

CEPLA

SUPER HEAT RESISTANT POLYIMIDE PLASTIC

Thermal Resistance

CEPLA's thermal decomposition is extremely high. It is stable in heat up to 300°C for a long time and if it was for a short period of time, the temperature can be raised up to 480°C. CEPLA can be used continuously with a wide temperature ranges as it doesn't have melting point and doesn't soften.

Radiation Resistance

CEPLA has the best radiation resistance amongst other high performance plastics. It is especially resistant to degradation by gamma-ray radiation.

Electrical Properties

CEPLA has stable dielectric constant at a high frequency and low in dissipation factor.

Chemical Properties

CEPLA is acid-resistant and alkali resistant and it doesn't degrade its mechanical strength by chemicals. It also has an exceptionally low water absorption factor and so offers dimensional stability with no dimensional change.

Mechanical Strength

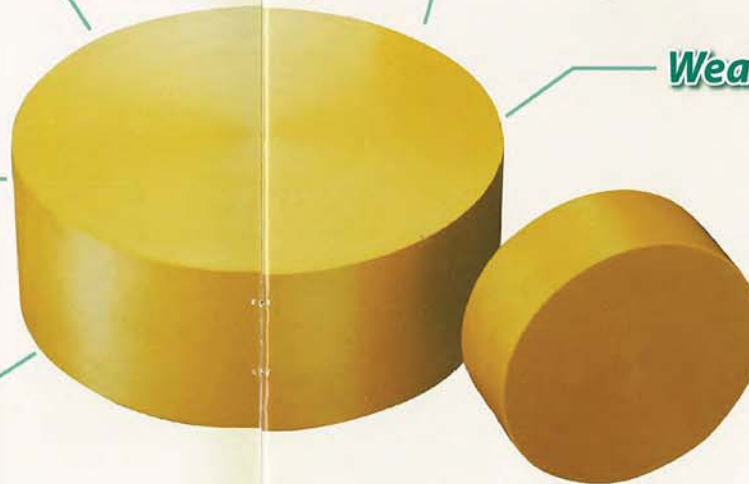
CEPLA is superb in its tensile strength, flexural modulus and creep-resistance in comparison to other high performance plastics.

Mechanical Processing

CEPLA is extremely suited for cutting and it makes it possible to cut any complicated form precisely.

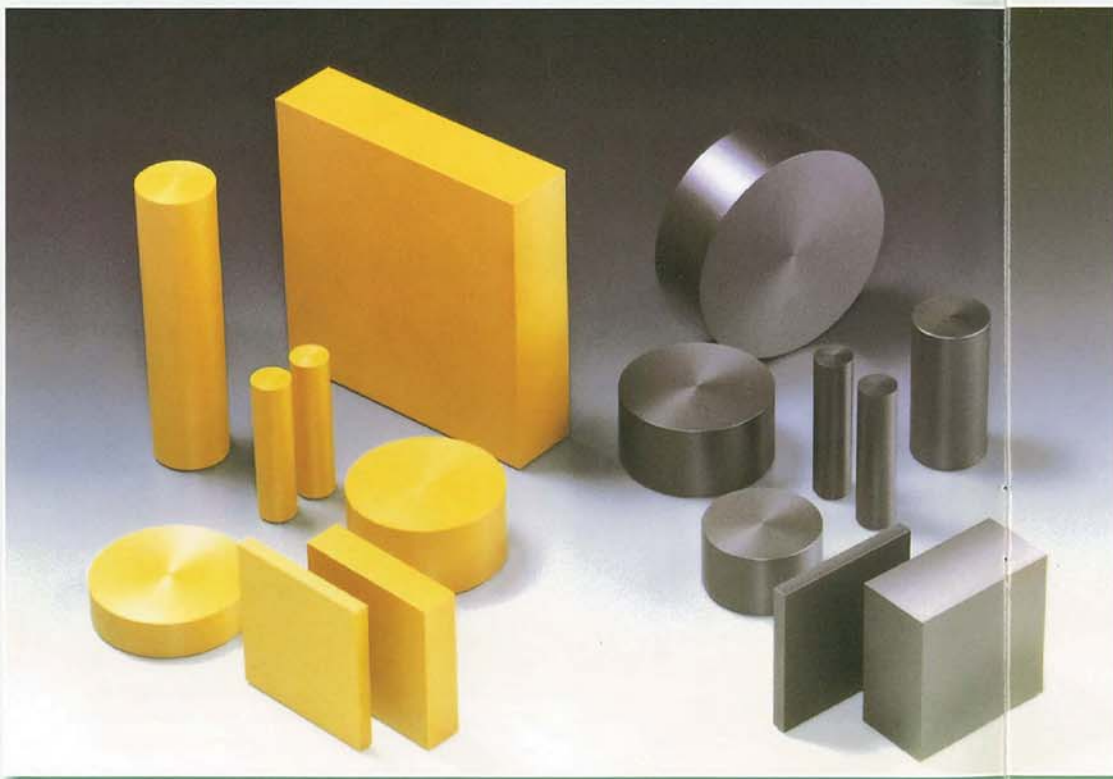
Wearing Resistance

CEPLA has good wearing resistance even without any lubrication and has stable frictional properties under high PV value.

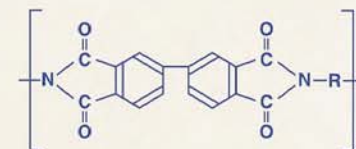


CEPLA

Aromatic Polyimide **CEPLA** is.....



CEPLA :
Super-Heat-Resistant
Polyimide plastic



CEPLA is a shape of aromatic polyimide resin, produced through condensation polymerization, biphenyltetracarboxylic dianhydride (BPDA) and diamine. CEPLA is excellent for wide range of use for its heat resistance, mechanical properties, mechanical processing, radiation resistance, chemical resistance and water absorption resistance.

APPLICATIONS

1. Heat resistant machinery parts
2. Frictional parts in high temperature
3. Electrical, electronic and office equipment parts
4. Nuclear related parts
5. Aircraft, aerospace related equipment parts

Mechanical Properties

Table-1 Mechanical Properties

Property	Unit	Typical Value						Test Method ASTM
		CEPLA		EXTRA		CEPLA-G II		
		°C		°C		°C		
		23	260	23	300	23	260	
Tensile Strength	Mpa	116	41	82	24	73	30	D-638
Tensile Elongation	%	5.0	6.0	2.0	1.5	3.0	2.6	D-638
Flexural Strength	Mpa	161	59	101	41	80	36	D-790
Flexural Modulus	Gpa	4.2	2.1	8.0	3.7	4.9	2.6	D-790
Compressive Stress (1% Deformation)	Mpa	26	—	40	—	24	—	D-695
Compressive Modulus	Gpa	2.6	—	4.0	—	2.3	—	D-695
Izot Impact (Notched, unnotched)	J/min	77.5 956.5	—	22.4 113.2	—	21.4 162.1	—	D-265
Rockwell Hardness	M scale	114	—	113	—	94	—	D-785
Compressive Creep	% 150°C	0.83		0.86		1.16		Stress 17.2Mpa 100Hrs

CEPLA's mechanical properties are outstandingly superior compared to other high performance plastics. It has exceptionally high mechanical strength, flexural modulus and creep resistance are exceptionally good in comparison with other high performance plastics.

(1) Stress vs. Strain Curve

Stress vs. Strain curves for CEPLA, EXTRA and CEPLA-GII are shown in Fig-1 and Fig-2.

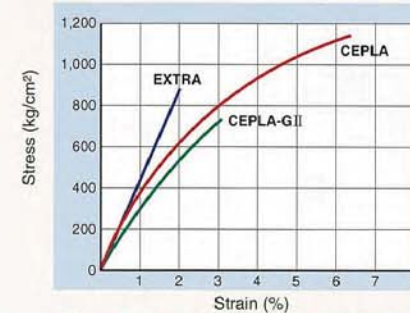


Fig-1 Tensile Stress vs. Strain Curve

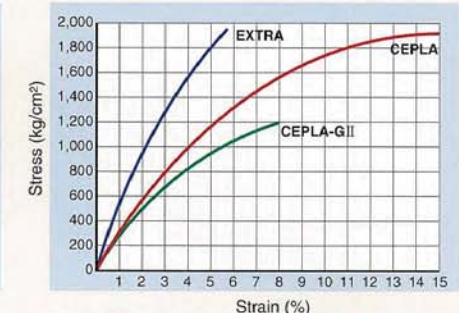


Fig-2 Compressive Stress vs. Strain Curve

(2) Tensile Strength

Tensile strength at high temperature are shown in Fig-3.

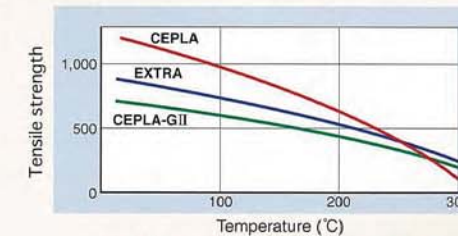


Fig-3 Tensile Strength vs. Temperature

(3) Flexural Properties

Flexural properties at high temperature are shown in Fig-4 and Fig-5.

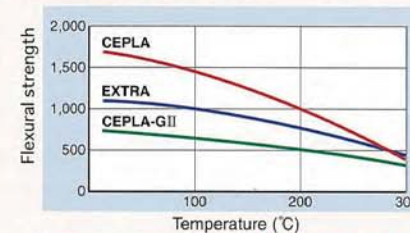


Fig-4 Flexural Strength vs. Temperature

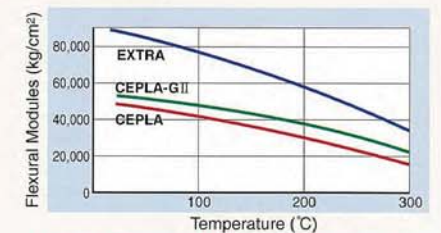


Fig-5 Flexural Modules vs. Temperature

GENERAL PROPERTIES

Thermal Properties

CEPLA's high-temperature properties are excellent and can be used continuously in a wide range of temperature. Especially EXTRA's heat distortion temperature of 500°C is far superior to other high performance plastics

Table-2 Thermal Properties

Property	Unit	Temperature (°C)	Typical Value			Test Method ASTM
			CEPLA	EXTRA	CEPLA-GII	
Coefficient of Linear Thermal Expansion	PPM/°C	20~100	36.2	25.0	—	E-233
		100~200	63.5	38.0	—	
		200~300	82.5	66.0	—	
		300~400	—	101.0	—	
		20~250	55.2	36.9	—	
		20~300	—	—	63.0	
Thermal Conductivity	W/m·°C	25	0.395	0.453	1.256	—
		25	1.05	1.05	0.97	—
Thermal Decomposition Temperature	°C	—	548	592	553	10% Reduced
Thermal Weight Reduction	%	—	0.20	0.15	0.50	300°C×18 ^H
			1.70	0.88	2.10	400°C×18 ^H
Heat Distortion Temperature	°C	—	360	500	370	D-648 (1.82Mpa)

Thermal Decomposition

Thermal decomposition and isothermal deterioration of plastic suggest heat resistance for short term. Fig-6 shows thermal decomposition and Fig-7 shows isothermal deterioration.

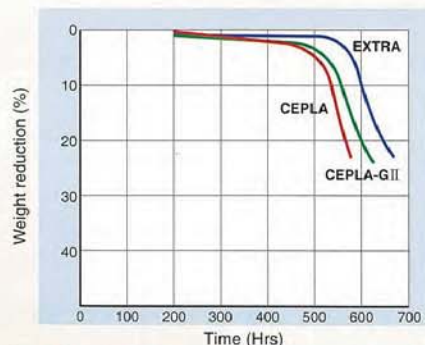


Fig-6 Thermal Decomposition Curve (in air)
(Weight reduction at an increasing temperature rate of 3°C/min)

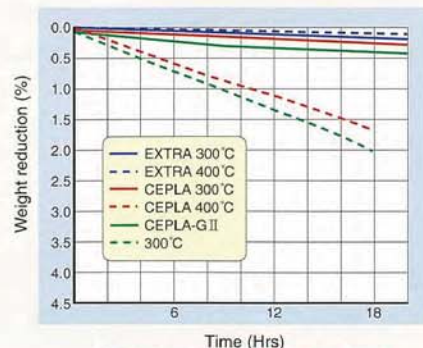


Fig-7 Isothermal Deterioration

Electrical Properties

CEPLA displays outstanding electrical properties over a wide temperature and frequency range.

Table-3 Electrical Properties

Property	Unit	Temperature (°C)	Typical Value		Test Method ASTM
			CEPLA	EXTRA	
Dielectric Strength (2mm Thick)	KV/mm	23	18.0	19.0	D-149
Dielectric Constant (1KHz)	—	23	3.59	3.58	D-150
Dissipation Factor (1KHz)	—	23	0.0012	0.0015	D-150
Volume Resistivity	Ω-cm	23	1.8×10 ¹⁶	1.9×10 ¹⁶	D-257
Surface Resistivity	Ω	23	9.4×10 ¹⁶	7.9×10 ¹⁶	D-257
Arc Resistance	Sec	23	124	122	D-495

Dielectric Constant

Dielectric constant of CEPLA is constant at increased frequency Fig-8 shows dielectric constant vs. frequency

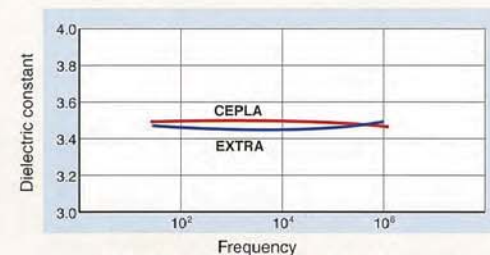


Fig-8 Dielectric constant vs. Frequency

Dissipation Factor

Dissipation factor shows heat loss for alternative currency, and this is very important for high frequency. Lower the dissipation factor, smaller the heat loss Fig-9 shows dissipation factor vs. frequency.

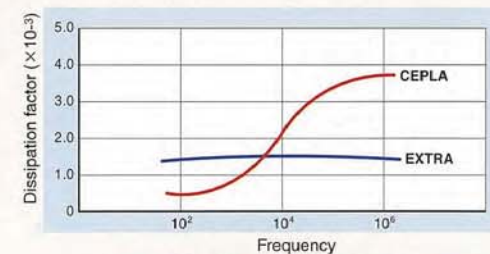


Fig-9 Dissipation Factor vs. Frequency

ENVIRONMENTAL PROPERTIES

(1) Resistance to Thermal Degradation

Without standing high heat distortion temperature, CEPLA can be used in high temperature environment. In such case, evaluation of resistance to thermal degradation is necessary to forecast projected lifetimes of parts. Fig-10 shows relationship between time and temperature when the retention of flexural strength is 50%. Thermal degradation of CEPLA is shown in Fig-11 and Fig-12. These data indicate excellency of EXTRA.

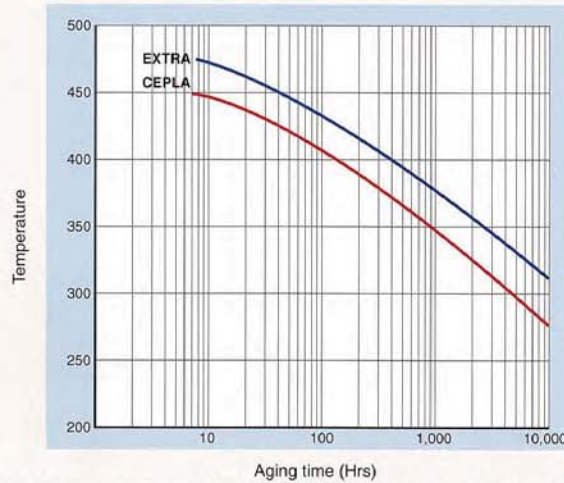


Fig-10 Temperature to 50% Reduction in Flexural Strength

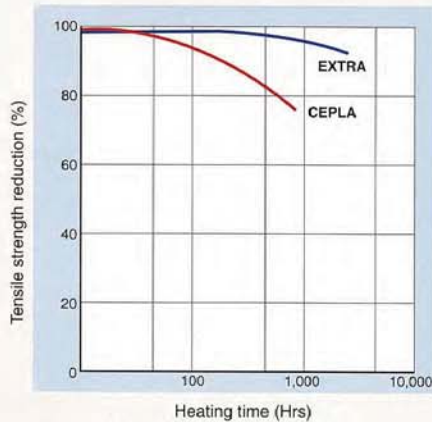


Fig-11 Thermal Degradation in Tensile Strength (300°C)

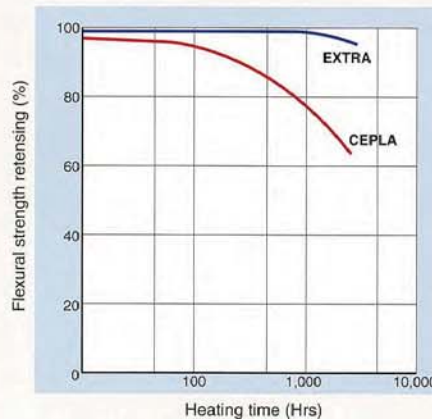


Fig-12 Thermal Degradation in Flexural Strength (300°C)

(2) Weather Ability

CEPLA is stable when exposed to sunshine or ultraviolet light. Fig-13 shows weather ability of CEPLA.

Test Conditions

- UVCON
- Sunshine Weathermeter
- Temp : 63±3°C
- Spray : 12min/1Cycle (60min)

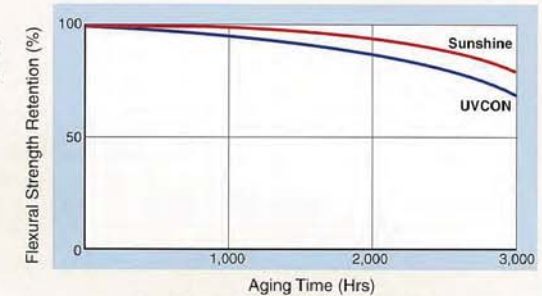


Fig-13 Weatherability of CEPLA

(3) Chemical Resistance

CEPLA is chemically stable and resistant to all organic solvent. In comparison with other polyimide resins, CEPLA is more resistant to acid or alkali.

Table-4 Chemical Resistance

Chemical	Test Condition	Evaluation		Tensile Strength Retention	
		CEPLA	EXTRA	CEPLA	EXTRA
Gasoline	Room Temp 2000hrs Dipping	No change	No change	100	100
Light Oil	Room Temp 2000hrs Dipping	No change	No change	100	100
Toluene	Room Temp 2000hrs Dipping	No change	No change	100	100
Methyl Ethyl Ketone	Room Temp 2000hrs Dipping	No change	No change	100	100
Trichlene	Room Temp 2000hrs Dipping	No change	No change	100	100
Isopropanal	Room Temp 2000hrs Dipping	No change	No change	100	100
35% Hydrochloric Acid	Room Temp 120hrs Dipping	No change	No change	99	99
97% Sulphuris Acid	Room Temp 120hrs Dipping	Swelling	Swelling	—	—
60% Nitric Acid	Room Temp 120hrs Dipping	No change	No change	98	98
10% Sodium Hydroxide	Room Temp 120hrs Dipping	No change	No change	95	95
85% Phosphoric Acid	Room Temp 120hrs Dipping	No change	No change	99	99
15% Acetic Acid	Room Temp 120hrs Dipping	No change	No change	100	100

CEPLA has excellent frictional properties thanks to its high limiting PV value.

(4) Water Absorption

Polyimide resin absorb water, but in comparison with other polyimide resins, CEPLA has a relatively low water absorption factor.

Table-5 Water Absorption

Property	Unit	Typical Value		Test Method ASTM
		CEPLA	EXTRA	
Water Absorption (48hrs)	%	0.46	1.12	D570
Equilibrium Water Absorption	%	1.3	0.4	D570

(5) Radiation Resistance

As shown in Fig-14, CEPLA shows no degradation on its mechanical strength until 1×10^9 rad and superior properties compared to other organic plastics.

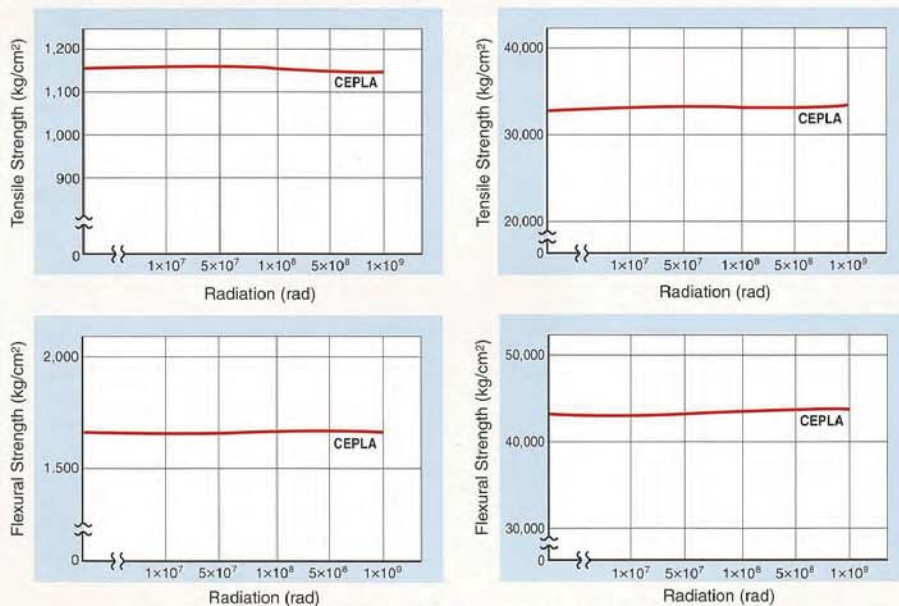


Fig-14 Radiation Resistance of CEPLA : Co-60 γ Rays : 1×10^6 rad/hour

Table-6 Frictional Properties

Property	Unit	Typical Value			Test Method
		CEPLA	EXTRA	CEPLA-GII	
Tabar Abrasion Lose (CS-17.1000g)	Mg/1000 Times	14.7	—	—	ASTM D-1044
Limiting PV Value	Mpa · m/s	1.71	2.21	2.94	S45C 0.5m/sec
Kinetic Friction Factor		0.25	0.31	0.30	S45C 0.5m/sec
Abrasion Lose	mg	3.8	1.2	2.5	1.5.1kgf

Friction Factor

Fig-15 shows relationship of limiting PV vs Kinetic friction factor.

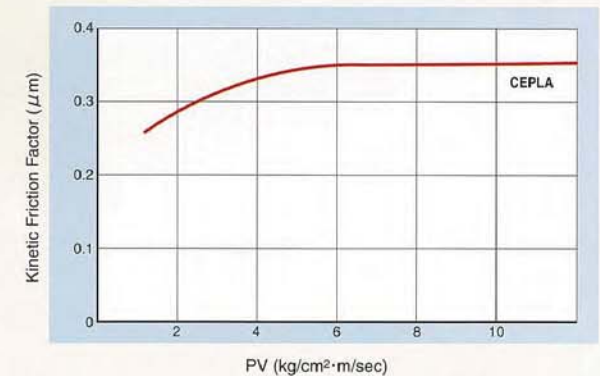


Fig-15 Limiting PV vs. Kinetic Friction Factor of CEPLA

CEPLA STANDARD SIZE



Circular Board	Diameter (mm)	Thickness (mm)		
	φ 200	50	25	10
	φ 150			
	φ 100			
	φ 75			

※ Available up to φ 350

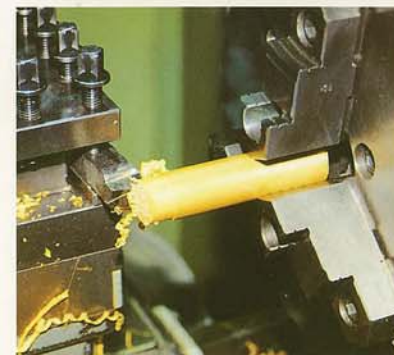
Square Board	Length×Width (mm)	Thickness (mm)		
	100×100	50	25	10
	150×150			
	200×200			

Rod	Diameter (mm)	Length	
	φ 50	200	100
	φ 40		
	φ 30		
	φ 25		
	φ 20		
	φ 15		
	φ 10		
	φ 5		

CEPLA PRODUCTS

CEPLA products are excellent parts for processing machines because of its super thermal resistance, radiation resistance, mechanical properties, wearing resistance, dielectric strength and easy processing.

Machinery Parts of CEPLA



Machinery Parts of CEPLA (Precise to a micron unit!)

What's so excellent about CEPLA is its outstanding precision in processing. CEPLA has the strength of ceramics, yet can cut like a metal. CEPLA products a custom made to a precise form and size by request. CEPLA is a new generation of material and its excellent properties enable a greater range of applications.