High-Performance Plastics & Technical Ceramics

SINCE 1984, PROFESSIONAL PLASTICS HAS BEEN SUPPLYING THE BROADEST RANGE OF HIGH PERFORMANCE PLASTIC MATERIALS AND TECHNICAL CERAMICS

PROFESSIONAL PLASTICS

OFFERING THE WIDEST RANGE OF HIGH-PERFORMANCE THERMOPLASTICS AND CERAMICS IN THE INDUSTRY

Our materials offer a combination of high temperature performance, mechanical stability, high-purity and machinablility for the most demanding applications. We provide basic shapes and precision parts for critical applications.

WE PROVIDE
Basic Shapes

Sheets
Rods
Tubes
Films
Profiles

AS WELL AS
Finished Parts

Seal Rings
Thrust Washers
Gas Baffles
Clamp Rings
Pump Rings
Labyrinth Seals
Retaining Rings
Screws
Heater Nozzles
Thermal Barriers
Insulators
Plasma Gas Baffles
Electrical Connectors
Heater Plugs
Terminal Blocks
Crucibles

INDUSTRIES

Semiconductor
(wafer process, handling & test)
Aircraft & Aerospace
Medical & Life Sciences
Petrochemical Refining
Oil & Gas Exploration
Plasma Cutting
Precision Optics & Lasers
Power Generation - Nuclear

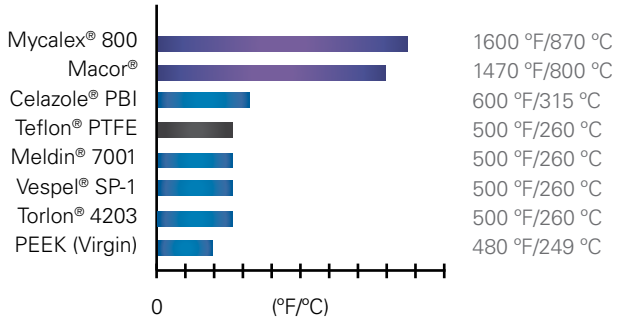
APPLICATIONS

Glass Handling
Chemical Etching
Insulating Parts
Vacuum & Seal Components
High-Purity Fluid Handling
Bearing & Wear Parts
Metal Production

CAPABILITIES

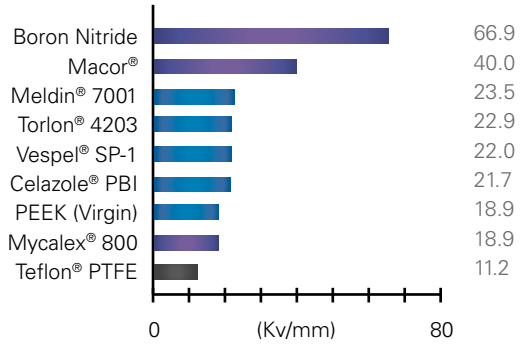
CNC Precision Fabricated Parts
Precision Cut Blanks

MAXIMUM CONTINUOUS OPERATING TEMPERATURE



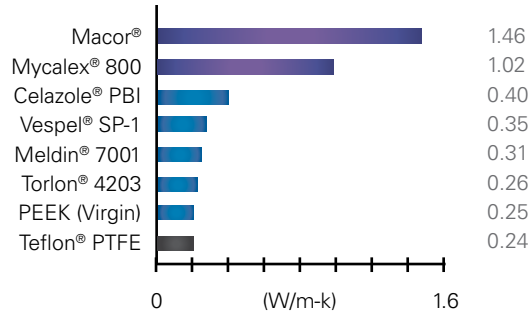
The maximum acceptable temperature above which mechanical properties (tensile strength, impact strength) or electrical properties (dielectric strength, linked to insulation properties) of a part are significantly degrading, over the reasonable life time of the tested product.

DIELECTRIC STRENGTH



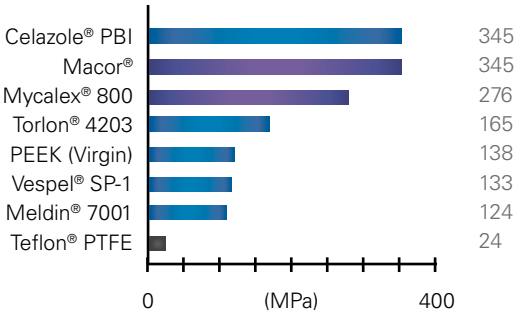
The maximum voltage that can be applied to a given material without causingit to break down,usuallyexpressed in volts or kilovolts per unit of thickness.

THERMAL CONDUCTIVITY



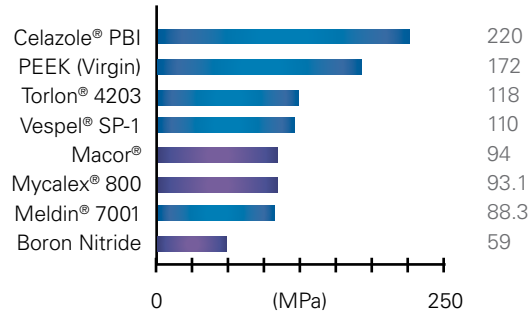
Thermal conductivity is the quantity of heat transmitted through a unit thickness in a direction normal to a surface of unit area, due to a unit temperature gradient under steady state conditions.

COMPRESSIVE STRENGTH



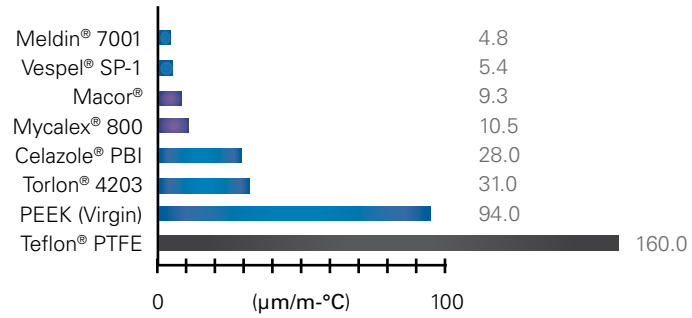
Maximum stress a material can sustain under crush loading. The compressive strength of a material that fails by shattering fracture can be defined within fairly narrow limits as an independent property. However, the compressive strength of materials that do not shatter in compression must be defined as the amount of stress required to distort the material an arbitrary amount.

FLEXULAR STRENGTH



Measure of the ability of rigid plastics to withstand permanent deformation and the ability of non-rigid plastics to return to original shape after deformation. Standard test methods for determining both types of deformation under load are given in ASTM D-621.

COEFFICIENT OF LINEAR THERMAL EXPANSION



The coefficient of linear thermal expansion is the ratio of the change in length per degree C to the length between 23 °C and 250 °C. Per test method ASTM E-831.

HIGH PERFORMANCE THERMOPLASTICS

COMPARE

Vespel® SP-1
Vespel SP-1 is a high-performance polyimide material that offers a broad combination of temperature resistance, chemical resistance, mechanical toughness, natural lubricity,wear-resistance and insulation properties.

Max Continuous Operating Temp: 500°F (260°C)

Meldin® 7001
Meldin is ideal for electrical and thermal insulating applications. More ductile than ceramics, and lighter weight than metals, Meldin 7001 is an excellent choice for structural parts in aerospace and other applications where metal replacement is desirable.

Max Continuous Operating Temp: 550°F (288°C)

Celazole® PBI
Celazole PBI is the highest performance engineering thermoplastic available today. Celazole PBI has better wear resistance and load carrying capabilities at extreme temperatures than any other reinforced or unreinforced engineering plastic.

Max Continuous Operating Temp: 600°F (315°C)

Vespel® SP-21
Vespel SP-21 has 15% graphite by weight added for increased wear resistance and reduced friction in applications such as bearings, thrust washers, bushings, seal rings, slide blocks and other wear applications.

Max Continuous Operating Temp: 500°F (260°C)

Meldin® 7021
Our self-lubricating grade, Meldin 7021, has 15% by weight graphite fillers, encapsulated by the base polyimide resin. With its low coefficient of friction and high heat resistance, Meldin 7021 provides our customers the best all-around choice for high temperature bearings, seals, and other low-wear applications.

Max Continuous Operating Temp: 500°F (260°C)

Torlon® 4203
Torlon 4203 PAI offers excellent compressive strength and the highest elongation of the Torlon grades. It also provides electrical insulation and exceptional impact strength. This Torlon grade is commonly used for IC Test Sockets and Handlers as well as electrical connectors and insulators.

Max Continuous Operating Temp: 500°F (260°C)

Vespel® SP-22
Designing with tight tolerances? Vespel SP-22 is the answer. When you have no room for error, Vespel SP-22's minimal thermal expansion and dimensional stability give you the freedom to create exactly what you've imagined.

Max Continuous Operating Temp: 500°F (260°C)

Meldin® 7022
Meldin 7022 is similar to the Meldin 7021 for wear and friction, but it has the best overall dimensional stability (thermally), and the 7022 has the lowest coefficient of thermal expansion – due to the relatively high graphite filler content.

Max Continuous Operating Temp: 500°F (260°C)

PEEK (Virgin)
PEEK grades offer chemical and water resistance similar to PPS (PolyPhenylene Sulfide), but can operate at higher temperatures continuously to 480°F (250°C). PEEK carries a V-0 flammability rating and exhibits very low smoke and toxic gas emission when exposed to flame.

Max Continuous Operating Temp: 480°F (249°C)

Vespel® SP-211
Vespel SP-211 has 10% PTFE and 15% graphite by weight added to the base resin for the lowest coefficient of friction over a wide range of operating conditions. It also has excellent wear resistance up to 300°F (149°C).

Max Continuous Operating Temp: 500°F (260°C)

Meldin® 7211
Meldin 7211 has the lowest coefficient of friction of all the Meldin 7000 grades. However, above 300°F, we typically use Meldin 7021, which has a very similar coefficient of friction to 7211 at temperatures above 300°F, and the wear factor of 7021 is lower than 7211 at temperatures above 300°F.

Max Continuous Operating Temp: 500°F (260°C)

Techtron® PPS
Techtron PPS offers the broadest resistance to chemicals of any advanced engineering plastic. 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.

Max Continuous Operating Temp: 218°F (425°C)

Vespel® SP-3
Vespel SP-3 is 15% moly-filled for wear and friction resistance in vacuum and other moisture-free environments where graphite actually becomes abrasive. Typical applications of Vespel SP-3 include seals, bushings, bearings, and other wear ultra-high vacuum surfaces.

Max Continuous Operating Temp: 500°F (260°C)

Meldin® 7003
Meldin 7003 includes 15% molybdenum disulfide lubricating filler for wear applications that operate in a vacuum or in very dry conditions where graphite actually becomes abrasive. Typical applications include seals, bushings, bearings, and other wear ultra-high vacuum surfaces.

Max Continuous Operating Temp: 218°F (425°C)

Ultem® 1000
Ultem 1000 (standard, unfilled polyetherimide) offers excellent chemical resistance, high dielectric strength, natural flame resistance and extremely low smoke generation. Ultem's exceptionally high mechanical properties and ease of fabrication, including bonding, make it an easy choice when exceptional performance is required.

Max Continuous Operating Temp: 340°F (171°C)

TECHNICAL CERAMICS

Technical Ceramics offer extreme heat resistance for exceeding the levels of thermoplastics. They also exhibit superior CTE properties.

Weakness: Impact-Resistance

Macor®
Unlike other ceramics, Macor can be machined with ordinary metalworking tools. Macor is also a problem solving material combining the performance of a technical ceramic with the versatility of a high performance plastic. Macor has no porosity and when properly baked out, will not outgas.

Max Continuous Operating Temp: 1470°F (800°C)

Boron Nitride Grade A Combat®
Combat® A uses boron nitride as a binder to create a hard, dense yet easily machinable product best used in inert and dry environments. It is ideal for general purpose high-performance applications. Combat® HP leverages Boron Nitride's outstanding thermal shock resistance with Calcuim Borate Glass's moisture resistance. HP is ideal for light metal processing applications such as aluminum, magnesium and zinc, particularly electrical insulation applications for up to 1000° C.

Max Continuous Operating Temp: 1562°F (850°C)

Mycalex® 400
The perfect alternative to high performance plastics where high temperature, good dielectric strength and good arc resistance are required. Softer than other high temperature machinable ceramics allowing for the fabrication of intricate or complex shapes.

Dark Grey - 2.5 Density

Max Continuous Operating Temp: 750°F (400°C)

Mycalex® 500
The perfect alternative to high performance plastics where high temperature, good dielectric strength and good arc resistance are required. Softer than other high temperature machinable ceramics allowing for the fabrication of intricate or complex shapes.

Light Grey - 2.7 Density

Max Continuous Operating Temp: 930°F (500°C)

Mycalex® 800
Mycalex MM 800 (formerly Mycalex 1600) is a compression molded machinable ceramic that can operate continuously at 1600 F. Components can be machined from compression molded sheets using conventional cutting tools thus providing designers and engineers in various industries with a new and cost effective material for high temperature insulating components.

Max Continuous Operating Temp: 1600°F (870°C)

FLUOROPOLYMERS

Fluoropolymers are known for their extreme chemical resistance and ability to operate in extreme heat or cryogenic environments. They also exhibit excellent insulative properties.

Weaknesses: Soft not suitable to parts that require rigidity or impact resistance.

PCTFE (Kel-F®/Neoflon®)
Kel F is a fluorocarbon-based polymer and is commonly abbreviated PCTFE. PCTFE offers the unique combination of physical and mechanical properties, nonflammability, chemical resistance, near zero moisture absorption, and excellent electrical properties.

Max Continuous Operating Temp: 500°F (260°C)

FEP
FEP is a relatively soft thermoplastic with lower tensile strength, wear resistance, and creep resistance than many other engineering plastics. However, FEP is chemically inert and has a low dielectric constant over a wide frequency range.

Max Continuous Operating Temp: 500°F (260°C)

PFA
PFA offers similar properties to FEP, but PFA is preferred when extended service is required in hostile environments involving chemical, thermal, and mechanical stress. PFA offers high melt strength, stability at high processing temperatures, excellent crack and stress resistance, a low coefficient of friction, and more than 10 times the Flex life of FEP.

Max Continuous Operating Temp: 500°F (260°C)

ETFE (Tefzel®)
Tefzel ETFE sheets and rods provide both corrosion resistance and mechanical strength over a wide temperature range. The fluoroplastic family offers plastics with high chemical resistance, low and high temperature capability, resistance to weathering, low friction, electrical and thermal insulation.

Max Continuous Operating Temp: 500°F (260°C)

ECTFE (Halar®)
Halar ECTFE is a partially fluorinated semi-crystalline polymer offering a unique combination of mechanical properties, thermal and chemical resistance with an outstanding ease of processability. Halar ECTFE, a copolymer of ethylene and chlorotrifluoroethylene, can bring advantages to the end user when compared to other fluoropolymers.

Max Continuous Operating Temp: 500°F (260°C)

TEMPERATURE

High-performance thermoplastics can perform at continuous operating temperatures of up to 600 °F, while certain technical ceramics will perform at temperatures as high as 1600 °F without degradation of properties. The Max Operating Temperature is determined by the maximum temperature before the material decreases in tensile strength. Thermoplastics such as Celazole® PBI and Meldin® polyimide offer the highest continuous operating temperatures of any thermoplastic shapes. For extremely low cryogenic temperature performance, materials such as PCTFE provide superior cryogenic properties without significantly compromising their physical integrity.

STABILITY

Materials such as Celazole®, Vespel®, Torlon®, Techtron® PPS and PEEK retain their superior physical properties by exhibiting higher heat deflection temperatures, glass transition temperatures and continuous use temperatures than general purpose plastic materials. These high-performance plastics are all well-suited to tight-tolerance precision parts in a variety of critical applications. Technical ceramics such as Macor® provide superior thermal stability at temperatures exceeding 600 °F where all plastics will begin to fail.

	Vespel® SP-1	Vespel® SP-21	Vespel® SP-22	Meldin® 7001	Meldin® 7021	Meldin® 7022	Celazole® PBI	Torlon® 4203	PEEK
Filler Material	Unfilled	15% Graphite	40% Graphite	Unfilled	15% Graphite	40% Graphite	Unfilled	Unfilled PAI	Unreinforced
Density (g/cc)	1.43	1.51	1.65	1.34	1.42	1.56	1.30	1.42	1.31
Water Absorption (%)	0.24	0.19	0.14	--	--	0.25	0.40	0.33	0.10
Tensile Strength (MPa)	86.0	66.0	52.0	75.8	66.9	49.6	160	152	110
Tensile Elongation (%)	7.5	4.5	3.0	8.0	5.5	3.0	3.0	10	--
Flexural Strength (MPa)	110	110	--	105	89.6	72.4	158.7	118	172
Flexural Modulus (GPa)	--	2.62	--	2.60	3.10	4.50	--	3.59	4.14
Compressive Strength 10% @73°F (MPa)	133	133	112	124	133	110	345	165	138
Compressive Modulus (GPa)	2.413	2.895	3.275	2.00	2.07	2.00	6.2	4.00	3.45
CTE, Linear 0-250 °C (µm/m-°C)	5.4	4.9	3.8	5.0	4.5	4.0	23.0	31.0	46.8
Max Operating Temp (in air) °F/°C	500/260	500/260	500/260	500/260	500/260	500/260	600/315	500/260	480/249
Thermal Conductivity (W/m-K)	0.350	0.870	1.73	0.317	0.432	--	.404	0.260	0.252
Flammability Rating	V-0	V-0	V-0	V-0 5VA	V-0 5VA	--	V-0	--	V-0
Dielectric Strength (kV/mm)	22.0	9.48	--	23.5	--	--	21.7	22.9	18.9
Dielectric Constant (at 1MHz)	3.55	13.41	--	--	--	--	3.3	4.2	3.3
Dissipation Factor (at 1MHz)	0.0034	0.0106	--	--	--	--	0.034	0.026	0.0030
Volume Resistivity at 50% RH (ohm-cm)	1.00e+14	1.00e+12	--	--	--	--	> 1.00e+13	2.00e+17	--

PURITY

Fluoropolymers such as PTFE, FEP, PFA, ECTFE and ETFE offer superior chemical resistance, and high-purity performance. These and other low-outgassing materials are required in many critical aerospace, semiconductor and medical applications to prevent contamination. Outgassing occurs when a material is subjected to heat in a vacuum environment, and some of the material's constituents evaporate. Zero porosity materials such as Macor® machinable glass ceramic exhibit no outgassing which can be seen by the percentage of water absorption. Polyimide materials such as Vespel® SP-3 and Meldin® 7003 are used in critical vacuum and dry environments that require low outgassing performance.

MACHINABILITY

Plastics by nature are softer than metals and ceramics, therefore generating less wear on tooling. Though softer materials are more difficult to machine to extremely tight tolerances, high-stability plastics such as Meldin® 7001, Celazole® & Torlon® 4203 overcome these challenges and provide a design solution for critical applications. These materials offer machinability, wear-resistance, chemical resistance, & electrical insulating properties that no metal can match. Our high-performance plastics are stress relieved to ensure the highest degree of machinability and long-term dimensional stability. By contrast, technical ceramics are typically extremely hard, and difficult to machine with standard tooling. Overcoming those challenges, ceramics such as Macor® & Mycalex® offer the performance of technical ceramics, combined with the ease of machining by means of standard carbide tooling.

		Boron Nitride								
Techtron® PPS	Corning Macor®	Grade A Combat®	Grade HP Combat®	Mycalex® 400	Mycalex® 500	Mycalex® 800	PCTFE	FEP	PFA	ETFE
Unfilled	Glass Ceramic			Mica-Filled Ceramic	Mica-Filled Ceramic	Mica-Filled Ceramic	Unfilled	Unfilled	Unfilled	Unfilled
1.35	2.52	2.00	2.00	2.50	2.70	2.74	2.10	2.15	2.15	1.70
.10	0.0	--	--	0.0	0.0	0.0	< .01	< .01	< .03	< .01
102	90	--	--	89.6	86.2	41.4	36.5	23.5	24.8	42.1
--	--	--	--	--	--	--	150	325	300	300
155	94	94	59	89.6	86.2	93.1	58.6	--	--	--
--	--	--	--	--	--	--	1.24	.59	.59	1.0
148	345	--	--	310	276	276	38	--	--	17
--	--	--	--	--	--	--	1.24	--	--	--
50	9.3	--	--	11.0	10.5	10.5	70	--	--	73
218/425	1470/800	1562/850	1562/850	750/400	930/500	1600/870	270/132	400/204	500/260	311/155
0.300	1.46	30	27	.87	1.15	1.02	.209	--	--	--
V-0	--	--	--	V-0	V-0	V-0	V-0	V-0	V-0	V-0
21	40	88	66.9	28.7	20.9	18.9	19.7	--	--	70.9
3	5.67	4.6	4.3	6.7	6.9	6.9	--	2.1	2.1	2.5
.0013	0.0047	.0012	.0015	0.0018	0.0013	.0030	--	.0001	.0001	.0060
> 1.00e+13	>= 1.00e+16	> 1.00e+14	--	1.00e+10	1.00e+14	>= 2.60e+15	1.00e+18	1.00e+18	1.00e+18	1.00e+17

PROFESSIONAL PLASTICS

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PP141004 Printed in the U.S.A.