Product Information

Feinpolyamide PA 2200 for EOSINT P

PA2200 is a fine-powder on the basis of polyamide 12. In comparison to standard polyamide 12 PA2200 is characterized by higher cristallinity and higher melting point as result of specific production process. PA2200 contains stabilizers against heat and oxidation.

Powder Properties

Property		Measurement Method DIN/ISO	Unit	Value
Bulk densitiy		DIN 53466	g/cm3	> 0,430
Mean	grain size d50	Laser diffraction	µm	58
	grain size d10	(Malvern Mastersizer)	µm	40
	grain size d90		µm	90

General Properties

Property	Measurement Method DIN/ISO	Units	Value
Melting temperature	DSC	°C	184
Melting empthalpy		J/g	ca. 115
Crystallization temperature		°C	138
Water absorption	DIN 53495		
100°C, saturation in water		%	1,93
23°C, 96% RF		%	1,33
23°C, 50% RF		%	0,52

Propterty	Measurement Method DIN/ISO	Unit	Value

EOS GmbH - Electro Optical Systems
Robert-Stirling-Ring 1
D-82152 Krailling / München
Telefon: +49 (0)89 / 893 36-0
Telefax: +49 (0)89 / 893 36-285
Internet: www.eos.info

Coefficient of linear thermal expansion	DIN 53752-A	$x10^{-4}$ /K	1,09
Specific hat	DIN 51005	J/gK	2,35
Solution viscosity	EN ISO 307	Eta rel	1,6
Molecular weight			
Mol mean M_n		g/mol	15000
Weight mean M_w		g/mol	29000

Density and Mechanical Properties of sintered parts *)

Property	Measurement method DIN/ISO	Unit	Value
Density	EOS-Method	g/cm³	0,90 – 0,95
Tensile modulus	DIN EN ISO 527	N/mm²	1700 ± 150
Tensile strength	DIN EN ISO 527	N/mm²	45 ± 3
Elongation at break	DIN EN ISO 527	%	20 ± 5
Flexural modulus	DIN EN ISO 178	N/mm²	1240 ± 130
Charpy-Impact strength	DIN EN ISO 179	kJ/m²	53 ± 3,8
Charpy-Notched impact strength	DIN EN ISO 179	kJ/m²	4,8 ± 0,3
Izod-Notched impact strength	DIN EN ISO 180	kJ/m²	32,8 ± 3,4
Izod-Notched impact strength	DIN EN ISO 180	KJ/m²	4,4 ± 0,4
Ball indentation hardness	DIN EN ISO 2039	N/mm²	77,6 ± 2
Shore-D-hardness	DIN 53505		75 ± 2

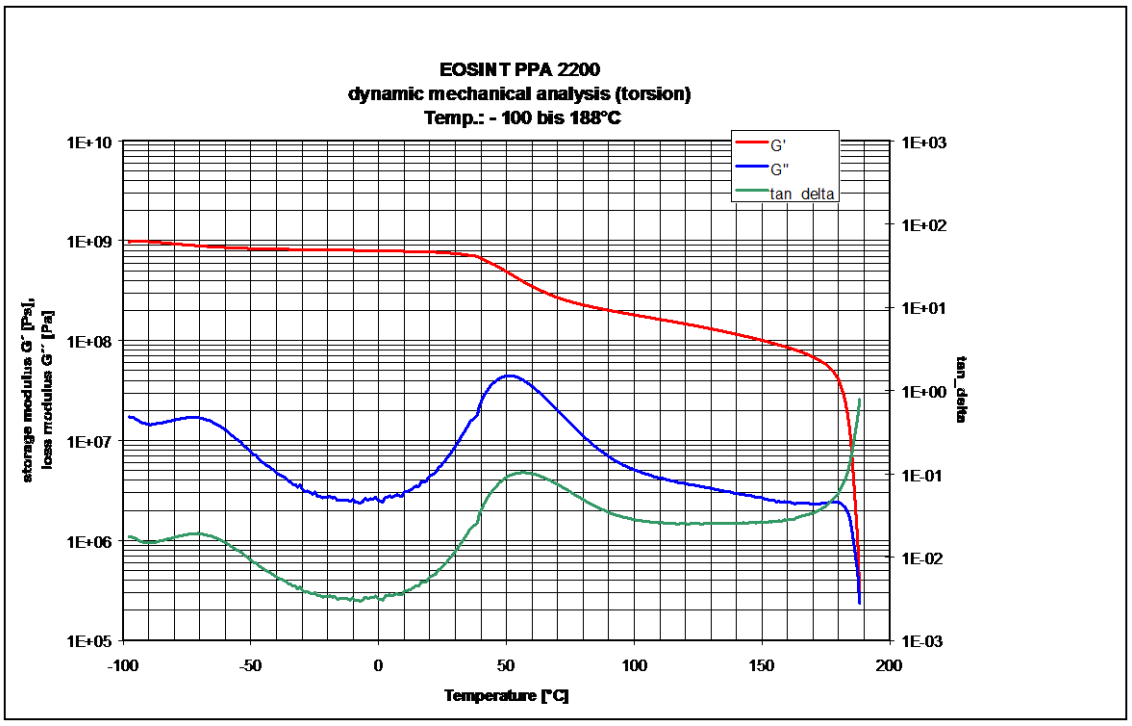
*) Density and mechanical properties of sintered part depend on exposure parameters and on x,y,z-position in building room.

Thermal properties of sintered parts

Property	Measurement Method DIN/ISO	Unit	Value
Vicat softening temperature	DIN EN ISO 306		
B/50		°C	163
A/50		°C	181
Thermal conductivity	DIN 52616		
vertical to sintered layers		W/mK	0,144
parallel to sintered layers		W/mK	0,127

Short term influcence of temperature on mechanical properties

An overview about the temperature dependence of mechanical properties of PA12 can be retrieved from the curves for dynamic shear modulus and loss factor as function of temperature according to ISO 537.

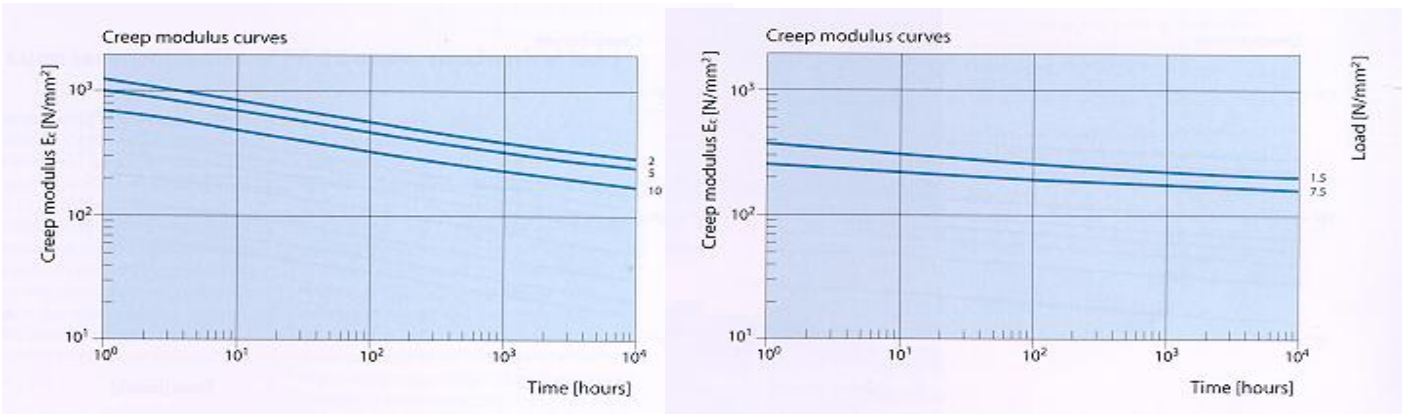


In general Polyamid12 – parts show high mechanical strength and elasticity under steady stress in a temperature range from - 40°C till + 80°C. Short time loading of PA12-parts without stress is possible up to 160°C.

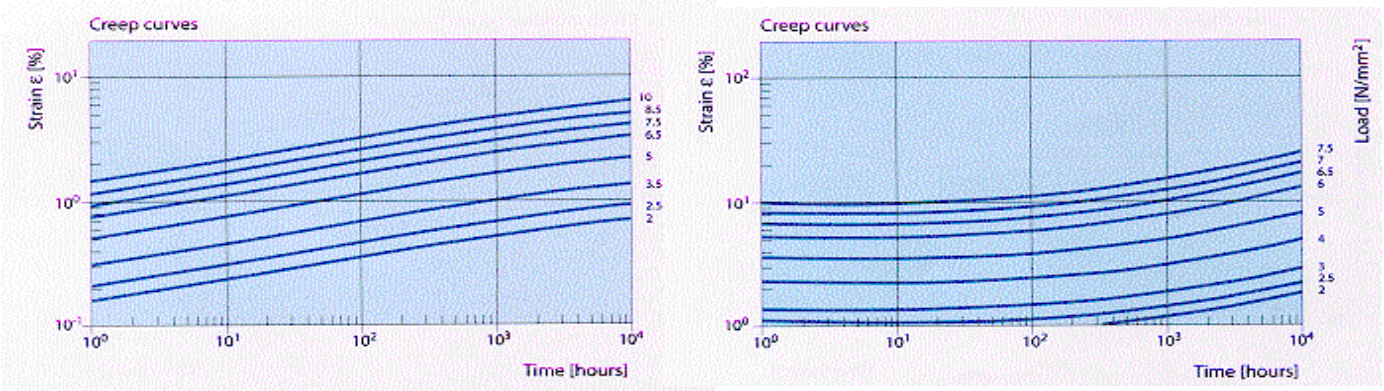
Long term properties under mechanical load and temperature

In general thermoplastics have higher mechanical strength under short term load then under long term load (> 1000 h) as result of creep. This occurs mostly at higher temperatures and leads to a reduction of modulus (creep modulus). Usually the creep resistance (mechanical properties under continous load) is determined with the uniaxial tensile creep test (DIN 53444) under different loads and temperatures.

Creep modulus curces PA 12 at T = 23°/100°C



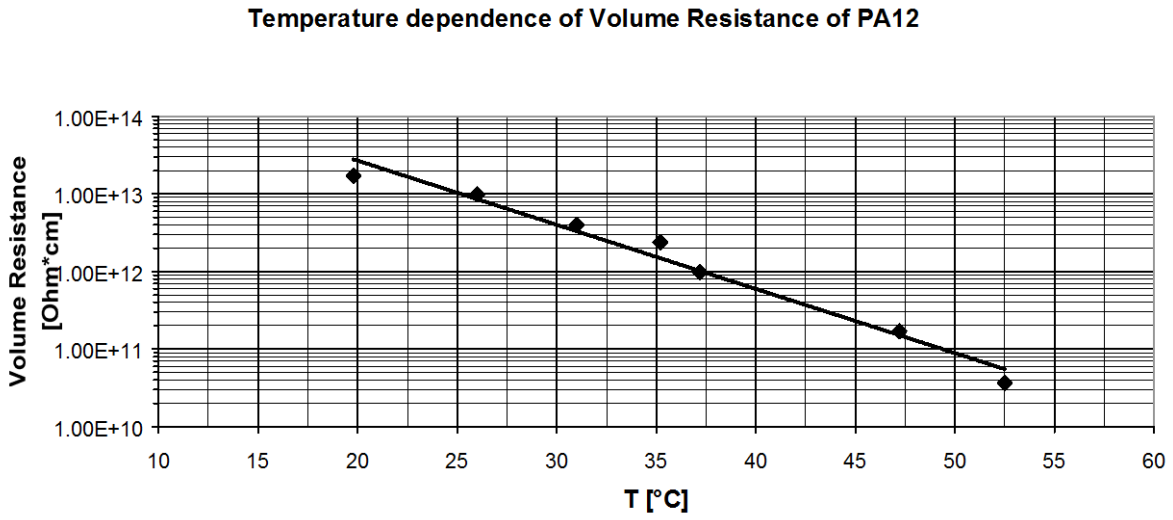
Creep elongation curves PA 12 at T = 23°C/100°C



Electrical Properties

Property	Measurement Method DIN/ISO	Unit	Value
Volume Resistance	DIN 53482 IEC-Publ. 93	Ω*cm	10^{13} –10^{15}
Surface Resistance	DIN 53482 IEC-Publ. 93	Ω	10^{13}
Relative Permittivity (1 kHz)	DIN53483 IEC-Publ. 250	10^{2} Hz	3,8
Dielectric strength	DIN 53481	KV/mm	92
Dielectric dissipation faktor (1 kHz)	DIN 53483 IEC-Publ. 250	-	0,05 – 0,09

The electrical properties depend on temperature and relative air humidity strongly. The above mentioned values charakterize polyamide 12 at following conditions: storage at 23°C, 50% air humidity up to saturation.
The details contained herein characterize the electrical behaviour of material and not of a spezified building part. The details are based on our present state of konowledge and experience. We do, however, pass them without any warranty or property assurance.



Flammability / Burning Behaviour

The powder contains no flame retardants. So PA2200-parts can burn. Fillers like glass intensify flammability as result of wicking.
Flammable gases forms at temperature above 350°C. Combustion in excess air produces CO, CO_2, H_2O and nitrogen containing compounds as end products.

Property	Measurement Method DIN/ISO	Unit	Value
Ignition temperature	DIN 51794	°C	> 350°C
Flammability	IEC 60707 *		
	ISO 1210	Klasse (1,6 mm)	HB
	UL94*	Klasse (1,6 mm)	HB (horizontal burning)

*) flammability test as approval for electrical application

The details contained herein characterize the burning behaviour of material and not of a spezified building part. The details are based on our present state of konowledge and experience.
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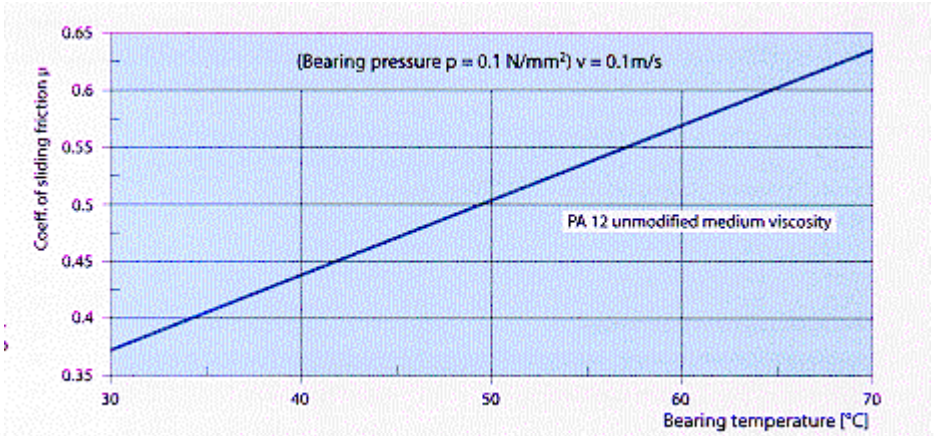
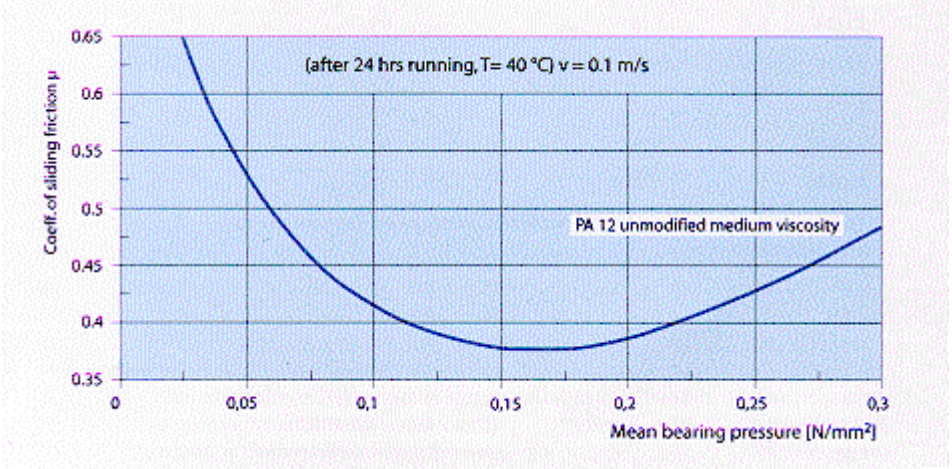
Frictional Properties, Abrasion and Wear

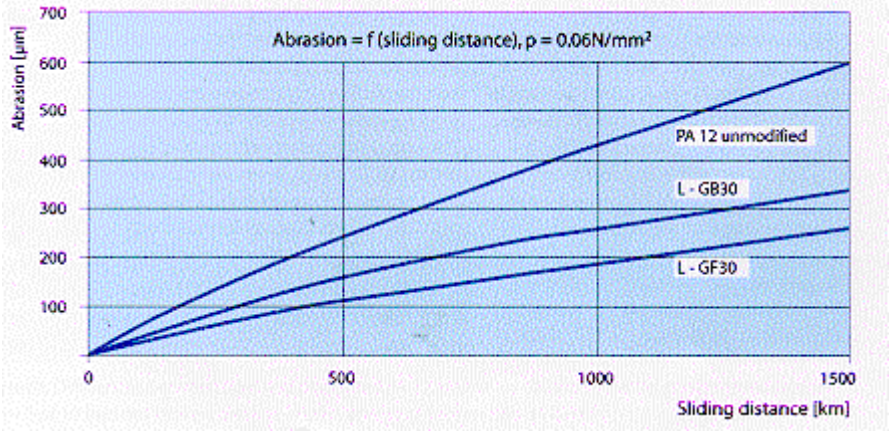
Polyamid 12 is characterized by a low coefficient of friction and by very good abrasion resistance.



Coefficient of sliding friction in dependence of bearing temperature (Lubrimeter test acc. A. Bartel)



Coefficient of sliding friction as function of pressure load (Lubrimeter test acc. A. Bartel))



Abrasion on bearing as function of the sliding distance and PA12-modification (L-GB30/glass spheres; L-GF30-glass fibres)

Abrasion of sintered parts according to Taber-Test

Material	Measurement Method DIN/ISO	Unit	Value
PA 2200	DIN 53754	mg/2000 U	34
PA 3200 GF	DIN 53754	mg/2000 U	30

Chemical Resistance of PA 12

\+ = resistant - = non-resistant ⊕ = praktisch beständig
O = conditional resistant ⊗ = litte resistant

Duration		6 Months	4 Weeks
Medium	Concentration	20°C	60°C
Aceton	100	+	+
Battery acid	10	⊗	-
Formic acid		+	O
Ammonia, aqueos solution	Conz.	+	+
Aniline	100	⊕	
Apple juice		+	+
Asphalt		+	+
Barium salts		+	+
Petrol		+	+
Benzene	100	+	O
Beer		+	
Break fluid		+	+
Butane Gas	100	+	+
Butane liquid	100	+	
Butter		+	

Duration		6 Months	4 Weeks
Medium	Concentration	20°C	60°C
Chrome acid	10	-	-
Cyclohexanone	100	+	O
Dibutylphtalate (Vestinol®C)		+	+
Diethyl-Ether (Kp 35°C)	100	⊕	
Dioctylphtalate (Vestinol ®AH)		+	+
Dixan®Base	useable	+	+
Acetic acid	10	+	⊗
Ethyl-Acetate		+	⊕
Ethyl-Alkohol, denature	100	+	⊕
Fish		+	
Flußsäure ???	40	⊗	-
Anti freezer		+	+
Dishes cleaner		+	+
Glycerine	100	+	+
Glycol	100	+	+
Fuel Oil		+	+
coffee, drinkable		+	
Caustig	50	+	+
Potassium Chlorate aqueous solution	cold, saturated (7,3)	⊕	O
Potass. Permanganate aqueous solution	cold, saturated (6,4)	⊗	-
Linseed Oil		+	+

Duration	6 Months	4 Weeks

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Medium	Concentration	20°C	60°C
Methanol	100	+	⊕
Milk		+	+
Lactid Acid aqueous solution	10	⊕	O
Sodium-Chloride aqueous solution	cold saturated	+	+
Sodium-Hypochloride, aqueous solution	5	⊕	⊗
Sodium hydroxid	50	+	+
Ozone (0,5 ppm)		O	
Paraffin	100	+	+
Persil®Base	useable	+	+
Petroleum	100	+	+
Propane Gases	100	+	+
Pyridine	100	+	
Rum	40	+	+
Nitric Acid	10	-	-
Salt Acid	10	-	-
Soft Soap		+	+
Sulfur	100	+	+
Sulfur Acid	10	⊕	⊗
Sea Water		+	+
Silicon Oil		+	+
Edible Oil, animal + vegetable		+	+

Prüfdauer		6 Monate	4 Wochen
Medium	Konzentration	20°C	60°C

Toluene	100	+	⊗
Tomato Juice		+	+
Trichlorethylene	100	O	⊗
Water	100	+	+
Hydrogen-Peroxide aqueous solution	30	+	
Whiskey	40	+	
Xylene	100	+	O
Citric acid aqueous solution	cold saturated	+	O
Lemon juice		+	+
Sugar solution	every	+	+

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Zertifikat , Biokompatibilität PA 2200

BIOSERVICE Scientific Laboratories GmbH

BIOCOMPATIBILITY
CERTIFICATE

Testmaterial: **PA 2200**

Supplier: EOS GmbH
Pasinger Strasse 2, D-82152 Planegg

Studies performed: The following studies were performed in order to determine the biocompatiblity of the product PA 2200 according to ISO 10993-1:

CYTOTOXICITY

SENSITISATION, polar extract

SENSITISATION, non-polar extract

INTRACUTANEOUS REACTIVITY

Results: **The product did not show any adverse effects in the studies performed. Therefore, the biocompatiblity of the test material was proved.**

BSL BIOSERVICE Scientific Laboratories GmbH Munich

Behringstraße 6

D-82152 Planegg

Dr. Achim Albrecht

Biological Safety Testing

Date: April 10, 2001

BIOSERVICE Scientific Laboratories GmbH GLP EN 45001