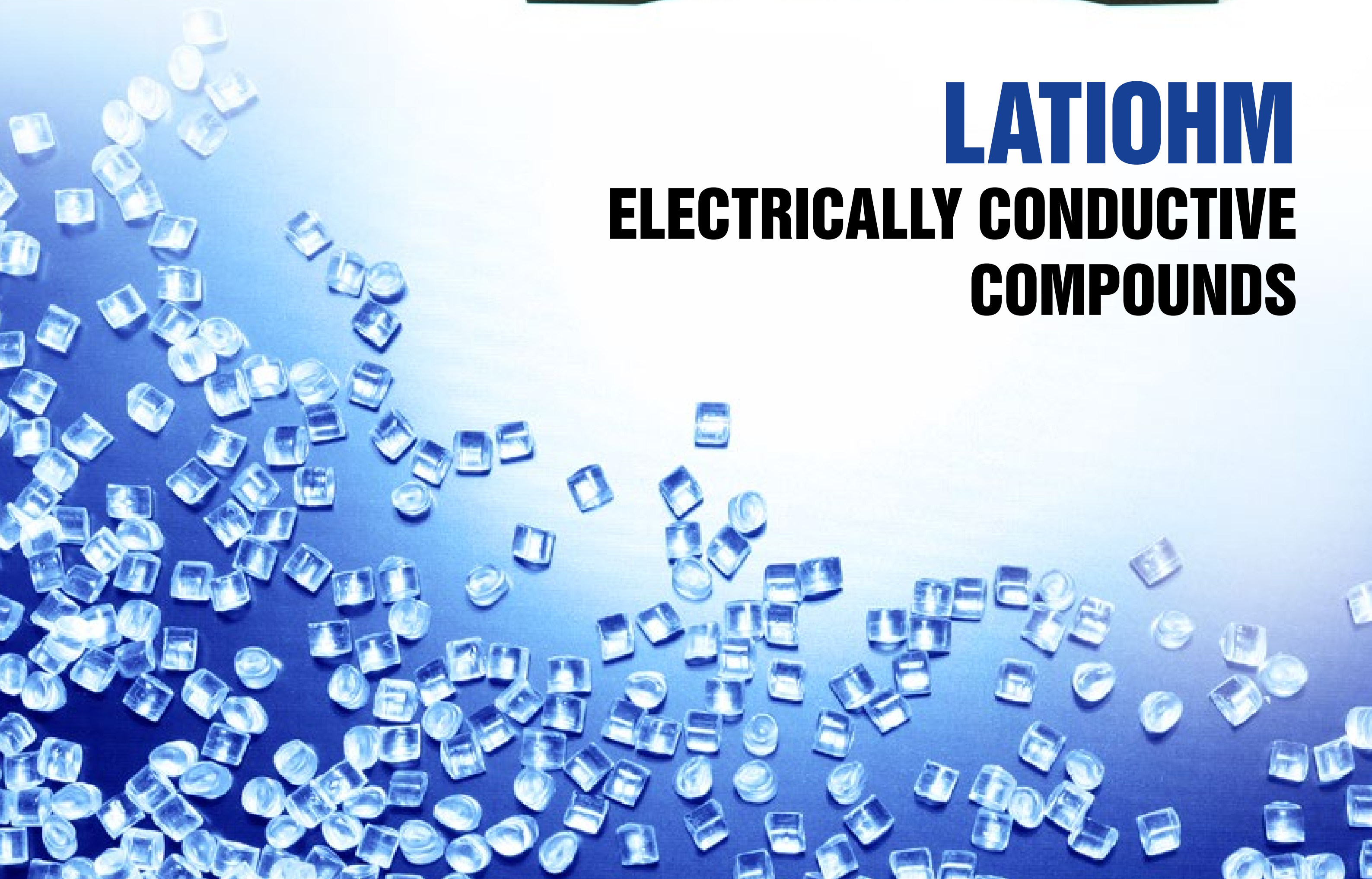
HIGH PERFORMANCE THERMOPLASTICS

LATIOHM

ELECTRICALLY CONDUCTIVE COMPOUNDS



WHO IS LATI?

LATI is a company founded in Italy in 1945.

Since its foundation, it has been gaining a prestigious position in the field of engineering thermoplastic compounds in Italy and worldwide.

In fact, LATI is:

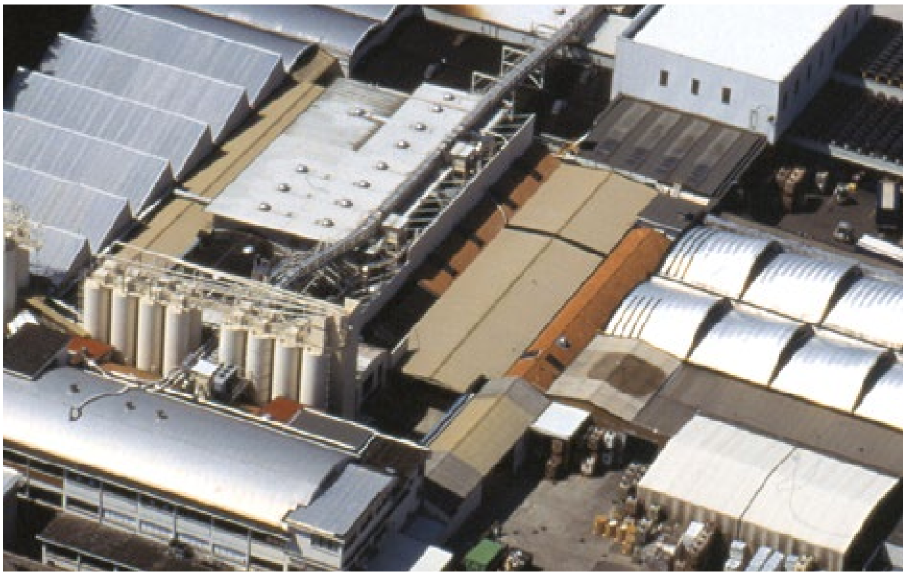
- an independent compounder with the widest range of products in Europe;
- one of the most qualified suppliers of self-extinguising compounds in the world;
- a partner in the development of high performance customized special products.

The company has two plants in Italy with a potential production capacity of 38,000 tons per year.

LATI products are used in the main application fields, from automotive to precision mechanics, from household appliances to electronics, from medical to biobased applications.

LATI's technical compounds are distributed in all major foreign markets through the company's own sales network.

LATI's mission is to achieve customer satisfaction through a high technical content service ranging from the compound development to the support for the development of final projects **according to customer's needs** and with maximum flexibility.



INTRODUCTION

Plastics are traditionally associated with the concept of electrical insulation.

In fact, since the days of Bakelite, these synthetic materials have been assigned the task of preventing the flow of electric charges.

From a technical point of view, conventional thermoplastic or thermosetting polymers are actually very bad current-carrying conductors due to the chemical nature of the macromolecules and the structure layout in which they are organized.

If this aspect has represented an almost exclusive advantage for many decades, the extensive diffusion of technical polymeric materials in the industrial sector requires now, in some particular fields of application, that plastic products have more or less distinctive electrical conductivity properties.

Electrical insulation may be, in fact, a concern in a variety of situations:

- **accumulation of electrostatic charges:** the lack of an effective grounding of some polymer parts may result in the local formation of high electrical voltages that may give rise to discharges constituting a potential hazard to humans as well as electrical and electronic equipment.

  This is a major issue in the case of parts operating in gas-saturated atmospheres, vapors or combustible dusts.
  In such cases, sparks may cause explosion, and for this reason there is a system of rules governing the safety in similar situations;

- **capture of particulates:** when electrostatically charged, the surface of plastic products may attract large amounts of dust and dirt, thus affecting the aesthetic and functional aspect of the part;

- **industrial finishing processes:** where the substrate to be coated must have specific electrical conductivity properties;

- **painting and special treatments:** in many industrial finishing processes the substrate to be coated requires specific electrical conductivity properties (cataphoresis, etc.);

- **transportation of flammable liquids or dusts:** e. g. gas, fuels, solvents or flours, metal powders, etc. In such cases, the sliding friction between insulating materials may give rise to the accumulation of electrostatic charges;

- **need for electromagnetic interference shielding:** as is the case with electronics enclosures intended to act as Faraday cages to protect the devices contained therein or the surrounding environment from interferences.

In order to offer the market a suitable solution to overcome the difficulties described above, LATI has developed three families of thermoplastic compounds for injection molding with different levels of electrical conductivity without affecting the many other advantages offered by polymers:

- **LATIOHM**
- **LATISTAT**
- **LATISHIELD**

Directive 94/9/CE - also known as ATEX - supervises performances of parts to be used in areas where explosion hazard is to be found, e.g. atmospheres where flammable dusts or gases are dispersed.
The goal of **ATEX (ATmosphére EXplosive)** is to protect personnel and people, imposing safe deployment of electrical and non-electrical equipment.
Static charges build-up can generate high-energy sparks leading to ignition of fuel-air mixtures, thus adoption of electrically conductive plastics becomes mandatory.
For those parts, surface resistivity limit is 1 GΩ.

PHYSICS

Materials behave as conductors when they allow electric charges to flow through them.

This occurs if the free electrons can move within their crystal lattice, as is the case with metals, or if ionic species are present that allow the transfer of electrons due to local differences in charge density.

None of the above conditions occurs with polymers, and for this reason nearly all plastics behave as perfect insulators.

Electrical resistance (R) defines the hindrance to the flow of electric charges within a medium.

The measure of this hindrance is related to the geometrical properties of the conducting body (section and length) and a property of the material, i.e. resistivity (ρ):

$$R = \rho \frac{\ell}{A}$$

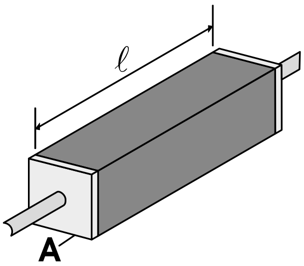
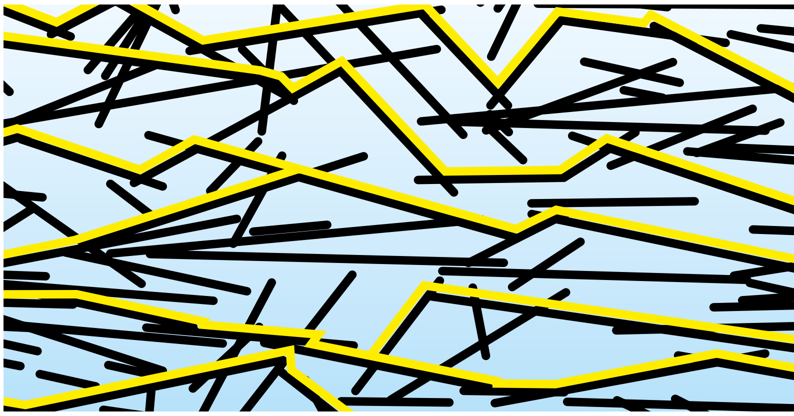


Fig. 1 - Diesel fuel filter: LATIOHM 66-06 PD03 G/20

To make an insulating material electrically conductive, it is necessary to suitably disperse a second phase in the matrix allowing this possibility.

Conductive particles must form, of course, a continuous structure through which electric charges are transferred.

So the charge quantity needed to overcome the percolation threshold, namely the limit below which the conductive elements are not effective being substantially surrounded by a barrier of insulating material, must be dispersed in a proper way, through an optimized compounding process.



The number of contacts among conductive particles is ruled by statistic phenomena.
For this reason it is not possible to provide and guarantee specific resistivity values of conductive compounds, and resistance of moulded parts.

Fig. 2 - Electric charghes flow is achievable by the mean of a continuous network of conductives particles

Apart from the insufficient quantity of conductive charge, percolation may also be inhibited by other factors:

- unfavorable geometry of the charges, e.g. too compact and isotropic particles;
- inhomogeneous distribution in the matrix due to poor dispersion;
- excessive fragmentation caused, for example, by incorrect process parameters or ground material recovery.

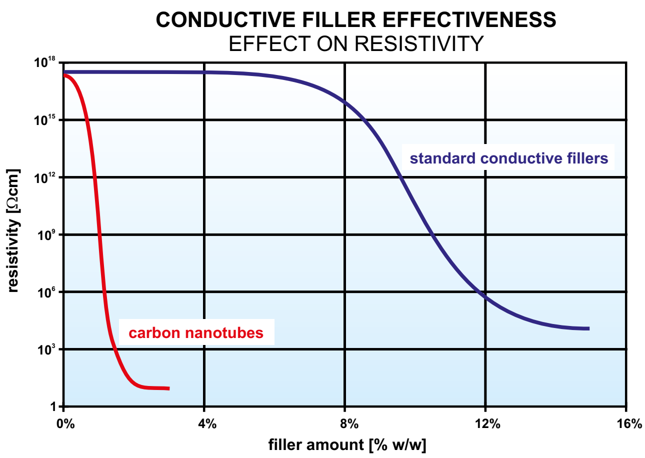


Fig. 3 - Influence of percolation in resistivity of CNT and carbon black filled compounds

EMI SHIELDING

Electromagnetic radiation emitted by electric machines and electronic circuits may generate serious disturbances in similar devices located in the vicinity of the source.

This interference (EMI) may cause malfunctions of various seriousness thus requiring shielding of the equipment to be protected in order to limit harmful effects.

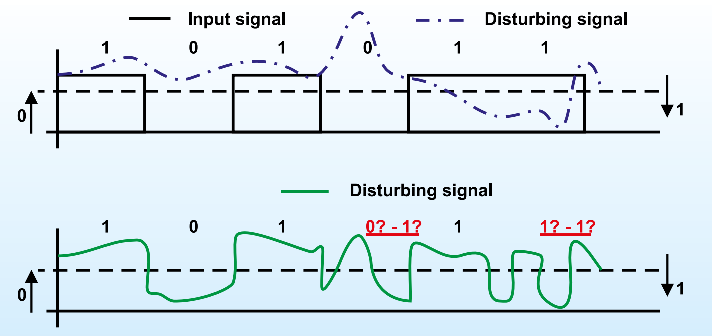


Fig. 4 - Electromagnetic interference blurs incoming signal and leads to errors in digital data

Shielding is obtained by protecting the electronics inside an enclosure able to ground the incident radiation (Faraday cage effect).
Metal enclosures or enclosures metallized with copper or nickel conductive coating are used for this purpose.

Measurement of the available attenuation (SE) is made by evaluating which fraction of the incident signal can penetrate the shielding. The ratio between the energy of the incoming interference (E_i) and that of transmitted signal (E_u) determines the level of protection and is expressed in dB.

0 - 10 dB	No shielding	Unsolved EMI issues
11 - 30 dB	Low shielding	Poor shielding benefits
31 - 60 dB	Fair shielding	Good shielding
61 - 90 dB	High shielding	For serious EMI issues
91 - 120 dB	Top shielding	Military applications

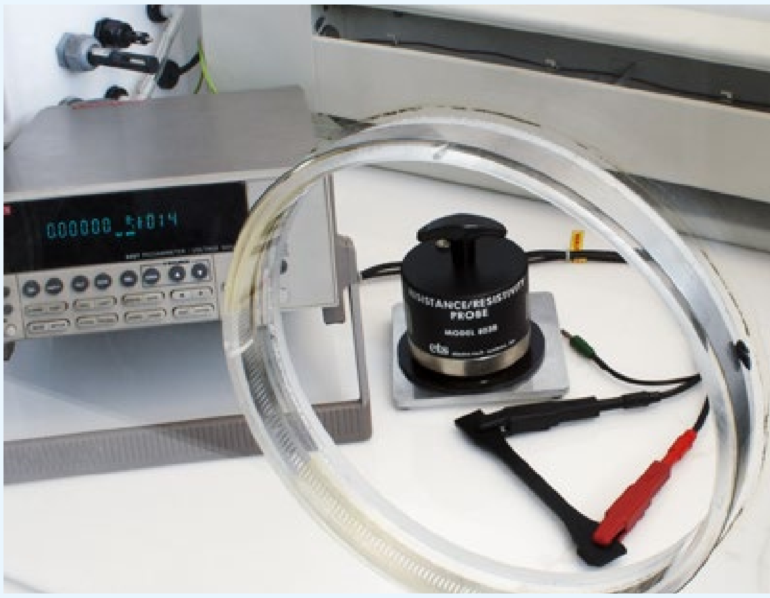
$$SE = 20 \cdot \log \frac{E_i}{E_u} \, [dB]$$

Table 1 - Shielding efficiency (dB)

MEASURING METHOD TIPS

Although the distribution of conductive charges is optimal, testing of the actual electrical resistivity of a thermoplastic product may not be immediate if performed with conventional methods. The polymer film on the surface of molded parts may, in fact, cause the locally measured electrical resistivity to become inhomogeneous.

For this reason, electrical properties should be evaluated by adopting measures that slightly increase the contact surface between the material and the test leads of the measuring instrument. An ideal solution is, for example, the use of conductive paint stripes applied on the workpiece surface, or metal pins inserted in its mass.



The frequency of interference plays a crucial role: very high frequency signals, such as WLAN networks and other microwaves (>3 GHz) are more difficult to shield than lower frequencies, such as radio waves up to UHF frequencies.

In order to provide plastics with shielding effectiveness, suitable quantities of conductive fiber, e.g. stainless steel, must be added to the base resin making sure to exceed the percolation threshold also in this case.

The integrity of metallic fibers is crucial for the formation of an effective wire mesh; for this reason, special measures are required not only during conversion, but also during the power system setup and the product design.

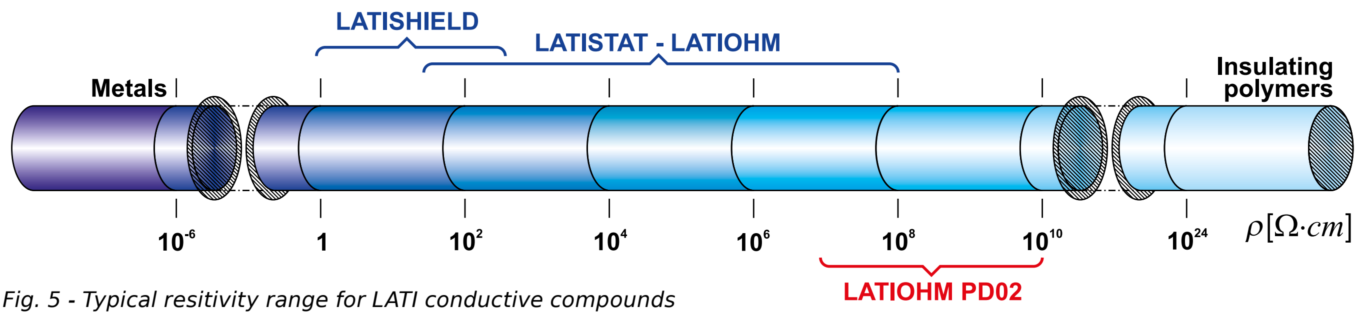


Fig. 5 - Typical resitivity range for LATI conductive compounds

LATIOHM®

The name LATIOHM identifies the widest group of LATI's electrically conductive materials. Compounds formulated with different reinforcements, depending on the technical aspect to be obtained, are part of this group.

All the offered solutions provide the molded parts with **permanent electrical conductivity**.

- **carbon fibers**: in this case, electrical **conductivity is at its highest**, with resistivity reaching 10 Ω.
  Added in variable amounts ranging from 5 to 50% by weight, carbon fibers provide **extraordinary mechanical properties** in terms of stiffness and tensile strength, allowing the use of LATIOHM materials in applications where static and dynamic stresses become relevant.
  Furthermore, grades are available that are extremely resistant and tough even with minimized carbon fiber content, thanks to the adoption of a combined reinforcement system with up to 50% glass fibers by weight.

  It is worth noting that LATIOHM solutions can often be transferred to formulations that already provide other specific technical properties (UL-listed self-extinguishing and self-lubricating materials, etc.).

- **graphite:** graphite use in combination with glass or carbon fibers ensures the best **dimensional stability** of the molded parts thanks to the geometry of the particles dispersed in the matrix; it is therefore recommended if compliance with dimensional tolerances and flatness are mandatory requirements.

  So it is ideal for manufacturing extremely accurate components, such as fans, enclosures and housings, as well as supports.

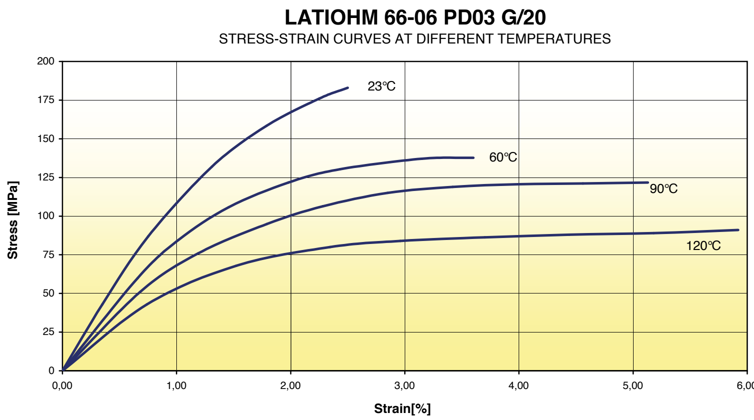


Fig. 6 - Stress-strain curves for LATIOHM 66-06 PD03 G/20

				AMORPHOUS				SEMICRYSTALLINE			
				ABS	PC	PPOm	PES	PPh	POM	PBT	
PROPERTIES (typical values)	**Testing conditions**	**Standards**	**Units (SI)**	**LATIOHM 36/07 PD01 G/20**	**LATIOHM 87/28-05 PD01 G/10**	**LATIOHM 90/13-09 PD01 G/10**	**LATIOHM 85-06 PD01 G/15**	**LATIOHM 52/11-10 PD02**	**LATIOHM 73-09 PD01 G/20**	**LATIOHM 75/4-03 PD01 G/20**	**LATIOHM 75/4-08 PD01 G/25**
Physical											
Density	23°C	ISO 1183	g/cm³	1.35	1.28	1.19	1.50	0.97	1.55	1.55	1.49
Linear shrinkage at moulding* (60x60x2mm-60MPa)	along flow	ISO 294-4	%	0.30 ÷ 0.45	0.20 ÷ 0.35	0.20 ÷ 0.35	0.10 ÷ 0.25	1.40 ÷ 1.70	0.40 ÷ 0.65	0.20 ÷ 0.50	0.20 ÷ 0.50
	across flow			0.50 ÷ 0.70	0.35 ÷ 0.55	0.35 ÷ 0.50	0.25 ÷ 0.45	1.45 ÷ 1.75	1.00 ÷ 1.30	0.75 ÷ 1.05	0.75 ÷ 1.05
Mechanical											
Charpy - Impact strength notched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eA	kJ/m²	4	10	3.5	6	15	6	6	7
Charpy - Impact strength unnotched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eU	kJ/m²	15	35	10	25	NR	20	40	50
Tensile modulus	23°C	ISO 527 (1)	MPa	12200	7500	8400	13800	800	12000	14000	15000
Tensile strength	23°C	ISO 527 (1)	MPa	85	100	70	150	10	110	135	145
Elongation at yield	23°C	ISO 527 (1)	%					10			
Elongation at break				1.2	1.8	1	1.5	95	1.5	1.7	1.5
Thermal											
Vicat - Softening point (heating rate 50°C/h)	49 N - 50°C/h	ISO 306	°C	100	150	155	215	50	155	215	215
HDT – Heat Distortion Temperature	0.45 MPa	ISO 75	°C	100	145	165	220	60	165	220	220
	1.82 MPa			95	140	160	210	40	160	210	210
Electrical											
Surface resistivity		ASTM D 257	Ω	1E5	1E3	1E2	1E2	1E10	1E3	1E2	1E4
Electromagnetic reflection (Bekiscan-CP)	3 mm-10GHz		%								
Testing conditions											
Pre-drying temperature	(at least 3 hours at…)		°C	70 ÷ 80	110 ÷ 130	80 ÷ 100	150 ÷ 180	80 ÷ 90	80 ÷ 100	120 ÷ 130	120 ÷ 130
Melt temperature			°C	220 ÷ 250	275 ÷ 320	270 ÷ 290	350 ÷ 390	180 ÷ 210	180 ÷ 210	240 ÷ 260	240 ÷ 260
Mould temperature			°C	50 ÷ 80	100 ÷ 120	80 ÷ 90	150 ÷ 190	50 ÷ 70	70 ÷ 90	70 ÷ 110	70 ÷ 110
Self-extinguishing				UL							
Colorability				✗	✗	✗	✗	✓	✗	✗	✓

* Values obtained according to ISO norm at the specified pressure. Actual shrinkage values may differ because of the design

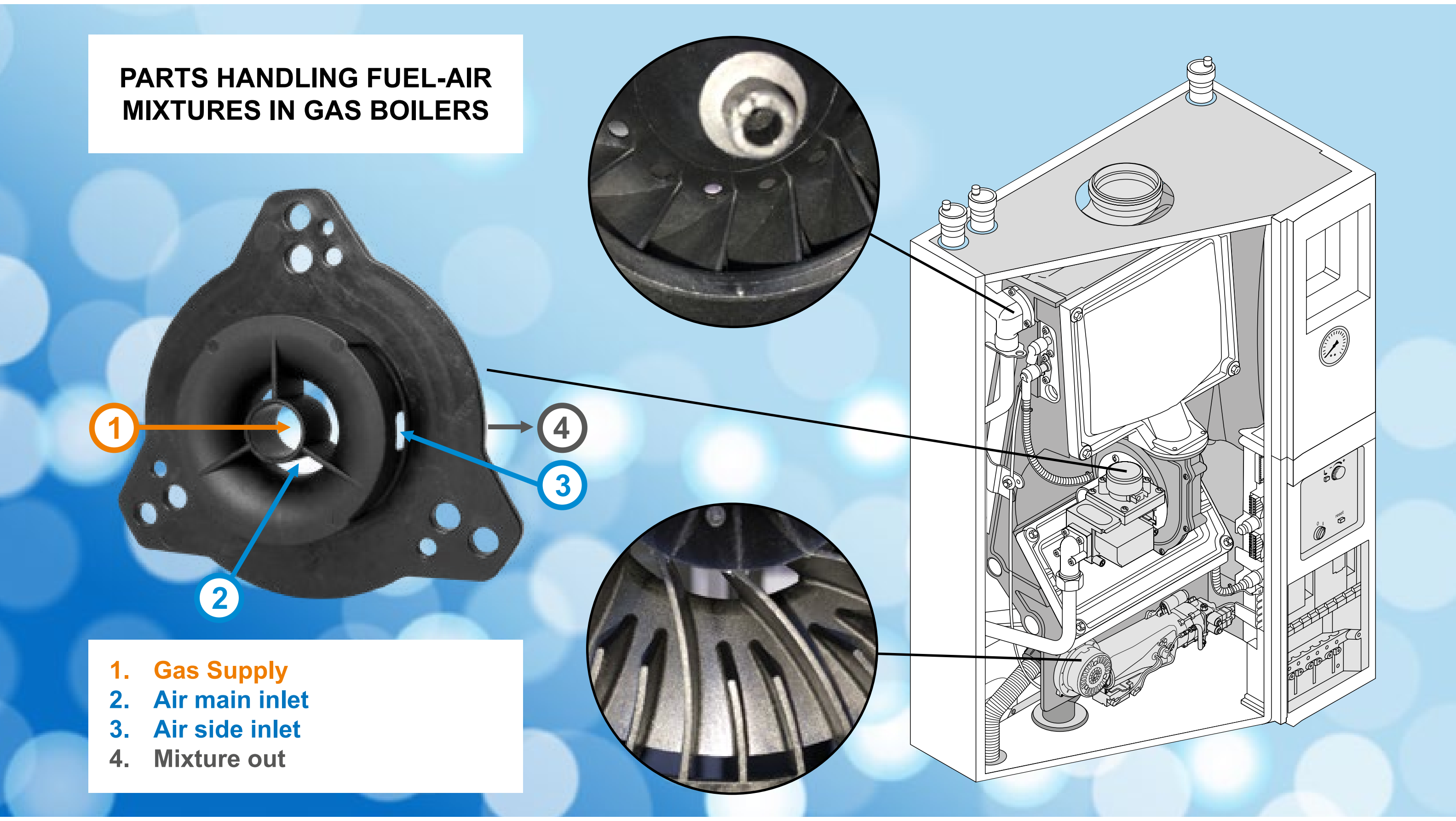


Fig. 7 - Parts handling fuel-air mixtures in gas boilers: LATIOHM 66-06 PD03 G/20

SEMICRYSTALLINE											
PA12	PA 6				PA66					PPA	PPS
LATIOHM 82-02 PD09	LATIOHM 62-03 PD01 G/20	LATIOHM 62-08 PD02 G/30	LATIOHM 62-09 PD01 G/20-V2HF	LATIOHM 63-08 PD02 G/25	LATIOHM 66-04 PD01 G/25-V0CT1	LATIOHM 66-05 PD01 G/20	LATIOHM 66-06 PD03 G/20	LATIOHM 66-07 PD08 G/30	LATIOHM 66-08 PD02 G/35	LATIOHM 57-05 PD01 G/15	LATIOHM 80-04 PD01 G/30
1.22	1.35	1.45	1.34	1.26	1.58	1.33	1.34	1.42	1.44	1.34	1.64
0.90 ÷ 1.10	0.30 ÷ 0.55	0.40 ÷ 0.55	0.30 ÷ 0.55	0.45 ÷ 0.60	0.30 ÷ 0.55	0.35 ÷ 0.50	0.40 ÷ 0.55	0.20 ÷ 0.50	0.40 ÷ 0.60	0.35 ÷ 0.65	0.25 ÷ 0.40
0.90 ÷ 1.20	0.65 ÷ 0.95	0.55 ÷ 0.80	0.60 ÷ 0.90	0.65 ÷ 0.90	0.65 ÷ 0.95	0.85 ÷ 1.15	0.90 ÷ 1.20	0.70 ÷ 1.00	0.75 ÷ 1.05	0.75 ÷ 1.05	0.65 ÷ 0.90
2.5	9	8	4	10	9	6	7	8	8	3.5	6
25	65	40	40	40	40	60	45	65	55	35	20
2100	15400	8600	10500	6100	17000	11000	12000	15000	7900	13600	22500
45	200	75	105	65	150	170	180	200	90	190	100
15											
50	2.5	2	2.3	2.5	2.4	3	2.5	2	4	2	0.5
140	215	160	210	145	215	255	255	250	230	230	255
115	220	205	215	195	250	260	260	260	250	270	280
50	210	155	195	145	215	245	245	250	210	260	270
1E2	1E3	1E11	1E8	1E9	1E3	1E5	1E5	1E3	1E8	1E4	1E3
80 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100	130 ÷ 140
210 ÷ 240	240 ÷ 280	240 ÷ 280	230 ÷ 250	240 ÷ 280	270 ÷ 290	270 ÷ 290	275 ÷ 300	275 ÷ 300	275 ÷ 300	320 ÷ 340	290 ÷ 310
45 ÷ 60	80 ÷ 100	80 ÷ 100	70 ÷ 100	60 ÷ 90	80 ÷ 100	80 ÷ 100	80 ÷ 100	80 ÷ 100	80 ÷ 100	130 ÷ 160	130 ÷ 140
			LATI	UL	UL			UL			
☑	☒	☑	☒	☑	☒	☒	☒	☒	☑	☒	☒

- **conductive polymers:** all carbon-based solutions are exclusively black, with the exception of products whose carbon fiber content is not excessive, which allows a fair colorability.
  If, instead, bright **colored technopolymers** without surface imperfections are required, LATI offers the LATIOHM PD02 range, obtained by using electrically conductive macromolecules bound to conventional resins, and moldable below 300°C such as, for example, PP, PA6, 66 and 12, as well as PBT. In this case, controlled electrical resistivity within the range of antistaticity (10^7-10^9 Ω) may be obtained in compounds that are also suitable for the manufacture of mechanically resilient parts being, at the same time, aesthetically pleasing and free from defects typical of semi-permanent solutions (streaks, peeling, deposits, etc.).

- **carbon nanotubes (CNT):** technologically very advanced materials typically providing excellent electrical conductivity values, even if added in extremely low percentages.
  Thanks to their efficiency, electrically conductive parts can be manufactured without affecting the properties of the polymer matrix, e.g. resilience and toughness, which would be altered if fillers are used that usually cause the compounds to stiffen or become brittle.

Suitably converted CNT grades allow a more accurate control of the electrical resistivity range applied to the polymer, resulting in ad hoc solutions for all requirements.

With their outstanding performance, the proposals based on PA, POM, PBT, PPS, and PC are characterized not only by uniform resistivity values over the entire surface, but also by an excellent appearance.

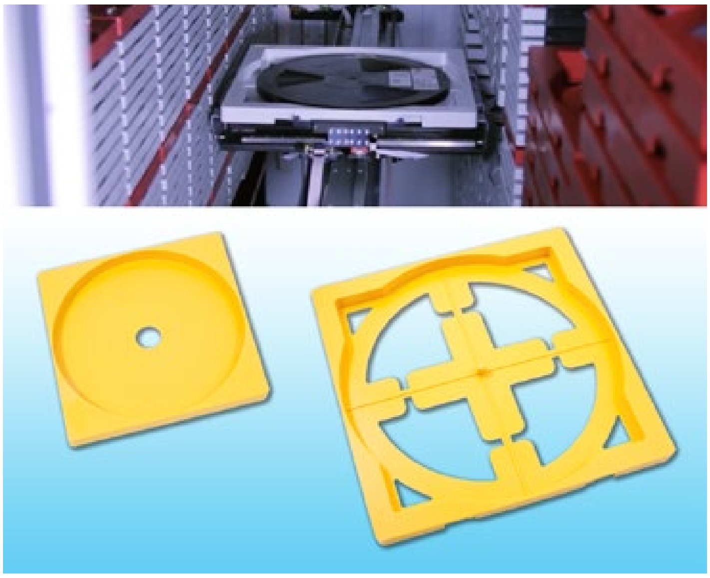


Fig. 8 - Trays for magnetic supports in coloured LATIOHM PD02

				AMORPHOUS	SEMICRYSTALLINE						
				PC	POM	PBT	PA 12	PA 66		PPS	PEEK
PROPERTIES (typical values)	**Testing conditions**	**Standards**	**Units (SI)**	**LATIOHM 87/28-07 CNT**	**LATIOHM 73/23-10 CNT**	**LATIOHM 75/4-10 CNT**	**LATIOHM 83-07 PD11 CNT**	**LATIOHM 66-10 H2 CNT CE/10**	**LATIOHM 66-10 H2 CNT G/35**	**LATIOHM 80-05 CNT GCE/500**	**LATIOHM 88/10-06 CNT**
Physical											
Density	23°C	ISO 1183	g/cm³	1.20	1.42	1.33	1.10	1.24	1.41	1.81	1.32
Linear shrinkage at moulding* (60x60x2mm-60MPa)	along flow	ISO 294-4	%	0.55 ÷ 0.75	2.00 ÷ 2.35	1.70 ÷ 2.00	0.80 ÷ 1.20	1.30 ÷ 1.65	0.35 ÷ 0.55	0.30 ÷ 0.40	1.15 ÷ 1.55
	across flow			0.60 ÷ 0.75	2.05 ÷ 2.25	1.70 ÷ 2.00	0.80 ÷ 1.20	1.30 ÷ 1.65	1.00 ÷ 1.35	0.70 ÷ 1.00	1.20 ÷ 1.55
Mechanical											
Charpy - Impact strength notched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eA	kJ/m²	8	4	2.5	75	1.3	7	3	5
Charpy - Impact strength unnotched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eU	kJ/m²	75	55	90	NR	20	50	20	40
Tensile modulus	23°C	ISO 527 (1)	MPa	2500	2900	2900	1100	5000	11500	15700	4000
Tensile strength	23°C	ISO 527 (1)	MPa	50	60	60	35	90	185	80	90
Elongation at yield	23°C	ISO 527 (1)	%	5			20				5
Elongation at break				25	10	10	85	2.7	2.5	0.5	35
Thermal											
Vicat - Softening point (heating rate 50°C/h)	49 N - 50°C/h	ISO 306	°C	140	150	180	120	245	255	255	>300
HDT – Heat Distortion Temperature	0.45 MPa	ISO 75	°C	130	150	170	100	235	260	280	200
	1.82 MPa			125	90	70	40	115	250	270	160
Electrical											
Surface resistivity		ASTM D 257	Ω	1E8	1E7	1E8	1E7	1E8	1E7	1E3	1E3
Electromagnetic reflection (Bekiscan-CP)	3 mm-10GHz		%								9E1
Testing conditions											
Pre-drying temperature	(at least 3 hours at…)		°C	110 ÷ 130	80 ÷ 100	120 ÷ 130	90 ÷ 100	90 ÷ 100	90 ÷ 100	130 ÷ 140	120 ÷ 150
Melt temperature			°C	265 ÷ 300	180 ÷ 200	240 ÷ 260	210 ÷ 240	275 ÷ 300	275 ÷ 300	290 ÷ 310	360 ÷ 390
Mould temperature			°C	100 ÷ 120	70 ÷ 90	70 ÷ 110	45÷ 55	80 ÷ 100	80 ÷ 100	130 ÷ 140	170 ÷ 200
Self-extinguishing										🔥	🔥
Colorability				☒	☒	☒	☒	☒	☒	☒	☒

* Values obtained according to ISO norm at the specified pressure. Actual shrinkage values may differ because of the design

LATISTAT

LATISTAT range of compounds is designed for all applications where electrical conductivity is of utmost importance.

Reinforced with **carbon black or graphite**, LATISTAT compounds represent, in fact, the most effective and less expensive proposal for manufacturing products with significant antistatic properties not subjected, for example, to severe static or dynamic mechanical stresses, shock or fatigue.

For the latter conditions, LATIOHM compounds reinforced with carbon fibers are better suited, as LATISTAT compounds may, in fact, be too fragile due to their high content of conductive charge.

Conceived to be cost-effective, LATISTAT grades are designed on flexible and versatile base resins such as ABS, PP, PA, as well as thermoplastic elastomers.

The use of graphite is particularly interesting, as it not only ensures to the products excellent dimensional stability, but also allows their use in applications that are in continuous contact with drinking water.

Of course, LATISTAT compounds can, however, be filled and reinforced, even if to a lesser extent than the LATIOHM range.

Very interesting is, for example, the use of fiber glass, **wollastonite or mica** in order to increase impact resistance, dimensional stability, and robustness of products.

Their simple formulation based on commonly used reinforcements and resins allows LATISTAT molding on any kind of equipment.

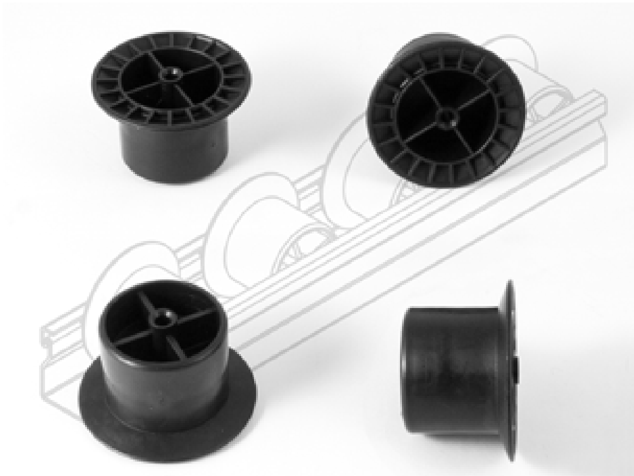


Fig. 9 - Conductive wheels for conveyor belts LATISTAT 47/7-03

				SEMICRYSTALLINE							
				PPh		PPc	POM	PA6		PA66	
PROPERTIES (typical values)	**Testing conditions**	**Standards**	**Units (SI)**	**LATISTAT 52/7-02**	**LATISTAT 52/7-02 MI/30**	**LATISTAT 47/7-03**	**LATISTAT 73/13-06**	**LATISTAT 62-06 K/10**	**LATISTAT 63-08**	**LATISTAT 66-06**	**LATISTAT 67-08**
Physical											
Density	23°C	ISO 1183	g/cm³	0.95	1.22	1.00	1.40	1.15	1.12	1.20	1.16
Linear shrinkage at moulding* (60x60x2mm-60MPa)	along flow	ISO 294-4	%	1.50 ÷ 1.80	0.80 ÷ 1.00	1.10 ÷ 1.30	2.00 ÷ 2.30	0.40 ÷ 0.55	1.15 ÷ 1.45	1.20 ÷ 1.50	1.30 ÷ 1.65
	across flow			1.55 ÷ 1.85	0.85 ÷ 1.05	1.20 ÷ 1.40	2.05 ÷ 2.25	1.05 ÷ 1.35	1.25 ÷ 1.50	1.25 ÷ 1.55	1.30 ÷ 1.60
Mechanical											
Charpy - Impact strength notched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eA	kJ/m²	2	1	20	5	15	10	3	7.5
Charpy - Impact strength unnotched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eU	kJ/m²	25	10	60	35	40	NR	20	NR
Tensile modulus	23°C	ISO 527 (1)	MPa	2700	5200	2100	3000	8100	2200	3700	2300
Tensile strength	23°C	ISO 527 (1)	MPa	35	30	25	55	115	40	75	50
Elongation at yield	23°C	ISO 527 (1)	%	2	1.5	5		3.5	3		
Elongation at break				3.5	3	7	5	6.5	80	2.7	15
Thermal											
Vicat - Softening point (heating rate 50°C/h)	49 N - 50°C/h	ISO 306	°C	115	110	95	150	205	170	245	190
HDT – Heat Distortion Temperature	0.45 MPa	ISO 75	°C	115	140	95	135	215	135	230	185
	1.82 MPa			75	95	55	85	200	60	100	65
Electrical											
Surface resistivity		ASTM D 257	Ω	1E2	1E3	1E2	1E5	1E4	1E8	1E3	1E5
Electromagnetic reflection (Bekiscan-CP)	3 mm-10GHz		%								
Testing conditions											
Pre-drying temperature	(at least 3 hours at…)		°C	80 ÷ 90	80 ÷ 90	80 ÷ 90	80 ÷ 90	90 ÷ 100	90 ÷ 100	90 ÷ 100	90 ÷ 100
Melt temperature			°C	180 ÷ 220	200 ÷ 240	200 ÷ 240	175 ÷ 200	240 ÷ 280	230 ÷ 250	270 ÷ 300	260 ÷ 290
Mould temperature			°C	20 ÷ 40	40 ÷ 60	40 ÷ 60	70 ÷ 90	80 ÷ 100	60 ÷ 70	70 ÷ 90	60 ÷ 80
Self-extinguishing											
Colorability				☒	☒	☒	☒	☒	☒	☒	☒

LATISHIELD

Electromagnetic radiation produced by electric machines and electronic circuits may generate serious disturbances in identical devices located in the vicinity of the source.

This interference (EMI) may cause malfunctions of various seriousness thus requiring shielding of the equipment to be protected in order to limit harmful effects.

Shielding is obtained by protecting the electronics inside an enclosure able to ground the incident radiation (Faraday cage effect).
Metal enclosures or enclosures metallized with special conductive coating are used for this purpose.

If there is the need to provide plastic containers with shielding properties, the use of LATISHIELD shielding compounds is recommended.

Available on almost every thermoplastic resin and in the most varied formulations, such as self-extinguishing, self-lubricating, thermally conductive, etc., LATISHIELD grades ensure excellent shielding power thanks to their **stainless steel microfibers**, added in a varied quantity ranging from 5 to 15% by weight.

Metal fibers suitably dispersed in the polymer during plasticizing and molding processes contribute to the formation of an electrically conductive grating that is extremely effective both in EMI shielding and in preventing the accumulation of electrostatic charges.

LATISHIELD allow reaching extremely high electrical conductivity values, but it is essential to convert these compounds taking care not to excessively fragment metal fibers by avoiding too high shear stresses (very high screw turns, too thin runners or cavity walls, high injection speed, etc.).

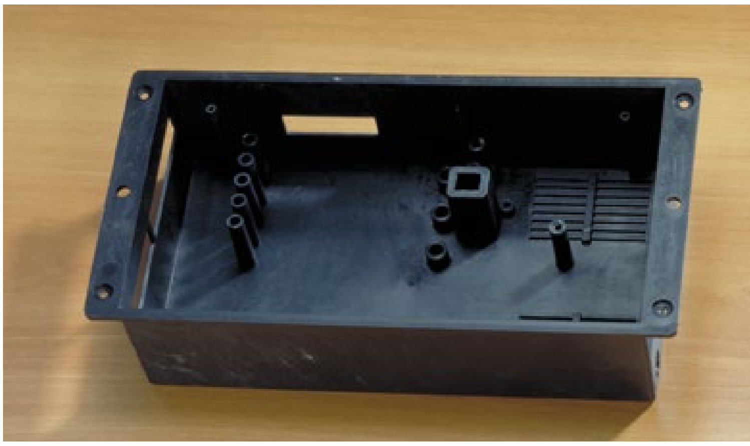


Fig. 10 - Shielding case for electronics

				AMORPHOUS			SEMICRYSTALLINE				
				ABS	PC	PES	PP	POM	PBT	PA66	
PROPERTIES (typical values)	**Testing conditions**	**Standards**	**Units (SI)**	**LATISHIELD 36/AR-10A-VOE**	**LATISHIELD 87/28-10A**	**LATISHIELD 85-08A G/20**	**LATISHIELD 52/5-07A**	**LATISHIELD 73/13-07A**	**LATISHIELD 75/4-10A**	**LATISHIELD 66-08A G/25-VOKB1**	**LATISHIELD 66-13A G/30**
Physical											
Density	23°C	ISO 1183	g/cm³	1.29	1.31	1.59	0.97	1.47	1.42	1.44	1.56
Linear shrinkage at moulding* (60x60x2mm-60MPa)	along flow	ISO 294-4	%	0.60 ÷ 0.85	0.55 ÷ 0.75	0.35 ÷ 0.50	1.40 ÷ 1.70	2.00 ÷ 2.30	1.70 ÷ 1.90	0.35 ÷ 0.50	0.45 ÷ 0.60
	across flow			0.70 ÷ 0.95	0.60 ÷ 0.75	0.75 ÷ 0.90	1.40 ÷ 1.70	2.05 ÷ 2.25	1.70 ÷ 1.90	0.95 ÷ 1.20	1.00 ÷ 1.25
Mechanical											
Charpy - Impact strength notched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eA	kJ/m²	2.5	5	5.5	3	4.5	3.5	7.5	6
Charpy - Impact strength unnotched (specimen 80 x 10 x 4 mm)	23°C	ISO 179-1eU	kJ/m²	10	NR	45	40	60	30	50	40
Tensile modulus	23°C	ISO 527 (1)	MPa	2700	3100	7000	2000	3000	2200	8300	9400
Tensile strength	23°C	ISO 527 (1)	MPa	40	50	110	70	45	NR	120	90
Elongation at yield	23°C	ISO 527 (1)	%				8	8.5	30		
Elongation at break				2.2	12	2	20	20	>100	2.5	2
Thermal											
Vicat - Softening point (heating rate 50°C/h)	49 N - 50°C/h	ISO 306	°C	85	145	210	105	150	185	245	245
HDT – Heat Distortion Temperature	0.45 MPa	ISO 75	°C	85	140	215	105	150	175	260	260
	1.82 MPa			80	135	205	60	110	70	240	245
Electrical											
Surface resistivity		ASTM D 257	Ω	1E1	1E2	1E1	1E2	1E2	1E1	1E2	1E1
Electromagnetic reflection (Bekiscan-CP)	3 mm-10GHz		%	95	95	90	86	95	94	92	93
Testing conditions											
Pre-drying temperature	(at least 3 hours at…)		°C	70 ÷ 80	110 ÷ 130	110 ÷ 130	80 ÷ 90	80 ÷ 90	100 ÷ 120	90 ÷ 100	90 ÷ 100
Melt temperature			°C	180 ÷ 220	265 ÷ 300	300 ÷ 340	180 ÷ 220	175 ÷ 200	240 ÷ 250	270 ÷ 290	275 ÷ 300
Mould temperature			°C	40 ÷ 60	80 ÷ 100	100 ÷ 130	20 ÷ 40	70 ÷ 90	70 ÷ 90	70 ÷ 100	80 ÷ 100
Self-extinguishing				LATI						LATI	
Colorability				✓	✓	✓	✓	✓	✓	✗	✓

* Values obtained according to ISO norm at the specified pressure. Actual shrinkage values may differ because of the design

SUPPORT & SERVICE

LATI's goal has always been to support customers in the implementation of innovative projects, providing both high performance compounds, and specialized technical services.

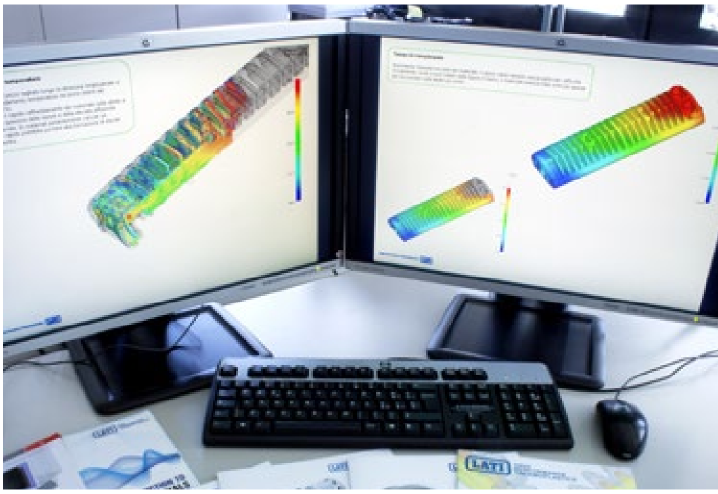
LATI provides assistance to its clients from the earliest stages of design through advice and, if necessary, customized formulations as well as assistance on site to ensure correct conversion.

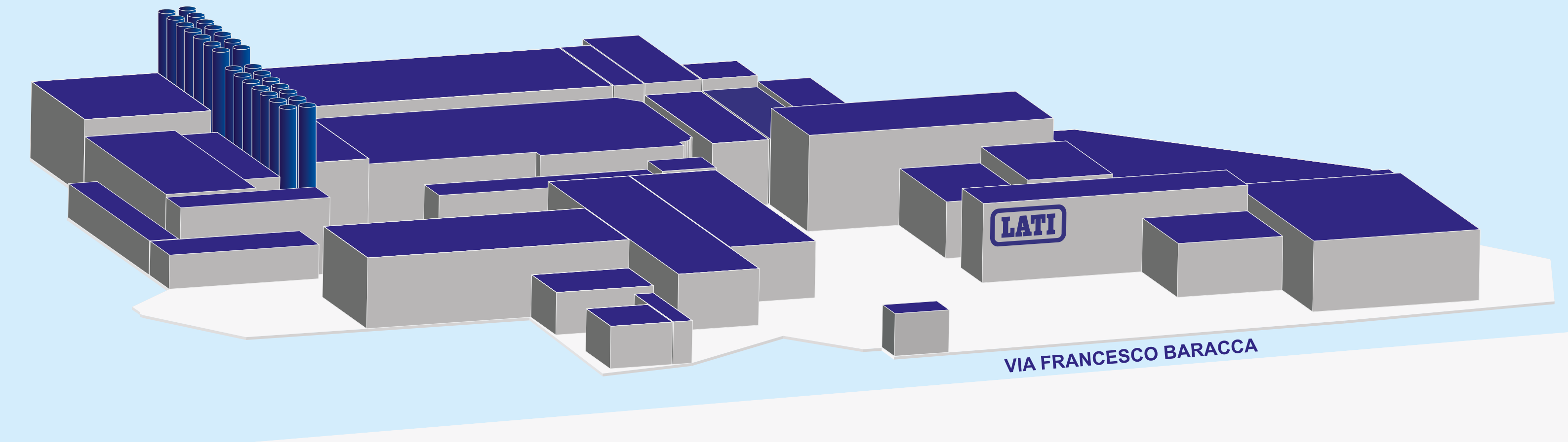
- **Co-design**
  Simulations are performed by technicians operating in this sector for almost twenty years, by directly working on the geometries provided by customers and using mechanical and rheological characterizations complying with conditions of use.

- **Support in injection molding**
  At the beginning, moulding a special compounds may not be a simple task.
  Getting the maximum thermal, mechanical, and dimensional performance from selected materials may require a number of attempts to best tune the process.
  For this reason, LATI provides injection molding technicians on site, with thirty years experience in the field of injection molding, injection molding machines, and molds.

- **Research and development**
  The offer of customized products meeting specific customer requirements is a key issue for LATI.
  Each formulation is optimized to meet application requirements even when it differs from those included in the product range.

- **Regulations in place**
  LATI's custom is to combine the supply of compounds with support in regulations.
  Its team of experts is at customers' disposal for the certification procedures with accredited laboratories worldwide.
  LATI releases internal certificates of conformity to rules governing all market segments involving thermoplastics marketed.

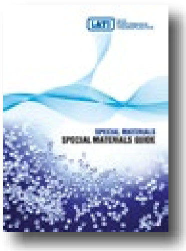




Products guide

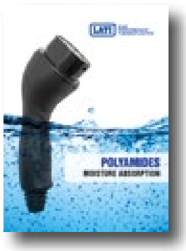
Engineering thermoplastics
flame retardant
high performance

Quick guide to LATI compounds



Special materials

Special materials guide

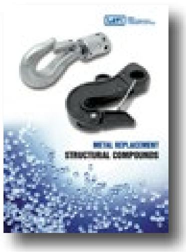


Polyamides

Moisture absorption

Latilub

Engineering polymers featuring low coefficient of friction and high wear resistance



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