Technical Specifications for X-Lon™ Material

X-Lon™ is a continuous carbon fiber-reinforced polymer laminate developed for use in oil sealed vacuum pump vanes. It has excellent chemical resistance, high strength, very low moisture absorption, low coefficient of expansion, and high temperature resistance. It is unparalleled in applications formerly served by asbestos composites.

Material Property	Value
Flexural Strength	128 KSI
Impact Strength (Notched Izod)	14.3 ft-lb/in @ 68ºF
Flexural Modulus	7.4 MSI
Heat Deflection Temperature	564 ºF
Coefficient of Thermal Expansion	0.13 X 10-5 in/in/ºF
Ultimate Tensile Strength	125 KSI
Ultimate Compressive Strength	75 KSI
Ultimate Shear Strength	9.5 KSI
Water Absorption	0.01%
Specific Gravity	1.59 g/cc

Chemical Resistance of X-Lon™ Material

Generally X-Lon™ exhibits excellent chemical resistance. A few strong acids, oxidizers and amines have adverse effects on the material properties. A representative chart is shown here.

Acids	
Acetic Acid 20%	A
Acetic Acid Glacial	A
Acetic Anhydride	A
Aqua Regia	D
Arsenic Acid	A
Benzene Sulfonic Acid	A
Benzoic Acid	A
Boric Acid	A
Butyric Acid	A
Carbolic Acid	A
Carbonic Acid	A
Citric Acid	A
Chloroacetic Acid	A
Chlorosulfonic Acid	D
Chromic Acid 30%	B
Formic Acid	B
Fluoboric Acid	A
Fluosilicic Acid	A
Glycolic Acid	A
Hydrobromic Acid	C
Hydrochloric Acid 37%	C
Hydrofluoric Acid 50%	C
Lactic Acid	A
Nitric Acid 10%	C
Nitric Acid Concentrated	D
Oleic Acid	A
Oxalic Acid	A
Phosphoric Acid	A
Sulfuric Acid 10%	A
Sulfuric Acid >10%	D
Sulfurous Acid	A
Tannic Acid	A

Tartaric Acid	A
Bases	
Ammonia, Aqueous 10%	A
Ammonium Hydroxide Concentrated	D
Barium Hydroxide	A
Ferric Hydroxide	A
Potassium Hydroxide 50%	A
Sodium Hydroxide 20%	A
Sodium Hydroxide 50%	C
Alcohols	
Amyl Alcohol	A
Butyl Alcohol	A
Cyclohoxanol	A
Ethyl Alcohol	A
Ethylene Glycol	A
Glycerine	A
Methanol	A
Aldehydes & Ketones	
Acetaloehyde	A
Acetone	A
Benzaldehyde	C
Formaldehyde 37%	A
Furfural	A
Methyl Ethyl Ketone	D
Methyl Isobutyl Ketone	D
Amines	
Aniline	A
n-Butylamine	D
Dimethyl Aniline	A
Ethanolamine	A
Ethylene Diamine	D
Triethanolamine	A
Esters	
Amyl Acetate	A
Butyl Acetate	A
Butyl Phthalate	D
Cresyldiphenyl Phosphate	A
Dimethyl Phthalate	D
Dioctyl Phthalate	D

Ethyl Acetate	A
Halogenated Organics	
Carbon Tetrachloride	C
Cloroform	D
Dibromethane	A
Dichlorobenzene	A
Ethylene Dichloride	C
Freon 12	A
Freon 22	A
Freon 113	A
Freon 114	A
Freon 134a	A
Freon 502	A
Methyl Chloride	D
Methylene Chloride	D
Perchoroethylene	A
Trichlorotrifluoroethane	A
Tetrafluoroethane	A

Key:

A = No attack, little or no absorption
B = Slight attack, may be used in some applications
C = Moderate attack, some degradation of properties, limited utility
D = Severe attack, material degrades; do not use.

Radiation Resistance of X-Lon™ Material

Conditions	Reactor Core	Water Pool
Temperature	95º	86º
Radiation	Mainly neutrons	Mainly gamma
Intensity	10^8 rad	10^7 rad
Detector	Calorimeter and activation detectors	Ionization chamber

Radiation Dose	Modulus of Elasticity, Msi	Flexural Strength, Ksi
0	1.90	28.7
5 x 10^8 gamma	1.81	29.7
1 x 10^9 gamma	1.84	30.2
5 x 10^9 gamma	1.82	28.5
5 x 10^8 neutron	1.91	29.0
1 x 10^9 neutron	1.88	28.9

Note:
These tests were performed on samples of the base X-Lon polymer with 2% carbon fill. Because X-Lon is approximately 80% carbon, test results should be similar or better on X-Lon material. However, further testing on X-Lon material is recommended prior to use in any critical application.