads, and thermal and electrical insulators. Its one drawback is its relatively high cost. A ¼" diameter rod, 38" long, can cost $400 or more.

Material Properties

Properties	Units	ASTM Test Method	ABS	Acetal	CPVC	G10-FR4	Halar® (ECTFE)
Molded or 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	103psi Mpa	D-790	350-400 2,413-2,757	375 2,585	360 2,480	270 1,862	170-325 1,172-2,240
Flexural Strength	103psi 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-Ib/in joules/m	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 conductivity	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)	Polycarbonate (Lexan®)
Molded or 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	103psi Mpa	D-790	189 1,303	261 1,800	2,901 20,000	170-325 1,172-1,750	375 2,585
Flexural Strength	103psi 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 conductivity	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 or 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	103psi Mpa	D-790	330 2,275	410 2,826	435 3,000	185-255 1,276-1,758	595 4,099
Flexural Strength	103psi Mpa	D-790	13.5 93	17 117	21.8 150	8.5 59	25 170
Izod impact strength notched	ft-Ib/in joules/m	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 conductivity	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

Properties	Units	ASTM Test Method	PEEK, 30% glass filled	PES®	PFA®	Polycar-bonate	Polyethylene (LDPE)
Molded or 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	103psi Mpa	D-790	1,495 10,310	420 2,895	90 625	340 2,344	29 199
Flexural Strength	103psi Mpa	D-790	34 233	16 111		14 97	1.5 10
Izod impact strength notched	ft-lb/in joules/m	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 conductivity	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

Properties	Units	ASTM Test Method	Polyethylene (HDPE)	UHMW PE	Polypro-pylene	Poly-sulfone	Polyurethane
Molded or 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	103psi Mpa	D-790	200 1,379	88 606	150 1,034	390 2,689	10-100 68-689
Flexural Strength	103psi Mpa	D-790		3.5 24	7 48	15 103	.7-4.5 5-31
Izod impact strength notched	ft-Ib/in joules/m	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 60-67	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 conductivity	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

Material Properties **CONTINUED**

Properties	Units	ASTM Test Method	PVC	RADEL® R-5500 NT	Rexolite®	Ryton® PPS, 40% glass	Santoprene®
Molded or Machined?	______		Both	Both	Machined	Both	Molded
Dielectric Strength	V/mil	D-149	1,413	380	500	385	810
Elongation at yield	%	D-638		7.2			
at fail			25	60-120	3	2	330
Flexural Modulus at yield	103psi	D-790	420	350	18	1,000	
	Mpa		2,896	2,410	124	6,895	
Flexural Strength	103psi	D-790	13	13.2	18	23	
	Mpa		86	91	124	159	
Izod impact strength notched	ft-Ib/in	D-256	1.3	13	1.2	1	
	joules/m		69	690	64	53	
Maximum Service Temperature	°F	D-648	140	410	212	450	275
	°C		60	210	100	232	135
Melting Point	°F	D-789	360	680			
	°C		182	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	D-638	7,450	10,100	10,500	13,000	680
	mpa		51	70	72	89	4.69
Thermal conductivity	Btu-in/hr-ft-°F	C-177	.96		1.23	2.1	
	W/m-k		.14		.177	.3	
UL Flammability	_______	UL 94	V-0	V-0		V-0	HB
Water absorption	%/24hr.	D-570	.05	.37	.08	.02	

Properties	Units	ASTM Test Method	Teflon (PTFE)	Torlon® 4301(PAI)	ULTEM 1000®	ULTEM 2300®	Vespel®
Molded or 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	103psi Mpa	D-790	100 689	600 4,136	500 3,447	850 5,860	450 3,102
Flexural Strength	103psi Mpa	D-790	No Break	24 165	20 138	27 186	16 110
Izod impact strength notched	ft-lb/in joules/m	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 conductivity	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

Chemical Resistance Data

	ABS	Acetal	CPVC	G10-FR4	ECTFE	Isoplast	IXEF	PVDF	PC	PPE	Nylon	PCTFE	PEEK	PES	HD/LD-PE	PFA	PSU	PU	PVC	PPSU	Rexolite®	Ryton PPS®	Santoprene®	PTFE	PAI	Ultem®	UHMW-PE	Vespel®
Acetaldeyde	D	A	D	A	C				D		B	A	A		C	A	A	D	D			A	B	A	A	D	A	A
Acetone	D	B	D	C	A	D	A	D	C	D	A	A	B	D	A	A	B	D	D	A		A	B	A	A	C	A	A
Alcohols, Isopropyl	C	A	C	A	A	A		A	A	A	B		A	A	A	A	B	D	A	A	A	A	B	A	A	A	A	A
Alcohols, Methyl		A	A	C	A	C		A	B				A		A	A	A	D	A	B	A	A	A	A		B	A	B
Ammonia Gas	D	D	A	A	A	A			D	B	C	A	A	C	A	A	A	D	A			A	A	A	C	C		C
Amyl Acetate	D	B	D	A	B	D			D	D	B	A	A	B	D	A	D	D	D	B		A	D	A	A	D	A	A
Aniline	D	A	D	A	A	A		C	D	D	C	A	A	A	A	A	D	D	D			A	A	A	A		A	C
Benzene	D	A	D	A	A	A	A	C	D	D	A	A	A	A	D	A	D	D	D	B	C	A	C	A	A	C	B	A
Benzene Sulphate Aq.					A			B			D		A		A							A		A	C		C	
Boric Acid Aq.		A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A			A	A
Butyric Acid	D	D	D	A	A	D		A	D	D	B		A		D			D	A			A	A	A				A
Calcium Hypochlorite		D	B	A	A	A			C	A	D		A		A		B	D	A	A		A	A	A	A			B
Carbon Tetrachloride	D	A	C	C	A	A		A	D	D	A	A	A	A	D		A	D	C	B	C	A	D	A	A	A	A	A
Chloral Hydrate			A		A						D		A		D				A					A				
Chlorine Aq.		D	A	B	A	C			C	C	D	A	A		C	A	D		A	A		D	C	A	D	D		A
Chlorusulphonic Acid Aq.		D	D	C	A	D		D	C	D	D	A	A		D	A		D	C			D	D	A	A			C
Chloroform	D	A	D		A	D		B	D	D	D	A	A	D	C	A	D	D	D	D	C	A	C	A	A	D		A
Chromic Acid Aq.	B	D	A	C	A	A		B	C	D	C	A	A		A	A	D	D	A			B	A	A	A	A	A	C

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	ABS	Acetal	CPVC	G10-FR4	ECTFE	Isoplast	IXEF	PVDF	PC	PPE	Nylon	PCTFE	PEEK	PES	HD/LD-PE	PFA	PSU	PU	PVC	PPSU	Rexolite®	Ryton PPS®	Santoprene®	PTFE	PAI	Ultem®	UHMW-PE	Vespel®
Citric Acid Aq.	B	B	A	A	A	A		A	A	A	C	A	A	A	A	A	A	A	A	A		A	A	A	A	A	A	A
Cresylic Acid		D	A	A	A			A	D		D	A	A		D	A		D	A				B	A	A			
Cyclohexanol		A	D		A	B			C	D	B		A	D	D		A		D	B		A	D	A	A	A	A	
Cyclohexananone	D	A	D		A	D		A	D	D	A		A	D	D		D	D	D	C		A	D	A	A	A	A	
Diesel Oil	A	D	A	A	A	A		A	A	D	A	A	A	A	A	A	A	C	A			A	D	A	A	A	A	
Ether, Diethyl	D	A	D		A	C			D		A		A				A	A		A		A	B	A	A	A	A	
Ethyl Acetate	D	A	D	A	A	D		A	D	A	A	D	A	D	C		D	A	D	B		A	A	A	A	C	A	A
Ethylene Dichloride	D	B	D	A	A	A			D	D	B		A		C			D	D	C		A	C	A	A	D		A
Ethylene Glycol Aq.	A	B	A	A	A	A		A	C	A	B		A		D		A	B	A	A		A	A	A	A	C	A	A
Ferrous Chloride Aq.	A	D	A	A	A	A		A	D	A	C		A		A			B	A	A		A	A	A	A			
Fluorine	A	D	A	D	A	D			C		D	A	D		C	A		D	A			D	D	D	A		C	C
Fluosilicic Acid Aq.	A	A	A	C	A	A			A	A	D		A		C			D				A	A	A	C		A	C
Formaldehyde Aq.	B	A	A	A	A	A	B	A	C	A	B	A	A	A	A	A	B	C	A	A		A	A	A	A	A	A	A
Gasoline, Unleaded	D	A	C	A	A	A	A		A	D	A		A	A			A			A		A	C	A	A	A	A	A
Glycerine	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	D	A	A		A	A	A	A	B	A	A
Heptane	D	A	A	A	A	A		A	C	B	A		A	A	A		A		A	A		A	C	A	A	D	A	A
Hydrobromic Acid	A	D	A	A	A	A		A		B	D	A	D			A	A	D	A			A	B	A	A		A	A
Hydrochloric Acid	B	C	A	B	A	A		A	D	A	D	A	A	A	A	A	A	D	A	A	A	A	B	A	A	A	A	A
Hydrofluoric Acid	C	D	C	B	A	D		A	D	D	C	A	D		B	A	B	D	A	A		D	D	A	A	C	A	A
Hydrogen Peroxide .5%	A	D	A	D	A	A		B	A	A	C	A	A	A	A	A	A	B	A	A		A	A	A		B	A	

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Hydrogen Peroxide Aq. 3%	A	D	A	B	A	A		B	A	A	D	A	A	A	A	A	A	B	A	A		A	A	A		D	A	B
Hydrogen Sulphide Aq.	B	C	A	A	A	A		A	A	A	B	A	A	A	A	A		D	A	A		A	A	A			A	A
Hydroquinone	D	A	A		A	A			A		B		A						A				A	A				
Iodine (in Alcohol)		D			A			B	D	A	D		A		D								A				A	A
Iodine (in Pot. Iodine) Aq.	D	D	D	A	A	D			D	C	D		A	C	D			D					A	A			A	
Lactic Acid Aq. (10%)	D	B	A	A	A	A		A	A	A	C	A	A	A	A	A	A	B	A	A		A	A	A	A	B	A	A
Linseed Oil	A	A	A		A	A		A	A	A	A		A	A	D		A	B	A	A		B	B	A	A		A	A
Lubricating Oil (Petroleum)	B	A	A		A	A		A	B	D	A	A	A	B	C	A	A	B	A	A		A	D	A	A	A	A	A
Lye (Sodium Hydroxide)	A	D	A	A	A	A		A	D	B	A		B	A	A		A	B	B	A		A	A	A	D	A	A	C
Mercuric Chloride	B	B	D	A	A	A			A	A	C	A	A		A	A	A	A	A			A	A	A			A	B
Methyl Chloride	D	C	D	A	A	A			D	D	C		A		A		A	D	A			B	D	A	A		A	
Methyl Ethyl Ketone	D	B	D	B	A	D		D	D	D	A		A	D	D		B	D	D	C		A	B	A	A	D	A	
Methylene Chloride	D	B		A	A	D	A	D	D	D	C		A	D	C	A	D		D	D		A	D	A	A	D	D	A
Mineral Oils	A	A	A	A	A	A		A	C	A	A	A	A		B	A	A	A	A	A		A	D	A	A	C	A	A
Napthalene	D	A	D	A	A	A		C	D	D	A	D	A		B	A	D	B	D	B		A	C	A		A	A	A
Nitric Acid Aq. 10%	B	D	A	A	A	B		B	A	A	D	A	A	A	A	A	A	D	A	A	A	A	A	A	A	A	A	C
Oxalic Acid Aq.	A	C	A	A	A	A		C	A	A	C	A	A	A	A	A	A	D	A	A		A	A	A			A	A
Perchloric Acid Aq.		C	A		A	A		A			D	A	A		B	A		D	A	A			D	A		C	A	C
Phenol Aq.	D	D	A	C	A	D		C	B	D	D	A	D		A	A		D	C			A	A	A		D	B	A
Phosphoric Acid Aq. 10%	C	C	A	B	A	A		A	A	A	D	A	A		A	A	A	D	A	A		A	A	A	A	A	A	A

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Phthalic Acid Aq.	B	C	B		A	A		B			B	A	A			A	A							A			A	A
Propane Gas		A	A	A	A				C	A	A		D		D		B	C	A	A		A	C	A			A	A
Salicylic Acid	A	D			A			A	A		A		A		D								A	A			A	A
Sea Water		A	A	A		A			A	A	A	A	A			A		D				A	A	A				
Sodium Hypochlorite 15% Cl	B	C	A	A	A	A			A	A	D		A		A		A	D	A	A		B	B	A	A	B	A	C
Sodium Nitrate Aq.	A	A	A	A	A	A		A	C	A	C		A		A			B	A			A	A	A		A	A	A
Styrene (Monomer)		A	D	A	A	A			D	A	A		A					D			C	A	C	A		A		A
Sulphuric Acid Aq. 2%	B	D	A	A	A	A		B	A	A	C	A	A	A	A	A	A	A	A		A	A	A	A	A	A	A	A
Toluene	D	A	D	B	A	A	A	B	D	D	A	D	A	D	D		D	D	D	B	C	A	D	A	A	D	B	A
Transformer Oil	A	A	A		A			A	A	A	A		A		B		A	A	A	A			D	A	A		A	
Trichlorethylene	D	D	D	A	A	D	A	A	D	D	C	D	A	D	D	A	A	D	D			A	D	A	A	A	B	A
Trisodium Phosphate	B	A	A		A	A			A	A	A		A		A			B				A	A	A				C
Turpentine	D	A	A	A	A	A			D	D	B		A		D		C	D		A		A	D	A	A	D	B	
Urea	B	A	A		A	A			D	A	A		A	A	A	A		B		A		A	A	A			A	B
Vegetable Oils	B	A		A	A				A	A	A	A	A			A	A	A		A			A	A	A	A	A	
Water, Fresh	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A	A	A	A	B
Xyelene	D	A	D	A	A	A		A	A	B	A	D	A	D	D		D	D	D	B	C	A	D	A	A	C	A	
Xylenol								A	D	D	A		A				D					A			A	A		

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NB:

1) The information listed above is intended as a guide only. Companies should do their own testing when using the above materials. Craftech Industries cannot be held responsible for any of the information listed above.
2) We apologize for any blank fields. The authors have done their best to provide the most detailed information possible.

craftech
INDUSTRIES, INC.

8 Dock Street, Hudson, NY 12534
Website: www.craftechind.com
Blog: info.craftechind.com/blog
E-mail: info@craftechind.com
Phone: 518-828-5001 or 800-833-5130
Fax: 518-828-9468