

Celazole[®] PBI U-60

Typical Properties

PROPERTIES	ASTM METHOD	ENGLISH VALUE	METRIC VALUE
MECHANICAL			
Tensile Strength	D-638	23 kpsi	160 MPa
Modulus		850 kpsi	5900 MPa
Elongation		3.0%	3.0%
Tensile Fatigue, % of stress to failure at 1,000,000 cycles, 1 Hz	D-638	35% (8.1 kpsi)	35% (56 MPa)
Flexural Strength	D-790	32 kpsi	220 MPa
Modulus		950 kpsi	6500 MPa
Compressive Strength (Yield)	D-695	57 kpsi	390 MPa
Compressive Strength (10% Strain)	D-695	50 kpsi	340 MPa
Compressive Modulus	D-695	850 kpsi	5900 MPa
Hardness – Rockwell M	D-785	>125	>125
– Rockwell E	D-785	104	104
– Shore D	D-2240	95	95
Izod Impact Strength (notched)	D-256	.53 ft-lb/in	30 J/m
(unnotched)		11 ft-lb/in	590J/m
THERMAL			
Heat Deflection Temp. (264 psi; 1.8 MPa)	D-648	815°F	435°C
Glass Transition	DMA	800°F	427°C
Coefficient of Linear Thermal Expansion			
75-300°F (25-150°C)	TMA	13 X 10 ⁻⁶ in/in°F	23 μm/m°C
390-570°F (200-300°C)	TMA	18 X 10 ⁻⁶ in/in°F	33 μm/m°C
Limiting Oxygen Index	D-2863	58%	58%
Thermal Conductivity 77°F (25°C)		2.8 Btu-in/hr-ft ² °F	0.41 W/m°C
ELECTRICAL			
Dielectric Strength	D-149	580 V/mil	23 KV/mm
Volume Resistivity	D-257	2 X 10 ¹⁵ ohm-cm	2 X 10 ¹⁵ ohm-cm
Dissipation Factor			
1 kHz	D-150	0.000	0.000
10 kHz	D-150	0.003	0.003
0.1 MHz	D-150	0.034	0.034
Dielectric Constant			
1 kHz	D-150	3.4	3.4
10 kHz	D-150	3.4	3.4
0.1 MHz	D-150	3.3	3.3
Arc Resistance	D-495	185 sec.	185 sec.

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Celazole[®] PBI U-60

Typical Properties – Continued

PROPERTIES	ASTM METHOD	ENGLISH VALUE	METRIC VALUE
OTHER			
Specific Gravity		1.3	1.3
Coef. of Friction, Static			
Aluminum		0.14	0.14
Steel		0.15	0.15
Brass		0.16	0.16
Coef. of Friction, Dynamic			
Aluminum		0.16	0.16
Steel		0.16	0.16
Brass		0.18	0.18
Water Adsorption, 24 hrs at 73F	D-570	0.4%	0.4%

U-60 grade Celazole[®] polybenzimidazole (PBI) resin is a unique organic polymer which does not burn in air and has extraordinary high temperature resistance, along with excellent stability to chemicals and hydrolysis.

The data shown here describe an unfilled high-performance part molded of Celazole PBI, with many outstanding properties:

- ◆ Highest compressive strength of any unfilled resin
- ◆ Excellent tensile and flexural strength
- ◆ Good fatigue properties
- ◆ Excellent hardness
- ◆ Low coefficient of friction
- ◆ Outstanding Tg and heat deflection temperature
- ◆ Relatively low coefficient of thermal expansion
- ◆ High volume resistivity
- ◆ Very good plasma resistance

Celazole PBI is ideal for applications where requirements cannot be met by other resins—in extreme high temperatures, in harsh chemical or plasma environments, or in applications where durability and wear resistance are important. Parts molded of Celazole PBI are being used in semiconductor and flat panel display manufacture, electrical insulating parts, heat insulating applications, as well as seals, bearings and wear plates in various industrial applications. They are also being evaluated in demanding aerospace applications requiring outstanding strength and short-term high temperature resistance.

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Celazole[®] PBI U-60 (Molded)

Environmental Resistance Ratings

Parts are molded of U-60 grade Celazole[®] polybenzimidazole (PBI) resin, a unique organic polymer which does not burn in air and has extraordinary high-temperature resistance, along with excellent stability to chemicals and hydrolysis.

In high-temperature exposure to organic chemicals, Celazole[®] molded parts offer outstanding chemical resistance and property retention, even after extended exposures. In hot caustic, Celazole parts out-perform other high-performance resins. And Celazole U-60 parts have been used successfully in a variety of harsh environments, ranging from oil fields to aerospace applications. In the field, Celazole parts have performed well when exposed to hydraulic and heat-transfer fluids, chlorinated solvents, polyester, nylon, PEEK, and PES molten polymers, and metal-corrosion inhibitors – conditions too severe for most plastics.

Celazole parts are hydrolytically stable after exposure to high pressure steam or boiling water. Moisture absorption of Celazole U-60 resin reaches equilibrium at 10-14% and, through solvation, some strength loss and swelling occur. However, Celazole parts typically regain their original properties after dehydration. When constrained, as in valve assemblies, Celazole U-60 parts have been used successfully in high-temperature, high-pressure steam environments.

Molded Celazole U-60 Environmental Resistance Ratings

Chemical	Temp. (°F)	Pressure (psi)	Rating @ Days		
			1	7	30
Hydrocarbons					
Xylene	Reflux	Ambient	--	A	--
Toluene	Reflux	Ambient	--	A	--
Kerosene	200	Ambient	--	A	--
Gasoline	200	Ambient	--	A	--
Ketones/Aldehydes					
Methyl Ethyl Ketone	Reflux	Ambient	--	A	--
Chlorinated Solvents					
Methylene Chloride	Reflux	Ambient	--	A	--
Organic Acids					
Acetic Acid (Glacial)	200	Ambient	--	A	--
Phenol	200	Ambient	A	A	A
Polar Aprotic Solvents					
Dimethylacetamide	200	Ambient	C	D	--
Alcohols					
Methanol	Reflux	Ambient	A	A	B
Triethylene glycol	200	Ambient	A	A	A
Triethylene glycol	450	Ambient	A	A	A
Strong Bases					
Sodium Hydroxide (Caustic (15%))	200	Ambient	A	B	C
Weak Bases					
Sodium Carbonate (10%)	200	Ambient	A	A	A
Strong Acids					
Sulfuric Acid (30%)	200	Ambient	A	C	D
Hydrochloric Acid (10%)	200	Ambient	A	C	D
Hydrochloric Acid (37%)	200	Ambient	B	C	D
Nitric Acid (10%)	200	Ambient	B	D	D
Phosphoric Acid (35%)	200	Ambient	A	B	D

Rating System: A = No Effect, B = Small Effect, C = Large Effect, D = Severe Effect

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Celazole® PBI U-60 (Molded)

Environmental Resistance Ratings - Continued

Use of Celazole parts may be less beneficial in exposures to polar, aprotic solvents or in high-temperature exposures to strong, oxidizing, aqueous acids. Although Celazole U-60 parts are affected by powerful oxidizing agents in high concentrations, tests show good resistance to organic acids. Performance in acid environments should be evaluated vs. application requirements.

In addition, tests have shown no noticeable change in strength or appearance of Celazole U-60 parts after 200 megarad exposure to Cobalt 60 gamma radiation (1.17 and 1.33 MeV). These tests were conducted in air at room temperature.

Celazole U-60 parts have excellent resistance to a range of extreme environments that degrade most plastics. Other high-performance materials, such as polyetherimide, polyimide, polyamideimide, polyetheretherketone, and polyphenylene sulfide are severely affected by many of these harsh conditions.

Environmental Resistance Ratings, Continued

Chemical	Temp. (°F)	Pressure (psi)	Rating @ Days		
			1	7	30
Weak Acids					
Acetic Acid (10%)	200	Ambient	A	B	B
Aqueous Oxidants					
5% Sodium Hypochlorite	200	Ambient	A	B	B
Water					
Boiling Water	212	Ambient	A	B	B
Steam	650	2200	B	B	B
End Use Specific					
"Mobile Bay" Sourgas (Hydrogen sulfide, carbon dioxide, methane)	450	2000	--	A	--
NACE "A" (amine, water-based) Corrosion Inhibitor	200	Ambient	--	A	--
NACE "B" (amine, oil-based) Corrosion Inhibitor	200	Ambient	--	A	--
Brine (Zn and Ca Bromide) 15-20 lb/gal	200	Ambient	--	A	--
Skydrol B Hydraulic Fluid	200	Ambient	A	A	A
Monsanto Therminol-66 Heat Transfer Fluid	520	Ambient	--	A	--
Texaco Havoline Supreme 30W Motor Oil	200	Ambient	A	A	A

Rating System: A = No Effect, B = Small Effect, C = Large Effect, D = Severe Effect

Chemical Resistance testing is conducted on tensile and compression test specimens using methodology derived from ASTM D 543. Ratings include tensile and compressive strength retention, weight gain or loss, swelling, and hardness changes.

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