

EOSINT P and FORMIGA P materials
for plastic laser-sintering systems

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EOS offers different application-optimized polymer materials for plastic laser-sintering systems (1)

Polymer materials and its typical applications:

Name of material	Material type	Typical applications
ALUMIDE®	Aluminium-filled PA 12	Dimensional accurate, high machinable illustr. models, tooling inserts, jig manufacture
CarbonMide®	Carbon fibre filled PA 12	Light weight, mechanically stressed, functional parts
PA 2200/2201	Polyamide 12	Illustrative models, functional parts/end products, spare parts
PA 2210 FR	Flame-retardant polyamide 12	Functional parts with requirements on fire protection**
PA 3200 GF	Glass-filled polyamide 12	Housing components, thermally heavy used parts, wear resistant
PrimeCast® 101	Polystyrene	Lost patterns, master patterns for plaster/vacuum casting
PrimePart® DC	Polyamide 11	Automotive components (esp. interior parts), aerospace applications

* same as PA 2200/2201, but reduced refreshment rate

** up to UL 94/V0

EOS offers different application-optimized polymer materials for plastic laser-sintering systems (2)

Summary of some relevant characteristics

Name of material	Tensile Modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
ALUMIDE®	3800* / 3200**	48* / 40**	4* / 2.4**
CarbonMide®	6100/3400/2200***	72/56/25***	4.1/6.3/1.3***
PA 2200/2201	1700* / 1650**	48* / 47**	20* / 10**
PA 2210 FR	2500* / 2300**	45* / 37**	4.7* / 2.4**
PA 3200 GF	3000* / 2500**	49* / 47**	8* / 5.6**
PrimeCast® 101	1600*	5.5* / 1.2**	0.4*
PrimePart® DC	1550	48	48

All data are guide values; please see material data sheets for further details

*x-/y-direction, **z-direction, ***x-/y-/z-direction

Source: EOS

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e-Manufacturing Solutions

ALUMIDE® - aluminium-filled PA 12

Properties and applications

Properties

- excellent dimensional accuracy
- high stiffness
- metallic appearance
- good finishing properties
- low tool-wear post-processing possibilities

Typical applications

- illustrative models
- thermally stressed housings
- jig manufacturing
- tool inserts for injecting and moulding for small series, end products and spare parts



Train door opener

Laser-sintered functional prototype of a door opener for a sliding train door

Source: Createc Engineering Products

ALUMIDE® - for special requirements on temperature, surface and optics

Essential material properties

General material data

- Bulk density: 0.67 g/cm³
- Density of laser-sintered parts*: 1.36 g/cm³

Mechanical properties

- Tensile modulus (x,y)/(z): 3800/3200 MPa
- Tensile strength (x,y)/(z): 48/40 MPa
- Elongation at break (x,y)/(z): 4/2,4 %
- 3,5% flexural stress (x,y)/(z): 72/61 MPa

Thermal properties

- Melting point: 172 - 180 °C
- Heat conductivity**: 0.5 - 0.8 W(mK)⁻¹



Rubber boot sole

ALUMIDE material as DirectTool for rubber injection moulding.

Source: Tecnologia & Design

* EOS-method (following DIN EN ISO 845)

** at 170 °C, hot wire method

CarbonMide® - carbon-fibre filled polyamide

Properties and applications

Properties

- outstanding mechanical properties
- extreme resistance and strength
- high stiffness
- anthracite-coloured parts
- electrical conductivity

Typical applications

- fully functional prototypes with refined surface (e.g. for wind tunnel tests)



Bearing block

Source: EOS

CarbonMide® - for parts under high mechanical load

Essential material properties

General material data

- Bulk density: 0.50 g/cm³
- Density of laser-sintered parts*: 1.04 g/cm³

Mechanical properties

- Tensile modulus x/y/z: 6100/3400/2200 MPa
- Tensile strength x/y/z: 72/56/25 MPa
- Elongation at break x/y/z: 4.1/6.3/1.3 %

Thermal properties

- Melting point: 172 - 180 °C

Electrical properties

- Specific resistance: 46.3 · 10⁻³ Ωm
[-5...+5V] x



Air duct

Source: EOS

* EOS-method (following DIN EN ISO 845)

Source: EOS

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e-Manufacturing Solutions

PA 2200/2201 - very fine multi-functional polyamide

Properties and applications

Properties

- good mechanical properties
- biocompatible with ISO 10993-1
- certified for use with food (except high alcoholic foodstuff)
- high detail resolution
- high long-term constant behaviour
- parts withstand high-temperature painting and metal coating

Typical applications

- parts in design quality
- functional parts
- vacuum casting pattern
- end products
- spare parts



Vacuum cleaner Volta Bolido

16-piece fully functional parts with all mechanical properties like the series part

By courtesy of GT Prototyper AB.

PA 2200/2201 - for fully functional parts under high mechanical and thermal load

Essential material properties

General material data

- Bulk density: 0.45 g/cm³
- Density of laser-sintered parts*: 0.9 - 0.95 g/cm³

Mechanical properties

- Tensile modulus (x,y)/(z): 1700/1650 MPa
- Tensile strength (x,y)/(z): 48/47 MPa
- Elongation at break (x,y)/(z): 20/10 %
- Ball indentation hardness: 78 N/mm²

Thermal properties

- Melting point : 172 - 180 °C



Steering wheel

Physically identically with series parts. Tests with different design variations.

Source: Volvo Car Corporation, Sweden.

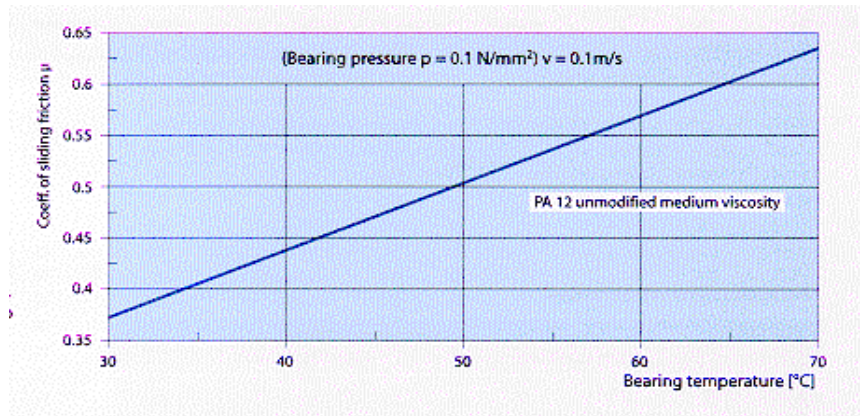
* EOS-method (following DIN EN ISO 845)

PA 2200 - for parts under high mechanical and thermal load

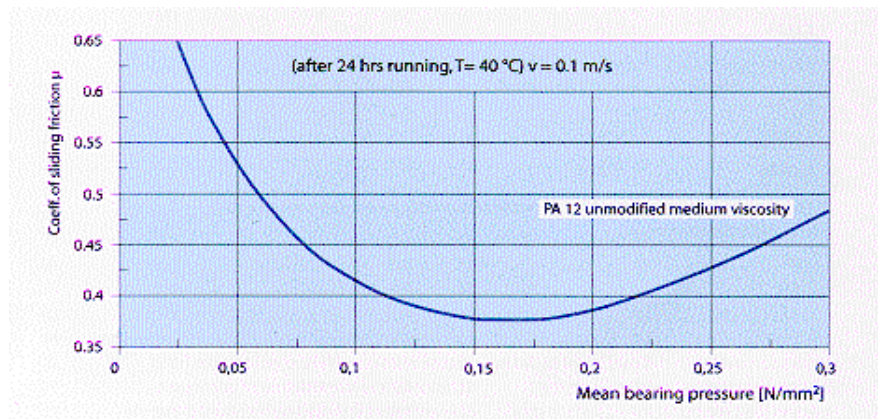
Property	Measurement Method DIN/ISO	Unit	Value
Volume Resistance	DIN 53482 IEC-Publ. 93	$\Omega \cdot \text{cm}$	$10^{13} - 10^{15}$
Surface Resistance	DIN 53482 IEC-Publ. 93	Ω	10^{13}
Relative Permittivity (1 kHz)	DIN53483 IEC-Publ. 250	10^2 Hz	3,8
Dielectric Strength	DIN 53481	KV/mm	92
Dielectric Dissipation Factor (1 kHz)	DIN 53483 IEC-Publ. 250	-	0.05 - 0.09

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

PA 2200 – low coefficient of friction and very good abrasion resistance* (1)



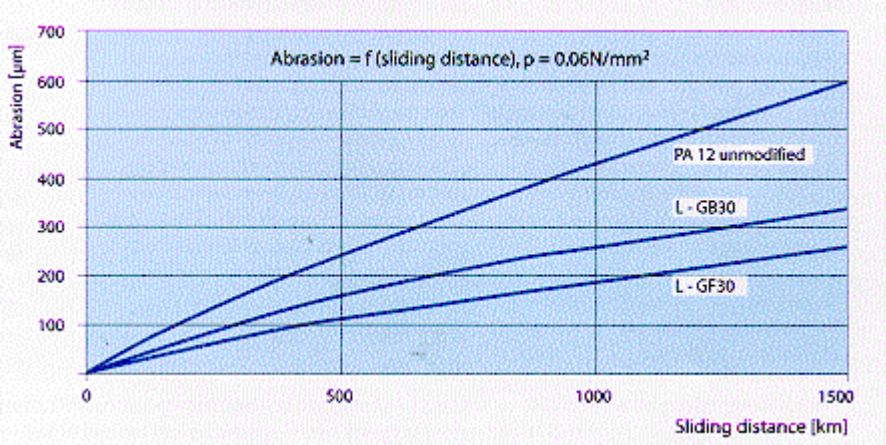
Coefficient of sliding friction in dependence of bearing temperature (Lubrimeter test acc. A. Bartel)



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

* by the example of PA12

PA 2200 – low coefficient of friction and very good abrasion resistance* (2)



Abrasion on bearing as function of the sliding distance
 L-GB 30 - glass spheres
 L-GF 30 - glass fibres

Abrasion of sintered parts 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

* by the example of PA12



PA 2210 FR- for increased requirements on fire protection

Properties and applications

Properties

- flame-retarding
- good mechanical properties
- high detail resolution
- good long-term constant behaviour
- parts withstand high-temperature painting and metal coating
- from wall thickness of 2 mm conform with UL94-V0

Typical applications

- fully functional parts in design quality
- functional parts
- vacuum casting
- end products
- spare parts



Fuel tank

Fully functional part, built within 4 days, and filled with fuel for testing purposes.

By courtesy of FKM Sintertechnik

PA 2210 FR with flame-retarding additives free of halogens

Essential material properties

General material data

- Bulk density: 0.52 g/cm³
- Density of laser-sintered parts*: 1.06 g/cm³

Mechanical properties

- Tensile modulus (x,y)/(z): 2500/2300 MPa
- Tensile strength (x,y)/(z): 45/37 MPa
- Elongation at break (x,y)/(z): 4.7/2.4 %
- 3,5% flexural stress (x,y)/(z): 67/58 MPa

Thermal properties

- Melting point: 172 - 180 °C

* EOS-method (following DIN EN ISO 845)



Telemetric housing

Laser-sintered telemetric housing for Tour de France

Project partner: SRM

PA 2210 FR - for flame resistant parts with high mechanical properties

Burning behaviour

Property	Measurement Method	Value	Unit
Flammability for parts in devices and appliances	UL 94 / HB UL 94 / V-0	1.1 2.0	mm mm
Flammability properties (Aircraft)	FAR 25.853 b(4) ABD 0031 / AITM 2.0002 BSS 7230 F2	1.5 / 2.0 1.5 / 2.0 0.06 / 0.08	mm mm inches
Smoke generation (Aircraft)	FAR 25.853 (d), App. F - Part V ABD 0031 / AITM 2.0007 BSS 7238	1.5 / 2.0 1.5 / 2.0 0.06 / 0.08	mm mm inches
Toxic gas generation (Aircraft)	ABD 0031 / AITM 3.0005 BSS 7239	1.5 / 2.0 0.06 / 0.08	mm inches

Conversion of units: 1.0 mm is equivalent to 0.03937 inches

PA 3200 GF - glass-filled, very fine precision polyamide

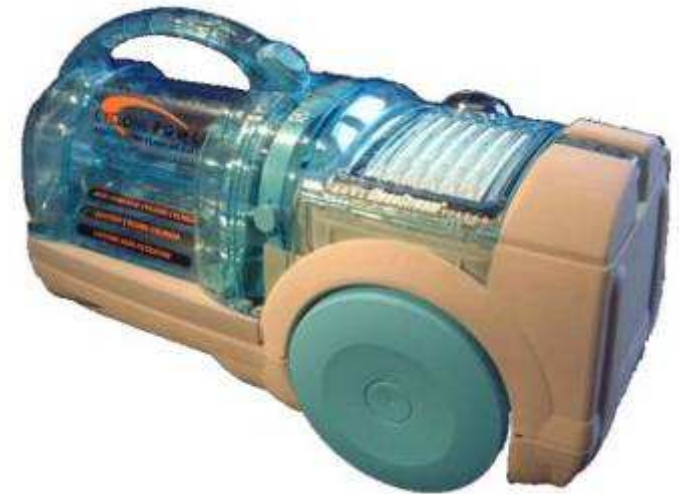
Properties and applications

Properties

- excellent stiffness
- good thermal properties
- excellent long-term constant behaviour
- parts withstand high-temperature painting and metal coating

Typical applications

- design models with high detail resolution and excellent surface quality
- end products
- spare parts
- load-bearing functional parts with high stiffness
- thermally stressed parts



Elux Twister

Fully representative prototype for series production with savings of 50 % of the development time

Project partner: Electrolux

PA 3200 GF - suitable for use in all plastic laser-sintering systems with fine polyamide option

Essential material properties

General material data

- Bulk density: 0.64 g/cm³
- Density of laser-sintered part*: 1.25 g/cm³

Mechanical properties

- Tensile modulus (x,y)/(z): 3000/2500 MPa
- Tensile strength (x,y)/(z): 49/47 MPa
- Elongation at break (x,y)/(z): 8/5,6 %
- Ball indentation hardness: 98 N/mm²

Thermal properties

- Melting point: 172 - 180 °C



Air intake unit

Fully functional prototype for development purposes

Project partner: Mann + Hummel

* EOS-method (following DIN EN ISO 845)

PrimeCast® 101 - the polystyrene laser-sintering material

Properties and applications

Properties

- excellent dimensional accuracy
- very high surface quality
- good strength
- exceptional finishing properties

Typical applications

- lost patterns
 - master patterns for plaster casting
 - master patterns for ceramic shell casting
- master patterns for vacuum casting



Turbocharger housing

Source: 3K-Warner

PrimeCast® 101 - the high performance pattern material

Essential material properties

General material data

- Bulk density: 0.61 g/cm³
- Density of laser-sintered parts*: 0.70 - 0.85 g/cm³

Mechanical properties

- Tensile modulus (x,y): 1600 MPa
- Tensile strength (x,y)/(z): 5.5/1.2 MPa
- Elongation at break (x,y): 0.4 %

Thermal properties

- Glass transition temp.: 105 °C
- Material destruction: 250 - 580 °C
- Remaining ash content: 0.002 %

* EOS-method (following DIN EN ISO 845)



Gearbox housing

Laser-sintered fully functional gearbox housing (DirectPattern® for casting in titan)

Source: Poggipolini

PrimePart® DC – a newly developed PA with improved impact strength

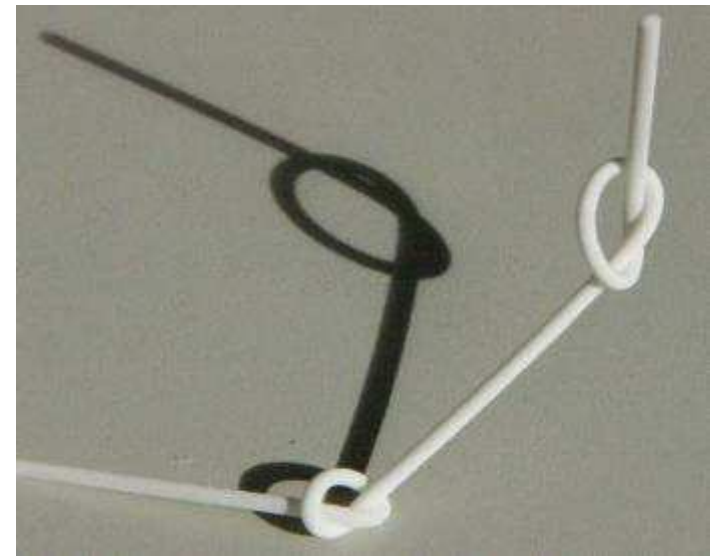
Properties and applications

Properties

- natural-coloured polyamide
- high tensile strength
- very high impact strength
- elongation at break about twice as high as previously available PA12-materials

Typical applications

- automotive components (esp. interior parts in head crash area)
- aerospace applications



Laser-sintered stick

Bend test successful

PrimePart[®] DC – whenever toughness is deciding

Essential material properties

General material data

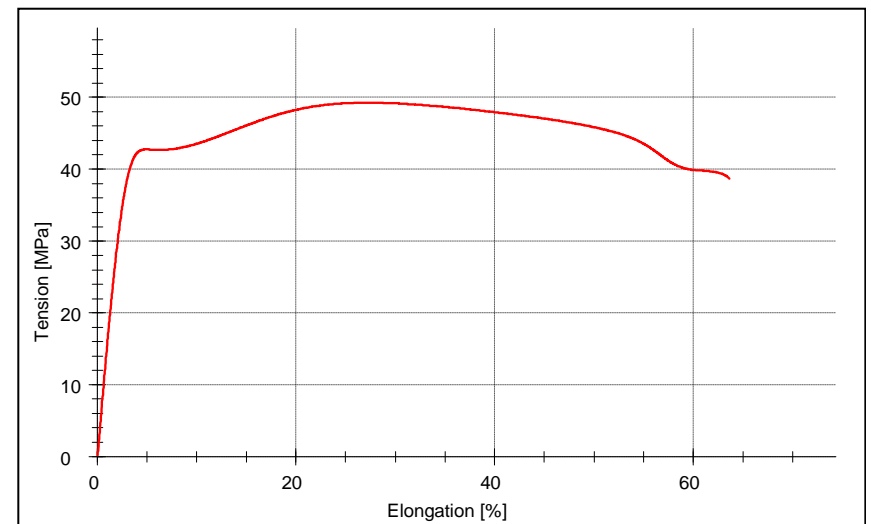
- Bulk density: 0.41 g/cm³
- Density of laser-sintered parts*: 0.96 g/cm³

Mechanical properties

- Tensile modulus: 1550 MPa
- Tensile strength: 48 MPa
- Elongation at break: 48 %
- E-modulus: 1420 MPa

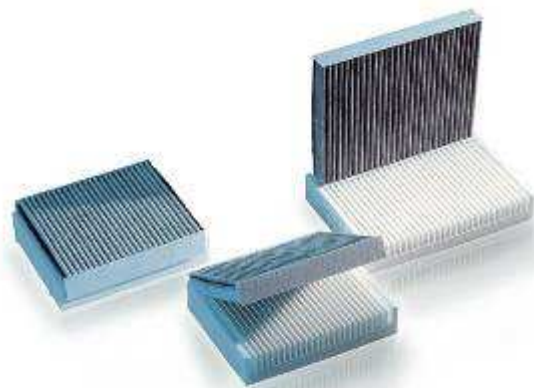
Thermal properties

- Melting point: 186 °C



Tension/Elongation diagram

* EOS-method (following DIN EN ISO 845)



Any shape • Anytime • Anywhere

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