

# DURATRON® PI Record Breaking Wear Resistance To 575°F (300°C)

- **Lowest wear rates and highest PV capability**
- **Lowest wear to mating surfaces**
- **Higher hardness and 1/3 lower thermal expansion than other polyimides**
- **Better chemical resistance than other polyimides**
- **Unfilled grade offers high purity levels**

Duratron® is a fully imidized thermoset polyimide. Full imidization and encapsulation of graphite lubricants in wear grades, make Duratron® PI stronger than other polyimides and provide excellent wear characteristics. In our Tribological Test Laboratories, Duratron® 150 has consistently achieved much higher limiting pressure/velocity levels and substantially lower wear rates than any other product tested. Duratron® PI is synthesized differently than competitive polyimides resulting in:

- Improved chemical resistance
- Lower coefficient of thermal expansion
- Significantly better physical properties

## Duratron XP (CM), Polyimide, high purity, unfilled, compression molded

**Duratron® XP** the first real alternative to traditional polyimide shapes, was developed for use in extreme applications like high performance valves, electronic devices and semiconductor manufacturing process equipment. Unreinforced Duratron® XP is bright yellow in color and is easy to machine. No special tools or procedures are required. A high purity polyimide, Duratron® XP contains less than 1 ppm of metallic impurities as measured using the ICP-MS test standard. This purity is comparable to other commercially available polyimide shapes. As a result, Duratron® XP is ideal for use in high -energy gas plasma etch and strip processes. Duratron® XP is resistant to most gas plasma formulations used in semiconductor processing and meets or exceeds the performance of other polyimide shapes

## Duratron® 150 PI,

### 15% Graphite Filled, Bearing Grade, Compression Molded Polyimide

Material Notes: Duratron is a fully imidized thermoset polyimide. Full imidization and encapsulation of graphite lubricants in wear grades make Duratron PI stronger than other polyimides and provide excellent wear characteristics. In Quadrant EPP's Tribological Test Laboratories, Duratron 150 and Duratron 400 have consistently achieved much higher limiting pressure/velocity levels and substantially lower wear rates than any other Quadrant-EPP product. Duratron PI is synthesized differently than competitive polyimides resulting in improved chemical resistance, lower coefficient of thermal expansion and significantly better physical properties.

### Proven Applications

#### Severe service bushings

Oven rollers and bearings made of Duratron 400 polyimide can endure high compressive loads and require no lubrication. (*Prior assembly: Rolling element bearings*)

#### Critical service bearings

A textile equipment manufacturer specifies only Duratron 150 polyimide for applications in which bearing failure would be catastrophic. (*Prior assembly: Self-aligning rolling element bearings*)

#### Wand tips and wafer boat handling tools

The high temperature capability and purity of Duratron HP polyimide, make it well suited for applications in the clean room. (*Prior materials: PPS, PEEK, Vespel® PI*)

Compression Molded	Rod	Disc	Plate	Tubular Bar	Other
Duratron™ XP PI	.375"-1.5"	3.5" -8.0" dia	.375" -2.0"(C)	1.50"-12..12" OD, .750" -7.50" ID	-
Duratron™ 150 PI	.375"-4.75"	3.5" -11.0" dia	.375" -2.0"(C,E)	1.50"-12.50" OD, .750" -11.25" ID	-

Key: C = 12" wide x 12" long    E = 12" wide x 24" long

		Duratron XP	Duratron 150 PI
<b>MECHANICAL PROPERTIES</b>	<b>ASTM</b>	<b>VALUE</b>	<b>VALUE</b>
Specific Gravity	D792	1.4	1.38
Tensile Strength, psi	D638	14200	9,600
Tensile Modulus, psi	D638	583,000	650,000
Elongation, %	D638	4	1.5
Flexural Strength, psi	D790	20,000	13,000
Flexural Modulus, psi	D790	600,000	610,000
Shear Strength, psi	D732	-	-
Compressive Strength, psi	D695, 10% Def.	24,000	17,000
Compressive Modulus, psi	D695	450,000	390,000
Hardness, Rockwell M	D785	110	110
Hardness, Rockwell R	D785	-	-
Izod Impact (Notched), ft-lb/in	D256 Type A	1.4	0.5
Coefficient of Friction, Dynamic	Dry vs. Steel,	-	0.7
Limiting PV, psi-fpm	PTM55010	10,000	41,500
k (wear) factor, 10-10in3-min/lb-ft-hr	PTM55010	50	5
<b>THERMAL PROPERTIES</b>			
Coefficient of Thermal Expansion,	E831 (TMA)	0.27	0.19
Deflection Temperature 264 psi, °F	D648	680	599
Tg-Glass Transition (Amorphous), °F	D3418	613	613
Continuous Service in Air (Max), °F	Without Load	580	580
Thermal Conductivity, BTU-in/hr-ft <sup>2</sup> -°F		-	3.74
<b>ELECTRICAL PROPERTIES</b>			
Dielectric Strength, Volts/mil	D149(2)	700	-
Volume Resistivity, Ohm-cm	D257	1E+15	1E+15
Dielectric Constant, 1 MHz	ASTM D150(2)	3.41	-
Dissipation Factor, 1 MHz	ASTM D150(2)	0.0038	-
<b>CHEMICAL PROPERTIES</b>			
Water Absorption Immersion, %	24 hr	0.4	0.65
Water Absorption, %	Saturation	1.3	-
Acids, Weak (acetic, dilute HCl)		3	3
Acids, Strong (conc. HCl or sulfuric)		2	2
Alkalies, Weak (dilute NaOH)		2	2
Alkalies, Strong (conc. NaOH)		1	1
Hydrocarbons, Aromatic (toluene)		3	3
Hydrocarbons, Aliphatic (gasoline)		3	3
Ketones, Esters (acetone)		3	3
Ethers (diethyl ether, THF)		3	3
Chlorinated Solvents (methylene chloride)		3	3
Alcohols (methanol, anti-freeze)		3	3
Inorganic Salt Solutions (NaCl, KCl)		3	3
Continuous Sunlight		2	3
Steam		1	1
1= Unacceptable, 2= Limited Service, 3= Acceptable Service			
<b>COMPLIANCE</b>			
Flammability, UL94 (5=V-0; 4=V-1; 3=V-2; 1=HB) V-O UL94		5 (VO)	5 (VO)
FDA(1=Yes)		0 Compliant	0 Compliant
USDA(1=Yes)		0 Compliant	0 Compliant
NSF (1=Yes)		0 Compliant	0 Compliant
3A-Dairy (1=Yes)		0 Compliant	0 Compliant
Canada AG (1=Yes)		0 Compliant	0 Compliant
USPClass VI (1=Yes)		1 Not Compliant	1 Not Compliant

## Duratron® XP (CM), Polyimide, high purity, unfilled, compression molded

**Material Notes:** Duratron XP is a compression-molded polyimide that offers high purity, high strength, high heat resistance, and good machinability.

These properties, combined with its chemical resistance and dimensional stability, make Duratron XP ideal for components in semiconductor manufacturing and test equipment.

MECHANICAL PROPERTIES	ENGLISH VALUES	COMMENTS	METRIC VALUES
Specific Gravity	1.4	ASTM D792	1.4
Tensile Strength, psi	16000	ASTM D638	110 MPa
Tensile Modulus, psi	583000	ASTM D638	4,020 MPa
Elongation, %	4	ASTM D638	4 %
Flexural Strength, psi	20000	ASTM D790	138 MPa
Flexural Modulus, psi	600000	ASTM D790	4,137 MPa
Compressive Strength, psi	24000	ASTM D695, 10% Def.	165 MPa
Compressive Modulus, psi	450000	ASTM D695	3,103 MPa
Hardness, Rockwell M	112	ASTM D785	112
Izod Impact (Notched), ft-lb/in	1.4	ASTM D256 Type A	75 J/m
Coefficient of Friction, Dynamic	0.23	Dry vs. Steel, PTM55007	0.23
Limiting PV, psi-fpm	32500	PTM55007	1.1 MPa-m/sec
k (wear) factor, $10^{-10}$ in <sup>3</sup> -min/lb-ft-hr	50	PTM55007	$50 \cdot 10^{-10}$ in <sup>3</sup> -min/lb-ft-hr
THERMAL PROPERTIES	ENGLISH VALUES	COMMENTS	METRIC VALUES
Coefficient of Thermal Expansion, 10E-4/°F	0.27	ASTM E831 (TMA)	$0.49 \cdot 10^{-4}$ /K
Deflection Temperature 264 psi, °F	680	ASTM D648	360 °C
Tg-Glass Transition (Amorphous), °F	613	ASTM D3418	323 °C
Continuous Service in Air (Max), °F	580	Without Load	304 °C
Thermal Conductivity, BTU-in/hr-ft <sup>2</sup> -°F	1.53		0.22 W/m-K
ELECTRICAL PROPERTIES	VALUES	COMMENTS	METRIC VALUES
Dielectric Strength, Short Term, Volts/mil	700	ASTM D149(2)	28 kV/mm

Surface Resistance, Ohm/Square	1E+13	Lower Limit; EOS/ESD S11.11	1E+13 Ohm/Square
Dielectric Constant, 1 MHz	3.41	ASTM D150(2)	3.41
Dissipation Factor, 1 MHz	0.0038	ASTM D150(2)	0.0038
CHEMICAL PROPERTIES	ENGLISH VALUES	COMMENTS	METRIC VALUES
Water Absorption Immersion, 24 hr., %	0.4	ASTM D570	0.4 %
Water Absorption Immersion Sat, %	1.3	ASTM D570	1.3 %
Acids, Weak (acetic, dilute HCl)	3	Acceptable Service	3
Acids, Strong (conc. HCl or sulfuric)	2	Limited Service	2
Alkalies, Weak (dilute NaOH)	2	Limited Service	2
Alkalies, Strong (conc. NaOH)	1	Unacceptable	1
Hydrocarbons, Aromatic (toluene)	3	Acceptable Service	3
Hydrocarbons, Aliphatic (gasoline)	3	Acceptable Service	3
Ketones, Esters (acetone)	3	Acceptable Service	3
Ethers (diethyl ether, THF)	3	Acceptable Service	3
Chlorinated Solvents (methylene chloride)	3	Acceptable Service	3
Alcohols (methanol, anti-freeze)	3	Acceptable Service	3
Inorganic Salt Solutions (NaCl, KCl)	3	Acceptable Service	3
Continuous Sunlight	2	Limited Service	2
Steam	1	Unacceptable	1
COMPLIANCE	ENGLISH VALUES	COMMENTS	METRIC VALUES
Flammability, UL94 (5=V-0; 4=V-1; 3=V-2; 1=HB)	5 (V-0)	UL94	5
FDA (1=Yes)	0	Not Compliant	0
USDA (1=Yes)	0	Not Compliant	0
NSF (1=Yes)	0	Not Compliant	0
3A-Dairy (1=Yes)	0	Not Compliant	0
Canada AG (1=Yes)	0	Not Compliant	0
USP Class VI (1=Yes)	0	Not Compliant	0

MATERIAL SAFETY DATA SHEET

MATERIAL IDENTIFICATION

PRODUCT NAME: DURATRON HP

CHEMICAL NAME: AROMATIC POLYIMIDE POLYMER.

CAS NO.: 58698-66-1

PRODUCT USE: ENGINEERING POLYMER SHAPE FOR SUBSEQUENT FABRICATION.

TSCA INVENTORY STATUS: ALL REPORTABLE INGREDIENTS ARE LISTED IN THE TSCA CHEMICAL SUBSTANCE INVENTORY.

---

SECTION 2

HAZARDOUS INGREDIENTS (ADDITIVES NOT HAZARDOUS BY 29CFR 1910.1200)

> IDENTITY	CAS#	CONCENTRATION	TVL (ACGI)
- -	58698-66-1	- -	10 mg/m <sup>3</sup>

---

SECTION 3

HEALTH HAZARD DATA

ACUTE OR IMMEDIATE EFFECTS: ROUTES OF ENTRY AND SYSTEMS.

INGESTION: NOT A PROBABLE ROUTE OF EXPOSURE.

SKIN: MOLTEN POLYMER CAUSES THERMAL BURNS.

EYE: MECHANICAL IRRITATION ONLY.

INHALATION: SHAPES NOT RESPIRABLE BUT MACHINING MAY GENERATE A NUISANCE DUST WHICH CAN CAUSE MECHANICAL IRRITATION TO THE EYES, SKIN, NOSE AND THROAT.

---

## SECTION 4

### EMERGENCY FIRST AID

- If exposed to fumes from overheating, move to fresh air. Consult a physician if symptoms persist.
- Wash skin with soap and plenty of water.
- Flush eyes with water. Consult a physician if symptoms persist.
- If molten polymer contacts skin, cool rapidly with cold water. Do not attempt to peel polymer from skin. Obtain medical attention to thermal burn.

CHRONIC EFFECTS: NONE KNOWN.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY THIS MATERIAL: NONE KNOWN.

---

## SECTION 5

### FIRE AND EXPLOSION HAZARD DATA

>FLASHPOINT: No observed flashpoint

> USUAL FIRE, EXPLOSION HAZARDS: Toxic fumes may be emitted at extreme temperatures.

HAZARDOUS DECOMBUSTION PRODUCTS: CO<sub>2</sub>, CO, traces of HCN, NO<sub>x</sub>, NH<sub>3</sub>.

SPECIAL FIRE FIGHTING INSTRUCTIONS: FIRE FIGHTERS AND OTHERS EXPOSED TO PRODUCTS OF COMBUSTION SHOULD WEAR FULL PROTECTIVE CLOTHING INCLUDING SELF-CONTAINED BREATHING APPARATUS. FIRE FIGHTING EQUIPMENT SHOULD BE THOROUGHLY DECONTAMINATED AFTER USE.

EXTINGUISHING MEDIA: WATER SPRAY OR ANY CLASS A EXTINGUISHING AGENT.

EXTINGUISHING MEDIA TO BE AVOIDED: HALONE, DRY CHEMICAL (not enough cooling effect)

---

## SECTION 6

### ACCIDENTAL RELEASES

SPILL OR RELEASE: CLEAN UP BY VACUUMING OR SWEEPING TO PREVENT FALLS.

---

## SECTION 7

### STORAGE CONDITIONS

Dry storage. Keep containers closed to prevent contamination.

---

## SECTION 8

### PROTECTION INFORMATION

EYE: Safety glasses are recommended to prevent particulate matter from entering eyes while grinding or machining.

SKIN: Protective gloves are required when handling hot polymer. Also, long sleeve cotton shirt and long pants if handling molten polymer.

VENTILATION: Local exhaust at processing equipment to keep particulates below 5 mg/m<sup>3</sup>, the OSHA limit for respirable dusts. Grinding and machining of parts should be reviewed to assure that particulate levels are kept at recommended levels.

RESPIRATOR: If dust is generated and ventilation is inadequate, use NIOSH/MSHA certified respirator which will protect against dust.

---

## SECTION 9

### PHYSICAL/CHEMICAL DATA

APPEARANCE: DARK YELLOW COLOR. SHAPE MAY BE IN THE FORM OF DISC, PLATE OR TUBE

ODOR: ESSENTIALLY ODORLESS.

MELTING POINT: N/A

SOLUBILITY IN WATER: INSOLUBLE.

VOLATILE CONTENT %: <1%

SPECIFIC GRAVITY: 1.34

---

## SECTION 10

### HAZARDOUS REACTIVITY

>STABILITY: **Stable under normal conditions**  
>CONDITIONS TO AVOID: **Long-term exposure to alkaline media.**  
>MATERIALS TO AVOID: **Reacts with molten alkali metals and finely divided magnesium and aluminum at temperatures above 425°C (797°F).**  
>HAZARDOUS POLYMERIZATION: **N/A**  
>HAZARDOUS DECOMPOSITION PRODUCTS: **Decomposition occurs at temperatures near 425°C (842°F). Carbon monoxide, traces of aniline, hydrogen cyanide, and NO.**

---

## SECTION 11

### TOXICOLOGICAL INFORMATION

CHRONIC TOXICITY: **DURATRON HP DOES NOT APPEAR TO POSSESS ANY TOXICOLOGICAL PROPERTIES.**

MEDICAL CONDITIONS PRONE TO AGGRAVATION BY EXPOSURE: **NONE KNOWN.**

CARCINOGENICITY: **NONE KNOWN.**

---

## SECTION 12

### ECOLOGICAL INFORMATION

AQUATIC TOXICITY: **Toxicity is expected to be low based on insolubility of polymer in water.**

---

## SECTION 13

### DISPOSAL

SPILL OR RELEASE: **Clean up by vacuuming or wet sweeping to minimize dust exposure.**

WASTE DISPOSAL: **Landfill or incineration in compliance with federal, state, and local regulations.**

---

## SECTION 14

### TRANSPORT INFORMATION

DOT HAZARD CLASS: **NA**  
SHIPPING NAME: **NA**

## SECTION 15 REGULATORY INFORMATION

### SECTION 313 SUPPLIER NOTIFICATION:

(SARA TITLE III-TOXIC CHEMICALS LIST)

This product contains no known toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40 CFR 372.

STATE RIGHT TO KNOW LAWS

No substances on the state hazardous list, for the states indicated below, are used in the manufacture of products on this Material Safety Data Sheet, with the exceptions indicated. While we do not specifically analyze these products, or the raw materials used in their manufacture, for substances on various state hazardous substances lists, to the best of our knowledge the products on this Material Safety Data Sheet contain no such substances except for those specifically listed below:

PENNSYLVANIA:

SUBSTANCES ON THE PENNSYLVANIA HAZARDOUS SUBSTANCES LIST PRESENT AT A CONCENTRATION OF 1% OR MORE: **NONE KNOWN.**

SUBSTANCES ON THE PENNSYLVANIA SPECIAL HAZARDOUS SUBSTANCES LIST PRESENT AT A CONCENTRATION OF 0.01% OR MORE: **NONE KNOWN.**

CALIFORNIA PROPOSITION 65:

SUBSTANCES KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER: **NONE KNOWN.**

SUBSTANCES KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM: **NONE KNOWN.**

>

**HMIS RATING**

Health	0
Flammability•	1•
Reactivity	0
PPE•	A•
#Acute•*Chronic•	

**SECTION 16**

MISCELLANEOUS INFORMATION

Prepared by: T.W. Swavely, Product Compliance Coordinator.

Reviewed August 28, 2001

REV. B

Supersedes: OCTOBER 27, 1995

The information set forth herein has been gathered from standard reference materials and/or supplier test data and is, to the best knowledge and belief of Quadrant EPP, accurate and reliable. Such information is offered solely for your consideration, investigation and verification, and it is not suggested or guaranteed that the hazard precautions or procedures mentioned are the only ones which exist. Quadrant EPP makes no warranties, expressed or implied, with respect to the use of such information or the use of the specific material identified herein in combination with any other material or process, and assumes no responsibility therefor.

NA = Not

NE = Not established.

> = New or revised information in this section when " > " appears in the left margin.

**END OF MSDS**