PLA (lubricated)

General information

Designation

PLA (lubricated), Polylactide / Polylactic acid (Lubricated)

Tradenames

Ingeo, Latilub

Typical uses

Fabrics, filters, membranes, nonwovens, twine, sanitary products, textile applications

Composition overview

Compositional summary

(CH(CH3)CO2)n + lubricant. The lactic acid is produced from sugar (dextrose) with plant starch origins e.g. corn, wheat, sugar beets and sugar cane.

Material family			Plastic (thermoplastic, semi-crystalline)	
Base material			PLA (Polylactic acid / polylactide)	
Additive			Anti-friction/wear lubricant	
Renewable content			95	%
Polymer code			PLA-L	

Composition detail (polymers and natural materials)

Polymer			95	%
Silicone (lubricant)			5	%

Price

Price	*	2,94	-	3,96	EUR/kg
Price per unit volume	*	3,65e3	-	5,07e3	EUR/m^3

Physical properties

Density		1,24e3	-	1,28e3	kg/m^3

Mechanical properties

Young's modulus		2,9			GPa
Specific stiffness		2,27	-	2,34	MN.m/kg
Yield strength (elastic limit)		51	-	59	MPa
Tensile strength	*	51	-	59	MPa
Specific strength		40,4	-	46,9	kN.m/kg
Elongation		4,5			% strain
Elongation at yield		2,5			% strain
Compressive modulus	*	2,83	-	2,97	GPa
Compressive strength	*	61,3	-	70,9	MPa
Flexural modulus	*	2,83	-	2,97	GPa
Flexural strength (modulus of rupture)	*	73,8	-	86,1	MPa
Shear modulus	*	1,06	-	1,12	GPa
Shear strength	*	30,6	-	35,4	MPa

Bulk modulus	*	2,77	-	2,91	GPa
Poisson's ratio		0,33			
Shape factor		5			
Hardness - Vickers	*	15,7	-	17,3	HV
Hardness - Shore D	*	73	-	80	
Elastic stored energy (springs)		451	-	597	kJ/m^3
Fatigue strength at 10^7 cycles	*	20,4	-	23,6	MPa

Impact & fracture properties

Fracture toughness	*	3,24	-	3,92	MPa.m^0.5
Toughness (G)	*	3,65	-	5,26	kJ/m^2
Impact strength, notched 23 °C		3,5			kJ/m^2
Impact strength, unnotched 23 °C		20			kJ/m^2

Thermal properties

Melting point	*	135	-	181	°C
Glass temperature	*	55	-	60	°C
Heat deflection temperature 0.45MPa		50			°C
Heat deflection temperature 1.8MPa		50			°C
Vicat softening point		60			°C
Maximum service temperature	*	40	-	60	°C
Minimum service temperature	*	-45	-	-12	°C
Thermal conductivity	*	0,12	-	0,15	W/m.°C
Specific heat capacity	*	1,18e3	-	1,21e3	J/kg.°C
Thermal expansion coefficient	*	68	-	78	µstrain/°C
Thermal shock resistance	*	235	-	287	°C
Thermal distortion resistance	*	0,00162	-	0,0021	MW/m

Electrical properties

Electrical resistivity	*	2,7e16	-	4,3e17	µohm.cm
Electrical conductivity	*	4,01e-16	-	6,39e-15	%IACS
Dielectric constant (relative permittivity)	*	3,1	-	3,2	
Dissipation factor (dielectric loss tangent)	*	0,00909	-	0,01	
Dielectric strength (dielectric breakdown)	*	3	-	6,2	MV/m

Magnetic properties

Magnetic type		Non-magnetic			

Optical, aesthetic and acoustic properties

Refractive index	*	1,44	-	1,46	
Transparency		Opaque			
Acoustic velocity		1,51e3	-	1,53e3	m/s
Mechanical loss coefficient (tan delta)	*	0,0124	-	0,0164	

Critical materials risk

Contains >5wt% critical elements?		No			

Absorption & permeability

Water absorption @ 24 hrs	*	0,1	-	0,13	%
Water absorption @ sat	*	0,7	-	1	%
Humidity absorption @ sat	*	0,21	-	0,3	%
Water vapor transmission		9,5			g.mm/m².day
Permeability (O2)	*	16	-	17	cm³.mm/m².day.atm

Processing properties

Polymer injection molding		Acceptable			
Polymer extrusion		Excellent			
Polymer thermoforming		Acceptable			
Linear mold shrinkage		0,2			%
Melt temperature	*	170	-	240	°C
Mold temperature	*	10	-	25	°C
Molding pressure range	*	55,2	-	103	MPa

Durability

Water (fresh)		Acceptable			
Water (salt)		Acceptable			
Weak acids		Acceptable			
Strong acids		Unacceptable			
Weak alkalis		Acceptable			
Strong alkalis		Unacceptable			
Organic solvents		Limited use			
Oxidation at 500C		Unacceptable			
UV radiation (sunlight)		Good			
Flammability		Highly flammable			
Oxygen index	*	19	-	21	%

Primary production energy, CO2 and water

Embodied energy, primary production (virgin grade)	*	47,8	-	52,6	MJ/kg
Sources					
Estimated from sources including Institute for Prospective Technological Studies, 2005; Vink et al. 2007					
Embodied energy, primary production (typical grade)	*	47,4	-	52,6	MJ/kg
CO2 footprint, primary production (virgin grade)	*	2,43	-	2,68	kg/kg
Sources					
Estimated from sources including Institute for Prospective Technological Studies, 2005; Vink et al. 2007; Ecoinvent v3.7.1					
CO2 footprint, primary production (typical grade)	*	2,41	-	2,68	kg/kg

Processing energy, CO2 footprint & water

Polymer extrusion energy	*	5,65	-	6,23	MJ/kg
Polymer extrusion CO2	*	0,424	-	0,467	kg/kg
Polymer molding energy	*	13,5	-	14,9	MJ/kg
Polymer molding CO2	*	1,01	-	1,12	kg/kg

Coarse machining energy (per unit wt removed)	* 0,839	-	0,925	MJ/kg
Coarse machining CO2 (per unit wt removed)	* 0,0629	-	0,0694	kg/kg
Fine machining energy (per unit wt removed)	* 4,1	-	4,52	MJ/kg
Fine machining CO2 (per unit wt removed)	* 0,307	-	0,339	kg/kg
Grinding energy (per unit wt removed)	* 7,73	-	8,52	MJ/kg
Grinding CO2 (per unit wt removed)	* 0,58	-	0,639	kg/kg

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 16,2	-	17,9	MJ/kg
CO2 footprint, recycling	* 0,826	-	0,911	kg/kg
Recycle fraction in current supply	* 0,1	-	1,1	%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 18,9	-	19,9	MJ/kg
Combustion CO2	* 1,8	-	1,9	kg/kg
Landfill	✓			
Biodegrade	✓			

Notes

Other notes

PLA is a renewable thermoplastic polyester manufactured from plants such as sugarcane, corn and tapioca. PLA can be amorphous or semi-crystalline. Various blends of D and L enantiomers are available, making available a broader range of properties.

Links

ProcessUniverse

Producers

Shape