

International Distribution

Innovative Materials for Your Success

Plastics Portfolio



The Grolman Group

The Grolman Group operates an international specialty chemical distribution business. It is composed of individual local sales offices based in all European countries, each supported by technically trained sales staff, customer service teams and local warehousing.

The Grolman Group, run by the fifth generation of the Grolman family, has been privately owned since it was established in 1855. The key to its success has been the dedication and commitment to building an efficient customer-focused organisation where customers' needs are an essential driving force.

Grolman. Quality since 1855.

Raw materials for Plastics

- Thermoplastic Compound / Extrusion
- Thermoplastic Masterbatch
- Thermoplastic Composites
- Thermoset
- Thermoset Composites
- Elastomers
- Rubber



International Distribution of Specialty Chemicals



Additives and Performance Fillers for Plastics

Chemistry	Supplier	Tradename	Page
Silanes	Momentive	Silquest*	11
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Performance Materials and Fillers for Plastics

Chemistry	Supplier	Tradename	Page
Talc	Mondo Minerals	Finntalc, Plustalc, Microtalc	24
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Flame Retardants	Nabaltec	APYRAL®, APYMAG®, APYRAL® AOH	26
Boron Nitride	Momentive	PolarTherm*, CoolFlow*, CoolFX*	27
Precipitated Calcium Carbonbate	Cales de Llierca	Calprec	28
Hollow Glass Spheres	Grolman	rima light	29
China Clay / Calcined China Clay	EICL	Hima*	30
Wollastonite	Sibelco	Casiflux	31
Mica	Grolman	rima mica	32
Carbon Fibre	C.A.R. FiberTec	CFTRIM, CF FLEX, CF BASE	33

Pigments for Plastics

Chemistry	Supplier	Tradename	Page
Titanium Dioxide / Zinc Sulphides	Venator	Deltio, Tioxide, Hombitan, Sachtleben, Hombitec, Sachtolith®, Sachtoperse	35
Infrared Reflective Pigments	Venator	ALTIRIS®	36
Pigment Blacks	Orion Engineered Carbons	Arosperse®, Colour Black, HiBlack®, Lamp Black, Nerox, NIPex, Panther, Printex®, Special Black	37
Ultramarine & Manganese Violet Pigments	Venator	CM, Premier, Prestige	38
Inorganic Colour Pigments	Venator	Colourplex, Ferroxide®, Transoxide, Tan, Chrome Green, Solaplex®	39
Complex Inorganic Colour Pigments (CICPs) / Lasermarking Pigments	Tomatec		40
Rare Earth Pigments	Hongbo Te	Neolor™, greenTop	41
Organic Pigments / Solvent Dyes	Grolman & Verdcol	rima colour / Verdcol / rima sol	42
Organic Pigments & Preparations	Toyo Ink	Cosmos, Lionol, Lionogen, Lutetia	43
Metallic Pigments	Schlenk	Metaface, Powdal, Grandal®, Constant, Multiflect® Wave, Zenexo® Luminor, Multiprint, Unicoat	[,] 44
Pearlescent Pigments, Lasermarking Pigments & Glitter	JointColor	AG, ES, TR, TS, TV	45
Fluorescent Pigments	Sterling	230, 911, 915, 925	46
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Thermochromic Pigments	TMC Hallcrest	ChromaZone®, Thermobatch®	48
Photochromic Dyes	Vivimed	Reversacol	49

Overview of Additives for Plastics

		Application				Functionality																				
Products	Supplier	Thermoplastic compound / extrusion	Thermoplastic masterbatch	Elastomers	Thermoset	Thermoplastic composites	Thermoset composites	Rubber	Wetting & Dispersing	Compatibilisation	Fibre wetting	Abrasion and scratch resistance	Rheology	Crosslinking	Cataloysis Levelling	Moisture scavanding	Processing	Light diffusion	CoF reduction /Tribology	Defoaming / Air release	Lubrication	Mechanical improvement	Creeb resistance	Light stabilisation	Impact modifying	Surface improvement
Silanes Silquest*	Momentive	•	-	•	•	-	•	-	-		-			-		-						•		Π	-	
Silicone Masterbatch PEarlene*	Momentive	-				-							-				•				-					-
Silicone Microspheres Tospearl*	Momentive	-	-	•		-						•						-	-							
Catalysts Fomrez*	Momentive				•		•								•											
Silicone-Copolymer Additives CoatOSil*	Momentive				•		•		-				-							•						-
Amine Curing Agents Baxxodur®	BASF				•		-							•											•	
Imidazoles Curezol® / Cureduct®	Shikoku				•		•							-								ŀ				
Performance Enhancers XIBOND™	Polyscope	-	•			-					-		-				-					•				-
Impact Modifiers and Compatibilisers	Lushan	-	-			-			-		-		-				ŀ					-			-	-
Light Stabilisers Sunovin®	Sunshow	•	•			-		-																•		
Optical Brighteners Jitabright	Jitat	-	-			-																				
Functional Additives (FAD)	Venator	-	-			-		-			-				•	-					•	-				

Overview of Performance Materials & Fillers for Plastics

		Application			Functionality																				
Products	Supplier	Thermoplastic compound / extrusion	Thermoplastic masterbatch	Elastomers	Thermoset	Thermoplastic composites	Thermoset composites	Rubber	Heat management	Abrasion and scratch resistance	Low shrinkage	Rheology	Gas barrier	Lubrication	Mechanical improvement	Temperature resistance	Creep resistance	Flame retardancy	Weight reduction	Impact modifying	Nucleation	Mould release	Surface improvement	Electrical properties	Colour enhancement
Talc Finntalc, Plustalc, Microtalc	Mondo Minerals	-		-		-	•		•			•				•	•				•				-
Graphene	Angstron Materials	-	•	-	•	-	•	-	-				-		•									-	
Flame Retardants, APYRAL®, APYMAG®, APYRAL® AOH	Nabaltec				•	-	•											•							
Boron Nitride PolarTherm*, CoolFlow*, CoolFX*	Momentive	-		-	•	-	•	-	-					-						-	•				
Precipitated Calcium Carbonbate Calprec	Cales de Llierca	-				-					-	-		-							•		•		•
Hollow Glass Spheres rima light	Grolman	-		-	•	-	•	-	-					-					•						
China Clay / Calcined Hima*	EICL	-			•		•			-	-				-								•		
Wollastonite Casiflux	Sibelco	-		-	•	-	•			-					-	-									-
Mica rima mica	Grolman	-				-		•			-				•		•					-			
Carbon Fibre CFTRIM, CF FLEX, CF BASE	C.A.R. FiberTec			-			•	-								-			•					-	

■ = highly recommended use □ = possible use = not recommended

Overview of Pigments for Plastics

				Ap	opli	cati	on			Functionality															
Products	Supplier	Thermoplastic extrusion	Elastomers	Thermoset	Thermoplastic composites	Thermoset composites	Masterbatch	Pigment pastes	Rubber	IR reflective	IR absorbtion	UV protection	Antistatic	Conductivity	Non migratory	Low warping	Metallic effect	Pearlescent effect	Daylight fluorescent	Luminescent	Thermochromic	Photochromic	Laser marking	Security	Colour
Complex Inorganic Colour Pigments (CICPs) / Lasermarking Pigments	Tomatec		•	•		•	•	•	-	•					•	-							-	•	•
Fluorescent Pigments	Sterling Colour		•	-		•	•	-	-							-			•						•
Infrared Reflecting	Venator		•	-		-	•	-	-	•					•	-								-	•
Inorganic Colour Pigments	Venator		•	-		-	•	-	-	-					•	-									•
Luminescent Pigments & UV / IR Pigments	Next Generation		•	•		•	•	•	-						•	-			•	-				-	•
Metallic Pigments	Schlenk		•	•		•	•	•	-	•		•	•	•	•	-	•						•	•	
Organic Pigments / Solvent Dyes	Grolman & Verdcol		•	-		-	•	-	-																•
Organic Pigments & Pigment Preparations	Toyo Ink Europe		•	-		-	•	-	-																•
Pearlescent Pigments / Lasermarking Pigments	JointColor		•	-		-	•	-	-						•	-		•					•	-	•
Photochromic Dyes	Vivimed		•				•	-	-							-						-		-	-
Pigment Blacks	Orion Engineered Carbons		•	-		-	•	-	•		•	-	•	•	•	-									•
Rare Earth Pigments	Hongbo Te		•	-		-	•	•	-	-		•			•	-									-
Thermochromic Pigments	TMC Hallcreast		•				•	-	-						•	-					•			-	-
Titanium Dioxide / Zinc Sulphides	Venator		-	-		-	•	-		-					•	-									•
Ultramarine & Manganese Violet Pigments	Venator		•	•		•	•	•	-	•					•	-								-	-

 \blacksquare = highly recommended use \square = possible use = not recommended

Products for Thermoset, Thermoplastic, Composites, Elastomer and Rubber

Our products are focused on the five market segments of plastic and rubber.



Thermoset plastics are cured or cross linked polymers which are chemically fully reacted either by ambient, heat or radiation cure. They are so named because the three dimensional chemical structure formed during curing, does not allow them to be remelted or recycled by the simple application of heat, although some can be softened and reformed. Structural thermosets are cured in a mould, where the final part is formed and a rigid three-dimensional crosslinking is achieved. Exposure of the polymer to low and high temperatures does not result in brittleness or softening as with a pure thermoplastic polymer. Polymer recycling is not generally possible – this means thermosets can not be remelted.

The main categories of thermosets are Unsaturated Polyester (UP), Vinyl-ester (VE), Epoxy (EP), Polyurethane (PU/PUR), Melamine, Phenolic, Urea-Formaldehyde and Acrylics (PMMA). The majority of thermoset resins used are unsaturated polyester resins for standard applications and epoxy for high performance uses. Melamine is used for applications where temperature resistance is required and phenolic applications are often used for flame retardant and electrical applications. lightweight

reinforcement

compatibilising

UV protection

Grolman

International Distribution

thermal management

electrical management

colour effects

flame retardancy

Thermoplastic polymers are a large group of polymer resins that become liquid when heated and rigid when cooled. At very low temperatures thermoplastics become glass-like and brittle. These characteristics, which lend the material its name, are reversible, which means they can be reheated or reshaped repeatedly. These properties also make thermoplastics recyclable. Polymers of one single type of monomer are called homo-polymers, those from more than one copolymers.

Composites or FRP (fibre reinforced plastics) are a category of plastics where fibrous materials are specifically used to mechanically enhance the strength and rigidity of plastics. Fibres used are glass roving, carbon fibre, hemp or aramid.

Elastomers are a variation of thermoplastic polymers which have a major difference in their elastic behaviour. Above a certain point, thermoplastics stay in the elongated shape when they are stretched too much. Elastomers take back the shape that they had before deformation. Their physical behaviour lies between thermoplastics and rubber.

Rubber – these are either natural (caoutchouc) or synthetic. The main difference to thermoplastic materials is their tough elastomeric behaviour. Synthetic rubber, like natural rubber, has uses in the automotive industry for tyres, door and window profiles, hoses, belts, matting and flooring.



Innovative Materials for Your Success

Additives and Performance Fillers for Plastics

Silanes



Momentive Performance Materials is a global leader in silicones, quartz and ceramics, with a 70-year heritage of being first to market performance applications for major industries that support and improve everyday life. The company delivers science-based solutions by linking custom technology platforms to opportunities for customers.

The key to the Silquest* line's versatile efficacy in adhesion promotion and coupling is the difunctionality of these organofunctional silanes: two types of reactivity built into the molecular structure. A functional group at one end of the molecule is designed for reactivity with an organic resin, while the other end has the ability to bond with a variety of inorganic materials as well as itself.

Momentive offers a variety of reactive silanes that improve the properties of the polymers. Silanes can improve the curing of thermoset resins such as polyesters, epoxies or phenolics. They also improve the adhesion to fibres and fillers in thermoplastic and thermosetting compounds. Adhesion to various polymer surfaces and substrates can be enhanced by using silanes in the polymer formulation. Silane crosslinking forms siloxane "bridges" (Si-O-Si) between molecules.

Silanes are widely used in crosslinking and grafting of polymers. Silanes have three possible crosslinking sites that can form a three-dimensional crosslinked network. This results in better hot-set or permanent set properties than peroxide crosslinking. Unlike radiation or peroxide crosslinking, silane systems need a curing cycle – immersion in hot water or exposure to steam – to complete the crosslinking.

Potential application areas for Silquest* silanes include:

- Fibre-reinforced composites
- Filler treatment
- Polymer modification
- Rubber and elastomers
- Thermoplastics

Silquest^{*} silanes and organosilicones for flame retardant formulations

Silquest* silanes are designed to work in halogen free flame retardant polymer systems in combination with hydrated fillers or polymeric flame retardants with intumescence behaviour. The additives help to wet the incorporation of the fillers, reduce the temperature in a fire situation, reduce or prevent drip when burning and reduce L.O.I..

Benefits of Silquest^{*} silanes in flame retardant systems

- Wetting & dispersing
- Reduce decomposition
- Reduce dripping



No silane treatment



Silquest A-1199 Silane

Silquest* is a trademark of Momentive Performance Materials Inc

Silicone Masterbatches PEarlene*



PEarlene silicone masterbatches are a family of functional masterbatches containing high levels of ultra-high molecular weight polysiloxanes (silicone gums) which are melt-compound into a variety of suitable polymer carriers. They are stable and very easy to handle, store and use in conventional equipment without modification. Tospearl Microspheres are a series of mono-dispersed, micro-fine spherical cross-linked siloxane particles.

These masterbatches modify the rheological characteristics of the resin or compound, which may allow for increased throughput in fabrication operations as well as reduction in drive torque and machine head pressure lowering energy costs and machine wear. Better flow also leads to less die drool and, therefore, to a potentially lower defect rate under certain conditions. They are effective in improving the processing and moulding of parts – especially those with thin walls and fine details. PEarlene* silicone masterbatches can also enhance dispersion properties of additives, especially if the loading levels are high.

PEarlene* silicone masterbatches can improve processing of e.g. extrusion rate, mould fill and power consumption and also increase performance (mar and scratch resistance and impact resistance) when used to compound or extrude certain plastics, copolymers or elastomeric formulations.

In addition to better scratch and mar resistance, finished components made with PEarlene* silicone masterbatches may feature enhanced impact resistance and a lower coefficient of friction. These masterbatches generally do not impact printability or bloom to the surface of finished parts.

Generally, PEarlene* silicone masterbatches can be added to the resin or compound during the final melt extrusion or fabrication step. The additive must be homogeneously mixed with the resin or compound in the melt process to yield the full cost effective benefit of the additive.

PEarlene^{*} silicone masterbatches aid plastics moulding in a wide spectrum of applications, including:

	Automotive	trim	interiors	
_	/ 10101101100		micorroro	

- Office equipment housing
- Pipes and conduits
- Wire and cable coatings
- BOPP (biaxially oriented polypropylene) packaging films
- HFFR (halogen free flame retardant) compounding

Benefits of PEarlene^{*} silicone masterbatches

- Improved scratch & mar resistance
- Improved impact resistance & lower coefficient of friction
- Increased fabrication line throughput
- Improved processing
- Reduced extrusion drive load and extruder head pressure

Silicone Microspheres Tospearl*



Tospearl 120, 130, 145, 2000B, 1100 and TSR 9000 are spherical silicone resin beads with narrow particle size distributions and a mean particle diameter between 2 and 10 microns depending on the grade. Their uniform particle sizes, thermal stabilities and low surface energies make them excellent candidates to consider for use as additives for plastics in which slip and anti-block properties are required.

Tospearl* is commonly used in thermoplastics to improve abrasion and scratch resistance. Other important applications include anti-blocking (reduction of CoF) and light diffusion.

Benefits of Tospearl* microspheres

- Spherical geometry and narrow particle size distributions help provide slip and anti-blocking for polyolefin films such as BOPP.
- Can be compounded with thermoplastics using typical polymer processing equipment, e.g. extruders, due to high heat resistance.
- Stable and low coefficient of friction (CoF) surfaces typically are obtained after extrusion. Tospearl beads do not migrate.
- Generally no change in the printability of films is expected.

TSR 9000 is specially designed for light diffusion applications where heat resistance is involved and good light distribution has to be managed. Spherical geometry and narrow particle size distribution provide homogeneous light diffusion properties to plastics. TSR 9000 composition is typically compatible with many polymers.

Low refractive index

The low refractive index diffuses point and line light and can give articles a matt finish. The light diffusing properties are attributable to the internal reflection angle and the larger delta refractive index. The higher total reflection angle of the TSR 9000 spherical silicone resin typically provides more efficient light diffusion than methyl methacrylate beads.



Properties of Tospearl spherical silicone resin beads

- Low surface energy
- Low refractive index
- Uniform size and shape
- Ability to impart lubricity and light diffusion properties to plastics

Tospearl* is a trademark of Momentive Performance Materials Inc



Catalysts Fomrez^{*}

Momentive offers the Fomrez* line of tin catalysts. This range of world class organometallic tin catalysts is one of the widest available to manufacturers around the world. With a knowledge of polyurethane catalysis and an experience from many years of service in polyurethane applications, Momentive brings unparalleled expertise to its customers.

Basic chemical structure of tin (IV) catalysts

Organotins are defined as those tin compounds having at least one covalent bond attached directly to a carbon (alkyl group). The particular compounds of interest in this series are the tin (IV) derivatives. The most predominant chemical structure of these tin catalysts comprises two alkyl groups and (typically) two anion groups bonded to the tin metal.

(Alkyl)₂Sn(Anion)₂

Figure 1. Basic chemical structure of Fomrez*tin catalysts

Where Sn represents the tin (IV) cation, Alkyl represents an alkyl group, and Anion represents an anion group such as a carboxylate or mercaptide anion.

The product line is differentiated into four major families based upon the chemical nature of the anion groups. These four major families are:

Carboxylates (includes maleate)	Mercaptides
Thioglycolates (Ester-containing Mercaptides)	Oxides

Mercaptides
Oxides

Fomrez* Catalysts are used for gelling of isocyanate and polyols to form high molecular weight polyurethanes or for reaction with water to form an urea foam structure.

Benefits

- Proper control of reaction
 Good control of molecular weight
- Controlled foam rise and structure
- Broad portfolio

Fomrez* is a trademark of Chemtura Corporation, used with permission by Galata Chemicals LLC.

Silicone – Copolymer Additives CoatOSil®



Momentive Performance Materials has designed a large family of specialty silicone surfactants. Each one is capable of changing the performance of customers' formulations in specific ways. To obtain the desired effect, properties like wetting can be enhanced by varying the weight percent of a surfactant's three main components: silicone, ethylene oxide and propylene oxide.

The effect of a silicone-polyether depends on the type and amount of polyether it contains:

- A molecule with significant silicone content will increase slip and mar resistance; if the silicone content is very high then the additive will act as a defoamer, and provide anti-blocking and release.
- A silicone with high polyethylene oxide content will be compatible with waterborne coatings and it can even be water-soluble. Such additives help wetting, flow, and levelling of waterborne coatings, allowing the coating to be "overcoatable" while providing gloss retention.
- If the polyether consists of polypropylene oxide, then the copolymer will be compatible with solventborne and high solids coatings and inks and can be considered for use as a flow and levelling (anti-cratering) agent for such formulations.

CoatOSil[®] silicone-polyethers can have a strong effect at low concentration on most types of thermoset systems. The silicone part of the molecule helps provide low surface tension and high surface activity. CoatOSil[®] additives or combinations thereof can help to enhance wetting, levelling, spreading, gloss, lubricity and defoaming.

CoatOSil[®] additives are used in thermoset systems, mainly liquid epoxies and vinyl-esters, and also in polyurethane systems and polyesters.

Benefits

- Surface wetting
- Enhanced flow & levelling
- Control of foam and air release
- Increased gloss

CoatOSil® is a registered trademark of Momentive Performance Materials Inc

Amine Curing Agents Baxxodur®



The curing agents from BASF sold under the Baxxodur[®] trademark include polyether amines, aliphatic and cycloaliphatic amines, which differ in molecular structure, basicity and in the type and number of functional groups. This allows accurate control of the curing reaction and the final properties of the cured thermosets. BASF is the only manufacturer handling different technologies for synthesising these highly diverse product categories and therefore offers a broad portfolio of amine-based curing agents for the epoxy industry.

We support our customers in selecting suitable curing agents by providing specific information on applications and properties.

Features and benefits of Baxxodur® curing agents

The properties of the curing agent are essential in controlling the curing of the epoxy resin and the properties of the finished product. Specific characteristic values for the reaction with standard resins based on diglycidylether of bisphenol A (DGEBA) are available for the Baxxodur® portfolio:

For the curing agent	Amine number	Viscosity	Density	
On the cured resin	Gel time	Reaction enthalpy	Peak exotherm	
And for the cured resin	Glass transition temperature Elongation at break T-peel test Lap shear strength	Impact strength Flexural strength Solvent resistance Compressive strength	Tensile strength Flexural modulus Chemical resistance Density	Tensile modulus Shore D hardness Water permeability Degree of cure

The broad portfolio of Baxxodur[®] curing agents allows the characteristics to be adjusted according to the required properties and application.

Baxxodur® EC 201

Baxxodur® EC 301

For the epoxy industry, BASF offers under the Baxxodur[®] brand a broad range of curing agents for professional epoxy resin processing.

The graph on the right shows the positive influence of the various amines on the final product.

Baxxodur^e EC 130 Gel time Shear strength (PE/PE) Glass transition temperatur

Impact strength

Benefits

- Defined curing properties
- Increased mechanical values
- Excellent chemical resistance
- Good shore hardness
- Improved cohesive strength

Baxxodur® is a registered trademark of BASF SE

Imidazoles Curezol[®] / Cureduct[®]



Shikoku was founded in 1947 and is a Japanese specialty chemicals company. They started the production of imidazoles in 1968. Since then the product lineup and production scale has been expanded to satisfy the various demands of their customers. Curezol[®] imidazoles cover a large range of reactivity and shelf life demands in the curing of thermoset resins. However, the main use is in epoxy systems. As Curezol[®] is a catalyst type, only small amounts are required (1-10phr). Imidazoles can be used either as the only curing agent or in combination with others such as anhydride, polyamines, phenolic resin and DiCy. The solid Curezol[®] will not increase the viscosity of the compound.

Features and advantages of Curezol®

Curezol[®] improves the heat resistance of the final parts and leads to improved mechanical properties as well as better chemical resistance. A broad range is available to improve properties, with low, medium and high curing temperature and short, medium and long pot life. As it is a single substance, there is no molecular weight distribution. This creates stable characteristics. Typical applications are prepregs for printed circuit boards, autoclave, compression moulding as well as adhesives, sealants and powder coatings.



Curezol reaction temperature chart

Cureduct[®] L07E

A special blocking agent Cureduct[®] L07E can stabilise a compound for up to several weeks to achieve a system that starts curing only if temperatures above 50°C are applied. This inhibitor is used in combination with an imidazole adduct.

Benefits

- Improved heat resistance
- Lower peak exotherm
- Higher mechanical properties

Curezol® and Cureduct® are registered trademarks of SHIKOKU CHEMICALS CORPORATION

Performance Enhancers XIBOND™



Polyscope initially started with the highly functional styrene maleic anhydride (SMA) but is now expanding its portfolio beyond SMA to support the industry with the increasing need to optimise polymers. The first step was the introduction of styrenics with glycidyl methacrylate (GMA). These functional styrenics are part of the XIBOND[™] family. Polyscope is continuously looking to expand this product family with a variety of products to fulfill the needs within the plastics industry.

The engineering plastics landscape contains a variety of polymers each with its unique characteristics. Over the last decade the landscape has more or less settled and nowadays product developers are looking to upgrade or combine the current product offering. Polyscope is eager to support the industry with fresh thinking by supplying state-of-the-art additives, which can offer optimised blend properties.

The XIBOND[™] portfolio consists of products that will affect the blend morphology or the surface characteristics of the polymer landscape. The key functionalities of the XIBOND[™] portfolio cover compatibilisers, coupling agents, chain extenders, viscosity modifiers and surface modifiers. These functionalities will contribute to improving the quality and optimising the processing conditions in polymer processing offering a better solution for various end markets such as automotive, building and construction, consumer goods, electrical and electronics, sports and leisure.



The highly versatile XIBOND[™] portfolio offers benefits, such as:

Improved morphology, resulting in better mechanical properties

- Adjusted flow behavior to reduce cycle times
- Improved processability of recycled polymers
- Adjusted surface tension to improve the wetting

Impact Modifiers and Compatibilisers



Guangzhou Lushan New Materials Co., Ltd. is a high-tech enterprise manufacturing functional polymer adhesive resins. Lushan is committed to bonding a more wonderful world with the power of chemistry R&D technology.

Impact modifier, compatibilisers and coupling agents

Lushan series compatibiliser for coupling agents has proven its value for a wide range of applications in the automotive, consumer, electrical/ electronic and industrial markets. Lushan compatibiliser products include halogenfree flame-retardant compatibiliser, wood compatibiliser, nylon toughener, and maleic anhydride grafted polypropylene:

Halogen-free flame retardant - compatibiliser

Lushan series compatibiliser for halogen-free flame-retardant cables and wires is used to improve the compatibility between the matrix resins and flame-retardant compatibiliser interfaces. It accelerates the flame-retardant compatibiliser spreading and enhances mechanics and processing performance of the flame retardant for wires and cables materials.

Wood plastic composites - compatibiliser

Lushan series compatibiliser for wood plastic composite is a maleic anhydride grafted polyolefin. Lushan compatibiliser enhance compatibility of wood fibres and plastics. The wood fibre's dispersion in plastics is improved as well as mechanical properties of wood-plastic composite materials.

Nylon toughener / PA impact modifier

Lushan series nylon toughener / PA impact modifier is a maleic anhydride grafted polyolefin elastomer. It's used for toughening nylon products like PA6, PA66 to enhancing impact resistance etc., and it can also be used as compatibiliser for PA / PE, PA / PP alloy.

Maleic anhydride grafted polypropylene

Lushan series maleic anhydride grafted polypropylene (PP-g- MAH) is evaluated as compatibiliser which is used to fill or reinforce polypropylene and PP/PA,PP/PE alloy. As the polymer coupling agent, it can significantly improve the filled or enhanced PP's mechanical properties and heat resistance, and can also significantly improve PP's shading ab.



Light Stabilisers



Sunovin[®] Light Stabilisers are essential additives in many polymers to minimise the damage caused by exposure to the environment, to boost the exterior performance and to protect the substrate from UV-degradation, discolouration and surface cracking.

Sunovin® additives comprise a range of HALS (Hindered Amine Light Stabilisers) and UV-absorbers.

HALS give excellent UV-protection via capture of free radicals formed during the UV-degradation process, protecting polymer chains from further deterioration. Low molecular weight HALS can be more efficient scavengers but also more mobile than high molecular weight HALS. These high molecular weight HALS are better suited for low migration in polymers longevity of performance and thermal protection. Some HALS also act as effective antioxidants.

UV-absorbers (UVA's) are commonly benzotriazoles, benzophenones or triazines, and are tuned to absorb specific wavelengths in the near-UV spectrum, thus blocking the penetration of damaging radiation into the matrix. Their action is sacrificial and UV-energy is absorbed, then dissipated thermally. For optimum protection, a formulated approach is called for, involving blends of HALS, UV-absorbers and sometimes an antioxidant to offer a complete protection package.

Typical application areas

- Automotive interior & exterior plastics
- Polyurethane foams
- PE pipes, wire & cable applications
- Wood plastic composites

Agricultural films
Artificial turfs
Adhesives & sealants
Polyamides, speciality fibres



Sunovin® is a registered trademark of Sunshow

Optical Brighteners



Jitat is a Hong Kong based chemical company with office and jointly invested manufacturing plants in China. They have been in the business since 1985. Optical brighteners and optical brightening agents (OBAs) absorb light in the ultraviolet and violet region (usually 340-370 nm) of the electromagnetic spectrum, and re-emit light in the blue region (typically 420-470 nm). Fluorescent activity is a short term or rapid emission response; unlike phosphorescence, which is a delayed emission.

These additives are often used to enhance the appearance of colour in fabric and paper, causing a "whitening" effect, making materials look less yellow by increasing the overall amount of blue light reflected.

Optical brighteners for thermoplastics

Jitabright PLI:	Standard optical brightener (OB) for various substrates for processing below 200°C
Jitabright PSF:	Optical brightener for fibre spinning (polyester, PET, PBT) and plastic processing up to 350°C

Optical brighteners for thermosets

	Jitabright PSF:	Suitable for polyester systems
-	Jitabright PLI:	Standard optical brightener for a variety of matrices

- Long lasting effect
 Brightens up all pigmented systems
 Brilliant, bluish whitening effects
- Good light fastness
- Excellent resistance to heat
- High chemical stability
- Low volatility
- Good compatibility with most substrates



Functional Additives Blanc Fixe[™] / Lithopone / Sachtolith[®] / Activox[®]

VENATOR

Venator's functional additives provide a wide variety of benefits for plastic formulators from improving mechanical properties to metal-deactivation properties. They have a range of products to choose from including synthetic barium sulphates, zinc sulphides, lithopones and active zinc oxide that can be used to optimise performance.

Fine tuning plastic performance

Mechanical performance - plastic and glass-reinforced plastics have high mechanical performance demands particularly in terms of impact strength and hardness. Venator's zinc sulphide and barium sulphates have been engineered to improve mechanical performance in a range of resin systems and coloured products.

Aesthetics – transparent polymers can benefit from Venator's barium sulphate grades due to a combination of defined particle size and particle geometry.

Manufacturing throughput – high extruder output is important for masterbatch and film production, helping to reduce processing costs. Also, using additives with low Mohs hardness can reduce abrasion in extruders reducing maintenance costs and intervals. Venator's zinc sulphide and barium sulphate grades can help optimise throughput.



Rubber is the most important application of zinc oxide. It has been used in this capacity for over a century. Zinc oxide along with stearic acid activates sulphur crosslinking of rubber. In addition it provides pigmentary properties which enhance the ability to absorb frictional heat, an important property in tire performance. Essentially all rubber goods contain zinc oxide.

Active zinc oxide has – compared to standard thermal ZnO – a finer particle size distribution that results in a much higher surface area which vastly improves its effectiveness and provides considerably higher efficiency. Due to this activity made on the accelerant, it allows a reduction of the dosage level in rubber mixtures of up to 50% as compared to thermal zinc oxides.

Benefits

- Increased mechanical properties
- Easier extrusion
- Higher output
- Transparency
- Lower dosage to activate rubber crosslinking

Blanc Fixe™ is a trademark of Venator Materials PLC. Sachtolith® and Activox® are registered trademarks of Venator Materials PLC



Innovative Materials for Your Success

Performance Materials and Fillers for Plastics

Talc Finntalc / Plustalc / Microtalc



Mondo Minerals, part of Elementis, is long-term oriented – in every respect. They actively continue to secure raw material around the globe for the next decades and to drive innovation to create new added value. Mondo Minerals is consolidating its position in Asia and the Americas to support its multinational clients. Their aim is to become the preferred global partner of innovation-driven end user industries. Today's and tomorrow's requirements of their customers are at the centre of their efforts. Pure talc, the softest of all minerals with a Mohs hardness of 1, is an organophilic, water repellent and chemically inert mineral. It is characterised as a hydrated magnesium sheet silicate with the formula $Mg_3Si_4O_{10}(OH)_2$. The bond between the layers of brucite (magnesium hydroxide) and silica is very weak and talc undergoes cleavage very readily, giving it a very soft and soapy feel.

In plastics, talc is used to improve the performance of the resins with respect to strength, stiffness and dimensional stability, among others.

Especially in polypropylene, but also in polyethylene and polyamide (nylon), this is clearly noticeable. Some application examples are automotive parts, household appliances or plastic packaging.

Talc for plastics

Mondo talc has a consistent colour and allows troublefree colouristics. All Finntalc® grades are flotated (purified) talc grades and therefore very pure and consistent in quality. This results in low abrasion values and hence extended tool life at moulding. Finntalc SL are grades with higher purity. Advantages are long-term creep resistance in PP pipes and low loss on ignition.



Plustalc[®] and Microtalc[®] grades have a very low iron oxide content. Heat and aging resistance is improved. For home appliances high whiteness is achieved with Plustalc[®] and Microtalc[®] grades.

Fine talc grades with a narrow particle size distribution are also used for nucleation, improved strength and impact performance in automotive parts (e.g. bumpers). Fine talc products are also available in compacted form to provide easy dispersion and improved production output.

-	Crystallisation temperature increase	Shrinkage control
	Stiffness	Warpage reduction
	Higher heat distortion temperature (HDT)	Thermal expansion control
-	Creep resistance	Permeability (gasses/vapor)
	Thermal conductivity	Dimensional stability

Graphene



Angstron Materials, Inc. is the world's largest producer of graphene nanomaterials. As the global leader in graphene production and applications development, Angstron specialises in helping companies engineer graphene solutions with distinct material performance advantages. They have the expertise to partner with customers throughout the commercialisation process from initial screening to market launch. Angstron is the only global manufacturer of graphene that can currently supply industries with large quantities of graphene for its commercialisation needs. To that end, their production capacity is over 300 metric tons annually.

Serving hundreds of customers in over 38 countries, Angstron is the global graphene powerhouse.

Graphene is a high-tech, carbon nanomaterial with unique and unrivaled material properties. Angstron Materials makes a family of graphene materials. On the nanoscale, the materials have different lateral dimensions and thicknesses. Angstron's graphene can also be functionalised to tailor the properties and applications. These raw materials are available as powders or dispersions.

In addition to the raw materials, Angstron offers graphene-enhanced materials. They sell thermal management materials in various form factors such as sheets, pastes and blocks. Also, they make graphene-enhanced nanocomposites which include thermoplastics, thermosets, and coatings. Lastly, Angstron tailor-makes graphene-enhanced formulations of many types for product development programs.

Industries that benefit from the graphene-enhanced nanocomposites include, but are not limited to, plastics, automotive, electronics, packaging, industrial coatings, conductive pastes and aerospace.



Flame Retardants



Nabaltec is a leading supplier of speciality inorganic flame retardants in a global market and an innovative, award-winning force in its field. Know-how, experience and the implementation of complex processes are the basis for prime quality and highly specialised products for many applications. The focus is on a range of prime quality functional fillers for the plastics industry with specific requirements. Design freedom and weight constraints in many industrial areas are solved by using flame-retardant plastics in everything from everyday to high-tech applications.

As most polymers are based on a hydrocarbon framework, fire protection requirements according to industry standards have to be fulfilled. Flame retardants protect modern polymer materials such as automotive and mass transit vehicle interior and exterior parts, building insulation material, circuit boards and cables against combustion, smoke emission and the spread of fire by preventing or retarding the occurrence and propagation of flames.

Halogen-free flame retardancy with metal hydrates

Flame retardants based on metal hydrates, in particular aluminum and magnesium hydroxide, have established themselves over the years as being by far the most important fire retardants in the plastics and coatings sector. In particular their environmental friendliness and favorable price-performance ratio make Nabaltec metal hydrates both sustainable and highly effective flame retardants.

- APYRAL[®], aluminum hydroxide
- APYRAL[®] AOH, aluminum oxide hydroxide
- APYMAG[®], magnesium hydroxide
- APYMAG[®] AOH, an optimised blend of metal hydrates

Benefits

•	Halogen-free
	Environmentally friendly
	Non-toxic
	Low smoke emission
	Higher ignition temperatures
	Less risk of flashover



APYRAL® and APYMAG® are registered trademarks of Nabaltec AG

Boron Nitride PolarTherm^{*} / CoolFlow^{*} / CoolFX^{*}

Boron nitride (BN) is a soft, white-coloured additive that contributes to thermal conductivity in plastics as well as being electrically isolating. Momentive boron nitrides also work as excellent nucleating agents and lubricants. Momentive offers a variety of different products from platelets, agglomerates and specially modified new CooIFX hybrid types for improvement of mechanical properties.

Heat management, lubrication and nucleation

Momentive boron nitride (BN) fillers solve tough heat problems by conducting and dissipating heat far better than other materials. Platelets, agglomerates and hybrid grades are available in various particle sizes varying from 1µm up to 350µm:

- Platelets are often used for lubrication in tribological applications in sizes from 1 to 10µm while in nucleation very fine ones are mostly used.
- Agglomerates are used for heat management in liquid thermoset systems. These are high performance, high purity pressed agglomerates that allow easy incorporation and distribution.
- Hybrid fillers allow the best incorporation and heat transfer properties in thermoplastic compounds.

4.0 Thermal Conductivity (W/mK) 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 20% 30% 40% 50% 60% Boron Nitride Loading (wt%)

Thermal conductivity performance

Electron microscope image of pressed agglomerate







MOMENTIVE

Benefits

- Heat management in thermosets and thermoplastics
- Excellent lubrication
- Nucleation for performance polymers

PolarTherm*, CoolFlow* and CoolFX* are trademarks of Momentive Performance Materials Inc

Precipitated Calcium Carbonate



Cales de LLierca S.A. was founded in 1969 on the site of an ancient lime factory near Girona, Spain. Since then the company has invested extensively in improved process facilities, capacity increase and the development of new products, all of which have contributed greatly to the consolidation of the company and its recognition on the international market.

Precipitated Calcium Carbonate, or PCC (CaCO₃) is refined, purified synthetic calcium carbonate with the same chemical formula as standard calcium carbonates of chalk, limestone and marble. PCC is produced by calcination of specially selected limestone, chosen for its very high calcium carbonate purity with the lowest levels of silica, iron, magnesia and other natural impurities. The limestone is calcined into calcium oxide and then hydrated to form a lime slurry. This slurry is precipitated to PCC under controlled conditions. The result is a PCC with a very defined narrow particle size distribution and extremely good whiteness.

Calprec products

Calprec products are available in two types:

- Calprec PA is a non-coated fine PCC with 1.7µm particle size and a scalenohedral shape.
- Calprec PR is a coated ultrafine PCC with 0.05µm spherical particle size.

Benefits of Calprec PA

- Rheology modifier
- Prevention of sedimentation
- Processing aid
- Higher impact resistance
- Improves weatherability
- Better surface appearance
- Brilliant white colour (TiO₂ extender)

Benefits of Calprec PR

- Improves processing
- Increases impact resistance
- Improves weatherability and surface appearance
- Improves gloss



REM exposure 1/5µm



REM exposure 0.5/3µm

Hollow Glass Spheres



Weight reduction is a driver in many industrial applications for state-of-the-art designs. In automotive, aerospace and mass transit plastic parts become an essential part of the structure. To enable the designer to enhance the given advantage of lightweight plastic parts Grolman offers glass hollow spheres that can allow weight reduction with additional advantages.

rima light bubbles are available for thermoset and thermoplastic applications and meet the strength requirements for various processes.

Specially designed for a variety of processes and applications

Hollow spheres are microbubbles made from Soda Lime Borosilicate glass with an internal cavity which is responsible for the density of the bubble. The wall thickness is designed according to the crush strength requirements. The melting point is high enough to allow use in oven-baked 1k paints and in parts that are painted in automotive paint lines at elevated temperatures.



REM exposures of rima light hollow spheres

Product lines

- rima light S series is designed for thermoplastic compounds
- rima light K series is specially made for thermosetting systems such as unsaturated polyester and epoxy system (e.g. SMC/BMC)
- rima light HS series are high crush resistant spheres for adhesive and plastic applications

- Excellent weight reduction
- Good contribution to flow
- Lubrication during extrusion
- Heat insulation

China Clay / Calcined China Clay



EICL as a specialty chemicals company is the largest integrated kaolin company in Asia Pacific and owns a large number of active kaolin mines in Asia. It has 75 years of in-depth experience in products for the plastics industry. The portfolio contains a full range of hydrous and calcined kaolin products.

Plastics & rubber

Calcined kaolin in plastics provides smooth surfaces, dimensional stability and resistance to chemical attack. It also acts as a rheological modifier and functional filler. Calcined kaolin also conceals fibre reinforcement patterns and reduces shrinkage and cracks during polymer compounding and shape forming.

In plastic films it imparts anti-blocking or infrared absorption characteristics.

In PVC cables calcined kaolin improves electrical resistance at lower cost due to its hydrophobic nature. Generally, using a finer particle size of calcined kaolin increases impact strength of plastics, especially in PVC cables and wires.

In high and medium voltage PVC cables meta-kaolin is used to improve the electrical insulation and chemical resistance.

In rubber kaolin adds strength, abrasion resistance and rigidity/stiffness due to its abrasive property. It finds extensive use in rubber insulation on high voltage power lines. Kaolin is an ideal additive to rubber due to its anisometric 'booklet' particle structure which adds strength and stiffness to the product through enhanced stress transfer.

HIMAPOL – Meta-kaolin recommended for use in insulating PVC compounds to attain volume resistivity in the order of 1014 ohms or above.

HIMARUB – Calcined kaolin for moulding and extrusion of automotive and non-automotive rubber components/products such as seals, hoses, conveyor belts, window profiles, pharmaceutical bottle stoppers and discs as well as PVC cables.

Inert rheological modifier that improves surface appearance
Reinforcement
Reduction of shrinkage and cracks during polymer compounding and shape forming (dimensional stability)
Anti-blocking & infrared absorption in films
Improves the tensile and modulus of ground calcium carbonate based rubber compounds
Improves the ease of extrusion, tear & tensile strength, resistance to abrasion, durability and rigidity
Adds strength, abrasion resistance and rigidity/stiffness to rubber
Rubber insulation on high voltage power lines

Wollastonite _{Casiflux}



Wollastonite is used as a functional filler to enhance the mechanical properties of plastics for better cost effectivity. Wollastonite-filled compounds are mainly used by the automotive, white goods and electrical industries. Typical applications include automotive interior, exterior & under-the-bonnet components and electrical insulation materials. Wollastonite is typically used as a filler in Polyamide (PA 6 and 6.6), PA-ABS blends, Polyolefins (PP / PE), Polyesters (PBT / PET), Polycarbonate (PC) and in Thermosets such as Polyurethane (PU / RRIM applications) and moulding compounds from Epoxy (EP), Phenolic (PHE) and Unsaturated Polyester (UP).

Advantages and benefits of Wollastonite in plastics

Wollastonite is used either as sole reinforcement or in combination with chopped glass fibre or other reinforcements. Partial replacement of chopped glass fibre with Wollastonite improves the surface quality and painted finish and reduces warpage. The fine needles in the moulded surface have no influence on the part aspect ratio after painting. The surface roughness of the needles enhances the adhesion of the paint with the moulded surface.



Microscopic picture of Wollastonite particles

Benefits

	Needle shape particle structure			
		Increased flexural strength and modulus		
		Excellent impact resistance		
		Increased HDT		
		Good dimensional stability		
-	Haro	Iness		
		High scratch and mar resistance		
	Whi	teness		

Decreased need for pigment brighteners



Mica rima mica



Mica belongs to the group of lamellar, silicate minerals. The crystalline structure of mica consists of three-layer platy minerals with a strong internal bonding which provides a very high chemical and weathering stability. Depending on the final application, mica needs to be milled and delaminated to the required particle size distribution and aspect ratio. Through wet milling most engineered grades with high smooth sheet surface and particle edges are obtained.

rima mica is a wet ground muscovite mica with platy and elastic particles and high aspect ratio (particle diameter/thickness).

rima mica is used by the plastics industry as it offers film reinforcement and barrier properties. For injection moulding strengthening and elastic properties are beneficial. In PA and PP compounds mica provides high flexural modulus, improved scratch resistance, improved damping properties, decrease of thermal expansion (CLTE) and improved dimensional stability.

rima mica is used as anti-sticking powder and de-moulding agent in rubber processing.

- Reduction of warpage
- Low coefficient of thermal expansion
- Imparts dimensional stability
- Decrease of thermal expansion (CLTE)
- Film reinforcement
- Barrier properties



SEM pictures rima mica 200R

Carbon Fibre CFTRIM / CF FLEX / CF BASE



Based on 20 years of experience in reinforced compounding markets, C.A.R. FiberTec GmbH specialises in carbon fibre textile products for composite & compounding markets as well as concrete and textile applications. Due to their excellent strength, stiffness and weight ratio, carbon fibres enable advanced solutions for critical applications where light weight in combination with structural durability is critical.

C.A.R. FiberTec's proprietary reprocessing technologies and process standards are designed to meet specific market requirements determined by end-use application. Product conversion standards include sourcing of high quality residual carbon fibre products at technology-leading industries e.g. aviation, automotive as well as strict sorting by fibre type, grade, properties and sizing throughout the conversion process. Our products are not heat-treated or chemically altered, allowing retention of the original properties of the virgin feedstock.

Portfolio standards

- PRODUCT TRACEABILITY
 Product suitability to final application is determined through virgin properties as well as life cycle treatment during processing.
- PRODUCT SPECIFICATION
 Parameters relevant for sorting are fibre type (properties), grade (sizing, filaments) and source (process treatment).
- PRODUCT PURITY
 Pure & dry carbon fibre products virgin sized. Free of any contamination as binder, matrix resins or hybrid fibre.

CF TRIM – chopped fibre

Appearance: lint-free, free flowing Cut length: 4 mm up to 72 mm 4 mm or 6 mm steps Tolerance: +/- 0.5 mm Bulk density: > 350 g/l



Benefits

- Excellent specific strength modulus / weight performance
- Functional reinforcement, e.g. conductivity, wear resistance
- Reprocessed CF marketing advantage at virgin quality
- Excellent proven processing characteristics without bridging or deposit at various extruder feeding solutions
- Sustainable and eco-friendly products and conversion processing in compliance with ecological aspects on sustainability

Carbon fibre portfolio

- Carbon fibre based on Polyacrylonitrile precursor (PAN)
- Fibre grades: IM (intermediate modulus) / HT (high tenacity)
- Filament count: 3 K, 12 K, 24 K, 50 K
- Filament diameter: 5 7 μm
- Sizing: Epoxy, Polyurethane: applicable for thermoset, thermoplastics, others
- Sizing level: 0.2 1.5 %

CF TRIM SF - stable fibre Appearance: strand/spread-out Cut length: up to 90 mm customised Tows yield: ≥ 200 TEX





Innovative Materials for Your Success

Pigments for Plastics

Titanium Dioxide / Zinc Sulphides Delitio / Tioxide/ Hombitan / Sachtleben Hombitec / Sachtolith[®] / Sachtosperse

VENATOR

Venator Corp. is a leading supplier of inorganic pigments for the plastics industry. Huntsman acquired the Rockwood pigments and performance additives businesses and later carved out that division by an IPO under the name of Venator. Thus one of the most diversified producers of pigments and additives in the world was created.

TiO₂ for polymer systems

Venator has a broad range of TiO_2 , nano TiO_2 and ZnS products to meet the varied technical needs of the polymer market.

	Hombitan LW & Hombitan LOCR-K:	Anatase grades with low abrasion, high dispersibility, very bluish undertone
	Tioxide R-FC 5:	Versatile, bluish undertone, indoor applications
	Sachtleben R405:	Versatile, bluish undertone, indoor applications, FDA approved
	TioxideTR 28 &TR 48:	Low lacing in film applications, excellent dispersibility, bluish undertone
	TioxideTR 42:	Highly durable grade for exterior applications, good rheological properties and bluish undertone
	Tioxide R-TC 30 & Sachtleben R420:	High durability for exterior applications, bluish undertone
-	Deltio 81X:	Free flow and dust free grade with highest durability
-	Sachtolith HDS:	Zinc sulphide, only white pigment to retain mechanical properties of glass fibre reinforced plastics
	Hombitec RM range:	Nano-TiO ₂ long-term transparent inorganic UV-Blocker

- Excellent brightness and blue tone
- Broad polymer suitability
- Enhanced highly loaded masterbatches
- Excellent colour stability
- Low reactivity
- High durability
- Ease of powder handling and low dust (Deltio)
- Inorganic UV additives



Pouring a conventional product



Pouring DELTIO[™] 5x pigment



Infrared Reflective Pigments ALTIRIS®

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Product range

The sun can heat up the coloured surfaces of exterior polymers; increased heat build-up can cause warping and product failure. ALTIRIS[®] infrared reflecting pigment is a novel solution for the polymer industry, designed to help reduce energy without compromising on colour. When mixed with coloured pigments the result is higher infrared reflectance in an unprecedented range of colourful formulations. It can help polymer manufacturers to expand their colour palette and can help market penetration into hotter regions of the world.

ALTIRIS[®] pigment has been engineered to give high solar reflectance by modifying the rutile titanium dioxide crystal. The pigment is super durable. ALTIRIS[®] infrared reflecting pigment can help to reduce the amount of the sun's heat that is absorbed, helping to provide greater durability for exterior polymers or heat sensitive applications, like vinyl sidings, roof tiles or dashboards.

There are three different products available:

ALTIRIS[®] 800

- Engineered to give optimal near-infrared / visible reflectance ratios
- Offers exceptionally low tinting strength with high solar reflectance
- For production of dark colours (L* < 40) e.g. black and vibrant red colours</p>

ALTIRIS[®] 500

- Engineered for high solar reflectance
- For the production of medium and light shades (L* > 40) with high solar reflectance

ALTIRIS[®] W400 pigment

- For premium white and bright coloured exterior surfaces
- Designed to maximise total solar reflectance
- Excellent tinting strength
- Enhanced heat management and improved durability



Benefits

Reduce heat build-up without affecting visible colour

infrared reflecting pigments

- Expanded colour options (more than 80% of the colour space can be reached)
- Flexible and easy to incorporate
- Excellent durability

Pigment Blacks



Orion Engineered Carbons is one of the world's leading suppliers of Carbon Black and other specialised pigments. The company operates numerous global production sites and four Applied Technology Centres, focusing on quality supply and collaborative partnerships with customers.

Products for polymer systems

Specialty Carbon Blacks in the polymer industry are used for obtaining a deep jet black colour and absorb detrimental UV light and convert it into heat. This makes plastics such as polyolefins and polyethylene more resistant to UV radiation. A clear correlation between primary particle size and UV protection can be observed: The finer the particle size, the better the ultraviolet light absorption. UV protection is important for extending the life of exterior coatings, adhesives and sealants, plastic pipe and other products exposed to the sun.



Anti-static treatment is also an important application area, e.g. in the field of compounds for power cables. In the plastics industry Specialty Carbon Blacks are used to pigment synthetic fibres.

	Pipes	Wire / Cable	Foils	Blow & Injection Moulding	Fibres	Thermal Insulation	Miscellaneous
Application	Pressure pipes (water, gas) irrigation & waste water pipes, conductive pipes / hoses	Power cables (LV to HV), cable coatings	Agricultural, packaging, geomembranes, foil coating, multilayer foils	Packaging, household goods, container, automotive parts, electronic industry	Textile fibres, industrial fibres, non- woven fabric	Construction	Thermoset, TPE (e.g. shoe soles), profiles, FDA compliant grades, biodegradable plastics
Main Properties	Dispersibility UV Protection Conductivity	Dispersibility UV Protection Conductivity	Dispersibility UV Protection Conductivity	UV Protection Pigmentation Conductivity	Dispersibility Pigmentation	IR Absorption	Thixotropy / Filler Dispersibility Pigmentation Reinforcement UV Protection
	ga					<u>E</u> E	
Key brands	PRINTEX® AROSPERSE® HIBLACK®	PRINTEX® HIBLACK®	PRINTEX® AROSPERSE® HIBLACK®	PRINTEX® AROSPERSE® HIBLACK®	PRINTEX® AROSPERSE® GAS BLACK®	LAMP BLACK AROSPERSE®	PRINTEX® AROSPERSE® HIBLACK® LAMP BLACK

Printex®, Arosperse® and HiBlack® are registered trademarks of Orion Engineered Carbons GmbH

VENATOR

Ultramarine & Manganese Violet Pigments CM / Premier / Prestige

Holliday Pigments, now part of Venator, is a world leading supplier of ultramarine and manganese violet pigments. Over 130 years of manufacture has enabled them to establish an enviable reputation as leaders in ultramarine technology and experts in the use of ultramarines and manganese violet pigments in a wide variety of end applications. Especially ultramarine blue pigments with their reddish blue shade occupy a unique place in the world of colour.

Product range

The range of pigments for plastics covers the colour spectrum from blue to pink. All grades show bright, attractive shades both in mass tone and when blended with other pigments. The colour range includes ultramarines from green-shade blue to violet and pink as well as manganese violet for the plastic market. The colour of each grade is controlled within tight limits to ensure excellent batch to batch consistency.

- PREMIER D (very low moisture: <0.05%)</p>
- PREMIER F (fine particle size distribution)
- PREMIER BC (bottle cap applications)
- PRESTIGE (low dust)
- Acid resistant (encapsulated)
- Blues, Violets and Pinks
- Treated grades (silicon and stearate)
- Low volatile matter (non organoleptic effect)

- Heavy metal free
 High heat stability and excellent light fastness
 FDA approved
 Easy to disperse
 Non-migratory
- Non-warping



Inorganic Colour Pigments Colourplex / Ferroxide® / Transoxide / Tan Chrome Green / Solaplex®

VENATOR

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Product range

Venator is one of the world's leading suppliers of synthetic opaque and transparent iron oxides. They manufacture high-quality pigment particles in Europe, Asia Pacific and North America to help ensure global availability and efficient, sustainable supply chains. The long-established Ferroxide® pigment range is manufactured via the Penniman-Zoph process, which delivers grades of excellent tinting strength and purity. Venator manufactures a broad range of heat-stable yellow iron oxides and tan and black calcined ferrites. These, alongside the regular red iron oxides, give excellent stability at elevated process and end-use temperatures. To complement



the iron oxides, Venator offers a comprehensive range of industry benchmark chrome oxide green pigments. Furthermore, Venator produces innovative tin zinc titanates (PY 216), which are heavy metal-free, heat stable inorganic orange pigments.

Benefits

-	Ferroxide [®] pigments:	Untreated and treated yellow iron oxides (PY 42). Untreated red iron oxides (PR 101) with shades ranging from a unique orange to bluish red. Black iron oxides (PBk 11). All exhibit excellent hiding power, wetting, dispersion and suspension properties. Available as micronised or non-micronised versions.
-	Mapico™ pigments:	Heat stable range of clean, rich colours (PY 119, PBr 11), which disperse easily, are weatherfast and chemically resistant.
	Chromium Oxide Greens:	A comprehensive range of chromium oxide pigments (PG 17) featuring regular and easily dispersible grades. They provide excellent lightfastness, weatherability, heat stability, chemical resistance, colour, tint and hiding power as well as outstanding purity.
-	Solaplex [®] pigments:	Heat stable tin zinc titanates, which range from a reddish yellow to orange shades. Heavy metal free alternatives to cadmium or lead chromate pigments for all kinds of polymers. Also suitable for exterior applications.

Ferroxide® and Solaplex® are registered trademarks of Venator Materials PLC. Mapico™ is a trademark of Venator Materials PLC.

Complex Inorganic Colour Pigments (CICPs) / Lasermarking Pigments



TOMATEC (Toyo Seikan Material Technology Co., Ltd.) is a leading manufacturer of a wide range of CICPs with 65 years of experience and production sides in Japan, China and Indonesia.

Product range

CICPs are inorganic pigments that consist of two or more metal oxides (therefore also known as Mixed Metal Oxides) and are produced by calcination at temperatures > 800°C. CICPs are highly durable bright colours, which are typically used in demanding applications, where temperature, chemical, light or weathering resistance are critical. Due to their IR reflective properties, CICPs are used to produce "cool colours."

CICPs are non-toxic as they are chemically inert. Nevertheless, some of them contain heavy metals, such as Cr, Sb, or Ni. In order to meet the growing demand for heavy metal-free solutions, TOMATEC developed environmentally friendly pigments, which are heavy metal-free and offer very similar shades to well known colour indices, e.g. PBr 48 as alternatives to PBr 24 types.

The innovative Tomatec laser marking types can be used at much lower concentration than conventional types.

	PY 53:	yellow	-	PG 50:	green
	PY 119:	brown		PBr 24:	buff
	PY 157:	yellow		PBr 29:	black
-	PY 161:	buff	-	PBr 33:	brown to dark brown
-	PY 189:	yellow	-	PBr 34:	brown or black
-	PV 47:	pink	-	PBr 48:	buff
	PB 28:	blue to turquoise shades		PBk 26:	black
	PB 36:	blue to turquoise shades		PBk 27:	black
	PB 73:	pink		PBk 28:	black
	PB 74:	blue		Laser	black marking
	PG 17:	black		Marking:	

•	High heat stability
-	High chemical resistance
-	Excellent light and weather stability
-	IR-reflective
	Fine laser markings at very low concentrations



Rare Earth Pigment Neolor™ / greenTop



Hongbo Te was established in 2008 and is located in the Inner Mongolian Rare Earth High-Tech Industrial Development Zone. After having produced orange and red rare earth pigments already for some years, Hongbo Te acquired the Neolor[™] business from the market leader Solvay in 2016. Different to Solvay, which was producing by the gas-solid route only, Hongbo Te uses the solid-solid as well as the gas-solid production route, which leads to a bigger variety of grades. Where Solvay had one big gassolid reactor only, Hongbo Te uses several smaller reactors in parallel in a modular way. Thus a safe supply chain is assured.

Product range

Hongbo Te offers orange and red cerium sulphide pigments under the tradenames Neolor[™] and greenTop. Those pigments have a very high heat fastness, migration stability as well as light and weather fastness, which makes them ideal especially for the colouration of technical polymers. Because they are heavy metal-free, those pigments are excellent replacements of cadmium and lead chromate pigments, which in many regions and applications can no longer be used. Additionally, the cerium sulphides enhance the durability of plastics and reduce the need for anti-UV additives. These pigments have very effective IR-reflecting properties. Due to the limited number of orange and red pigments for these purposes, the pigments are ideal for the formulation of "cool colours". Cerium sulphides have unique soft crystals, which enable their use in glass fibre filled plastics. Neolor[™] and greenTop pigments are often used for shading, because organic pigments in such small concentrations deteriorate and are difficult to dose.

Typical applications for cerium sulphide pigments include automotive plastic parts, gardening and power tools, outdoor furniture, artificial grass, sport shoes, outdoor toys, window profiles and claddings.

Benefits

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÷.,	Heavy Heldi-Hee
	Soft crystals enable usage in glass fibre filled plastics
	Reduced need of light stabilisers
	IR reflective orange and red pigments
	Ideal for shading
	Heat fastness up to 320° C
	Very high light and weather fastness





Under the trade names rima colour/Verdcol, Grolman offers a range of organic pigments and under the trade name rima sol a range of solvent dyes. All are selected for plastics applications, with high tinting strength, good dispersibility and high fastness properties.

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Benefits

Excellent FPV values

Technical support – pre & post sales

Prompt deliveries

High temperature resistance

Consistent quality is assured by our in-house quality assurance department

Colour Index	Grade	leat [^o C] Stability	/ligration in PVC]	lubber	SVC	E/PP	ABS	ő	ç	Å
PV 14 (+r)	Verdcol DI Vellow 14 GP	180	2 E		•		4	ш	ш.	ш.
PV 62	rima colour Yellow 620	250	4	-	-		п	П		
PV 83 (tr)	Verdcol DI Yellow 83 PTB	200	5	_	-	-				
PY 109	rima colour Yellow 1093	280	5		П					П
PY 110 (op)	rima colour Yellow 1103RN	300	5		•					
PY 151	Verdcol BML Yellow 151 GH	260	5							
PY 138	rima colour Yellow 1382	280	5							
PY 139	rima colour Yellow 1395P	240	4-5							
PY 180	Verdcol BML Yellow 180 T/2T/3T	280	5		•		•			
PY 183	rima colour Yellow 1835	300	4-5							
PY 191	rima colour Yellow 1910	300	5		•		•			
PO 43	Verdcol Orange 43	280	4-5		•		•			
PO 64	rima colour Orange 641	280	5	-	•		•			
PO 73	rima colour Orange 733C	300	5			-				
PR 122 (tr)	Verdcol Pink 122 GP	300	5		•		•	•	•	
PR 144	Verdcol Red 144	300	5			-	•	-		
PR 149	rima colour Red 1490/1490F	260	5		•		•			
PR 166	Verdcol Scarlet 166	300	4-5		•					
PR 170	rima colour Red 1703Y/1707B	260	4-5							
PR 176 (tr)	Verdcol BML Carmine 176 T/2T	260	5		•					
PR 177	Verdcol Red 177	260	5	-	•					
PR 179	rima colour Red 1792P	300	5	•	-	-				
PR 254	rima colour Red 2543CO/2546PS	300	5	-	-			-		
PV 19 (β)	Verdcol Violet 19 B2	300	5	-	•					
ΡV 19 (γ)	Verdcol Violet 19 G	300	5	-	•					
PV 23	Verdcol Violet 23 E 01/23 KR	240	4-5		•					
PB 15:0	rima colour Blue 1507	200	5		•					
PB 15:1	rima colour Blue 1518P/1511F	280	5		•		-			
PB 15:3	rima colour Blue 1538P/1531F	300	5				-		-	
PG 7	rima colour Green 7087/7087F	300	5	-	-	•	-	•	-	•

Colour Index	Solvent Dyes	Heat [^o C] Stability	S	SAN	ABS	PC	PA	PMMA	PET	PVC-U
SY 93	rima sol Yellow 931	280		-		-		-	-	-
SO 60	rima sol Orange 601	300		-		-		-		
SR 135	rima sol Red 1351	300						•		
SB 104	rima sol Blue 1041	300								

 \blacksquare = highly recommended use \square = possible use = not recommended

Organic Pigments & Preparations **TOYOINKEUROPE** Cosmos / Lionol / Lionogen /Lutetia



Product range

Toyo Ink offers a range of high performance organic pigments (e.g. phthalocyanine blues and greens, and dioxazine violets) as well as a range of low warping pigment preparations for plastics:

	Lionogen Violets:	PV 23 types, bluish or reddish shades
	Cosmos Blues:	PB 15.0 types
	Lionol Blues:	very heat stable PB 15.1 and PB 15.3 types
	Lutetia and Lionol Greens:	PG 7 and PG 36 types
	Low bronzing:	phthalocyanine blue grades with low bronzing properties
-	Low warping:	phthalocyanine blues and greens with low warping properties
	Lioprep:	low warping pigment preparations
	Fibre grades:	PV 23, PB 15.1 and PB 15.3 grades with very low filter pressure values

- High colour strength
- Excellent dispersibility
- Low warping qualities
- Low bronzing qualities
- Highest heat stability
- Very low filter test values for fibre and film applications



SCHLENK 💋

Metallic Pigments Metaface / Powdal / Grandal® / Constant Multiflect® Wave / Zenexo® / Luminor Multiprint / Unicoats

Schlenk is an internationally successful family enterprise founded in 1879. Worldwide, Schlenk employs about 1000 members of staff and is a leading international manufacturer of metal powders, pigments and foils.

Product range

Schlenk supplies a wide range of effect pigments. It stretches from leafing or non-leafing Aluminium pigments (Cornflake or Silverdollar types) and extremely thin and brilliant pigments for films, called vacuum-metallised pigments (VMPs), to leafing and non-leafing gold-bronze and platelet-shaped zinc pigments. These products are available as powders, pastes and granules.

-	Aluminium and goldbronze ON pastes
	Grandal [®] P aluminium pellets
	Various types of untreated and treated aluminium and goldbronze powders and flitter types
	Multiflect® holographic pigments
	Unique gold effect pigments (Zenexo®) and novel chrome-like effect pigments

Benefits

- Metallic silver effects with good hiding power or sparkling brightness
- Metallic goldbronze effects in various shades (red gold, pale gold, rich pale gold, rich gold and others) with good hiding power or sparkling brightness
- Coated types for improved chemical resistance, e.g. for PVC systems and outdoor applications
- Easy to disperse aluminium pellets for dust and solvent free handling
- Effect pigments exhibiting polychromatic light sparks when perceived under directional lighting
- Ultra-thin gold pigments with outstanding shade and hiding power
- Chrome-like effects without chrome
- Apart from metallic effects ultra-thin pigments have laser marking properties



Grandal® , Multiflect® and Zenexo® are registered trademarks of Schlenk Metallic Pigments GmbH

Pearlescent Pigments, Lasermarking Pigments & Glitter



The JointColor Group is an integrated manufacturing, sales and marketing organisation under the aegis of JointColor Group (HK) Co., LTD. It was founded in 2013, but has a management history dating back to 1988. On their four production sites they manufacture pearlescent pigments based on natural or synthetic mica and glass flakes as well as the synthetic mica itself and glitter.

Product range

The product range includes pearlescent pigments based on natural or synthetic mica or glass, which are coated with TiO_2 , Fe_2O_3 and SiO_2 . Thus silver white, iridescent (rainbow), golden, cupreous (metallic) or diamond-like effects can be achieved in all kinds of polymers.

Natural mica-based pearlescent pigments

The classic pearlescent pigment range is based on natural mica. Additional surface treatments lead to further benefits, e.g. antiyellowing (AY series) and weather resistance (WR series).

Dust-free series

Dust-free preparations are offered for better handling and processing in the plastic industry. Those contain 70% pigment and 30% PE wax as an easy-to-handle prill or granule.

In summary, the following portfolio is available.

Synthetic mica-based pearlescent pigments

Synthetic mica is much purer and whiter than natural mica. It has thinner platelets and a more uniform particle size distribution and aspect ratio. Pearl pigments based on synthetic mica powder show a bigger light refraction difference between the TiO_2 / Fe_2O_3 layers, which makes the final effect more vivid. Based on those advantages JointColor decided to build up their own synthetic mica production dedicated to pearlescent pigments only. Thus JointColor offers a broad range of pearlescent pigments based on synthetic mica, including surface treated grades for anti-yellowing (AY series) or weather resistance (WR series).

Base	Series			
	Silver White	Rainbow	Gold Luster	Metallic Luster
Natural Mica	AG1xx	AG2xx	AG3xx	AG5xx
Synthetic Mica	AG61xx	AG62xx	AG63xx	AG65xx
Natural Mica Weather Resistent	AG91xxWR	AG92xxWR	AG93xxWR	AG95xxWR
Synthetic Mica Weather Resistent	AG61xxWR	AG62xxWR	AG63xxWR	AG65xxWR
Natural Mica Anti Yellowing	AG1xxAY			
Synthetic Mica Anti Yellowing	AG61xxAY			
Natural Mica Dust Free	AG1xxNDPEW30			
Synthetic Mica Dust Free	AG61xxNDPEW30			

Specialty products

Pearl pigments based on glass (Ca-Al borosilicate) platelets give very high glitter / diamond-like effects (AG8xxx series). Synthetic mica based grades, which beneath the TiO_2 and/or Fe_2O_3 layer have an additional SiO_2 surface coating show colour variable effects (AG68xx / Multi-Color series). By adding colour pigments (e.g. Fe_2O_3 , manganese violet, pigment black) to the surface coating, grades with interesting colour effects are produced. By combining pigment black with Cr in the surface coating, JointColor has developed unique colour variable pigments with a very high opacity (CF series).

Laser marking pigments

JointColor has developed the AG Laser111, which is a classic laser marking pigment based on mica, Sb_2O_3 and SnO_2 . Based on AG Laser 111 black markings can be achieved.

Glitter

Fuding Glitter Pigment Co.,LTD. is the well-known daughter company of JointColor. They offer glitter products based on aluminium or PET, coloured by dyes or pigments and which are available in various sizes and forms.

Fluorescent Pigments



Sterling Colour is one of the world's principal suppliers of Daylight Fluorescent Pigments. Sterling was established in the UK over forty years ago and is situated in Stalybridge near Manchester, England. Since 1981 it has been part of the original Dane company, which started as a printing ink company in East London in 1853. Dane has a long history of providing specialised colours for plastics applications.

Daylight fluorescent pigments for polymer systems

Daylight fluorescent colours are finely ground resin systems that have unique fluorescent dyes incorporated into them. The type of resin system determines the chemical properties of the different ranges, and the applications where they should be used. Plastics come in a variety of forms and both thermoset and thermoplastic types, formed in a wide-variety of ways. It can be pigmented with fluorescent pigments to give a brilliant effect.

Fluorescent colours are much brighter than conventional non-fluorescent colours and often only low loadings are required to achieve a bright fluorescent effect. The final colour and opacity depends on the characteristics of the polymer as well as the loading and type of fluorescent pigment and the use of an opacifying pigment. Thermoplastic polymers are coloured most readily by the use of a melt-in thermoplastic grade whilst thermoset applications, depending on processing temperature, will find a thermoset pigment more effective. Daylight fluorescent pigments can be included directly or through the medium of a masterbatch formulation.

230 Series: Based on a unique thermoset resin matrix, offering improved resistance properties. Reduced formaldehyde (ISO 14184-1), all batches are certified. The high colour strength makes it economical to use and the very small spherical shaped particles ensure easy dispersion. It is particularly recommended for PVC, where dye migration occurs with other types of pigments. It is also recommended for a limited number of plastic applications because of its resistance to plate-out.

911 Series: A high strength, formaldehyde free, thermoplastic pigment with superior temperature and light stability, designed for use in plastics. The polyamide / polyester 911 series pigments are compatible with most polymers in general use and are recommended for processing between 175°C and 240°C.

915 Series: Similar to 911 series but with a lower melting point recommended for masterbatch manufacture and processing between 115°C and 220°C. This series has a medium particle size to reduce dusting and is compatible with most polymers. It is also suited to dry colourblending preparations, for use in plastics and mouldings applications

925 Series: Based on a polyamide / polyester thermoplastic copolymer the 925 series offers a very high tinting strength. It is formaldehydefree with good temperature and light stability for plastics. The colours disperse and are compatible with most polymers in general use. It is recommended for processing between 170° C - 240° C.

Gem-Tone series: The Gem-Tone products are polymeric dyes for use in clarified PP, which have an FDA food contact approvals. They offer superior clarity, extraction and migration properties and show virtually no effect on crystallisation behaviour of clarified PP.

- Very bright colours
- Broad polymer suitability
- Easy to disperse





Luminescent & UV / IR Pigments



Next Generation B.V. founded in 2003 and headquartered in the Netherlands, is a producer of photoluminescent and electroluminescent pigments. Next Generation offers non-toxic, non-radiating pigments under the brand names NLP (New Luminescent Pigments) and EL (Electroluminescent Pigments).

Photoluminesence

New Luminescent Pigments (NLP), respond to day and artificial light by absorbing light energy while giving it back when light conditions are changed to a darker environment. They can be used in many applications and products such as coatings, inks, plastics, rubber, ceramic and glass. NLP are used in toys, safety or decorative products. NLP comply with EU legislation and in masterbatch are FDA approved for children toys and direct food contact. They are available in the colours yellow green, ocean blue, light blue, purple, red and white with particle sizes from 3–450 µm.

Electroluminesence

EL is similar in chemical composition to older luminescent pigments, it is a hybrid between old and new technology available which gives light (80–120 CD) as it receives electricity. EL is available in several colours similar to photoluminescence. EL can be used in inks, coatings, plastics and PVC sheets.

- Big variety of luminescent pigments (various particle sizes and colours)
- Available as powders or ready-made masterbatches
- Innovative electroluminescent pigments available



Thermochromic Pigments ChromaZone[®] / Thermobatch[®]



TMC Hallcrest is a family owned pioneer of temperature-sensitive, colour changing graphic technology known as thermographics. For almost 40 years thermographics have been used to monitor / communicate temperature, and solve communication / identification problems in a wide range of industrial applications with multiple manufacturing sites in the US and UK.

Product range

ChromaZone® pigments are available as free flowing powders or slurries. They change from coloured to colourless as temperature rises, with the colour reappearing when the temperature is reduced. This thermochromic effect is a highly marketable characteristic.

It can be used to add security or brand protection or gives a visual display of temperature change. ChromaZone® is used in various applications to create many effects.

For those customers which do not want to disperse the ChromaZone® pigments by themselves, ready-made masterbatches are offered. Those THERMOBATCH® masterbatches based on an EVA carrier are loaded with approximately 20% thermochromic pigments. The masterbatch is compatible with numerous polymers (e.g. PE, PP, PS, EVA), but not with PET and PC. THERMOBATCH® EVA masterbatch offers reversible colour changing properties to moulded items, e.g. a baby plastic spoon. Standard activation temperatures are 15, 31 and 47° C. Other activation temperatures from -10 to +69° C are available as well.

Mechanism



SPECIAL COLOURS: Turquoise, Brown & Purple (special mixes are also available upon request)

ChromaZone® and Thermobatch® are registered trademarks of TMC Hallcrest

the colour forming components are separated. Therefore no



Photochromic Dyes Reversacol



Vivimed is a world leader in the development of innovative photochromic dyes. They offer dyes with a reversible colour change when exposed to ultraviolet sources, such as sunlight.



Photochromic dyes for polymer systems

The Reversacol[™] photochromic range consists of over 30 vibrant colours. In addition there is a range of unique single molecule photochromic greys which offer the advantage of achieving a neutral colour without the need to mix several dyes. Applications for Reversacol[™] photochromic dyes in plastics include lenses, toys, novelties, packaging, security markers and films/laminates.

Reversacol[™] Dyes are readily incorporated into plastics extrusion processes due to their high temperature resistance. The flexural modulus of the matrix is an important consideration for the dye performance. Softer, low flexural modulus polymers such as LDPE, HDPE and polypropylene are all excellent media for exhibiting Reversacol[™] photochromic dye activation. Engineering plastics such as polycarbonate, polymethyl methacrylate, PET, styrenes and ABS tend to have higher flexural modulus which can lead to a reduced photochromic response: the matrix can be physically too stiff to allow the photochromic molecules to twist into their fully activated forms.



- Reversible colour change
- Single step colour change (colourless to colour)
- Temperature resistant up to minimum 260° C

Grolman Lab Services

Your technical support for success

Every phase in the development of a new plastic part is important: from the selection of each raw material, the process of compounding and moulding up to the customising of the final part such as cleaning, drilling, die-cutting or painting and mechanical testing. Grolman laboratories have been established and equipped to help you with this challenge. In our lab, we can:

Provide cost-effective solutions for your technical needs		
Train our sales and technical people to facilitate a better dialogue with you		
Offer testing services which include:		
Compound development or optimisation		
- Moulding		
 Mechanical testing and temperature performance		
 Heat and electrical conductivity		
Paintability		
 Surface tension and scratch resistance		

Additionally, we have at our disposal a dedicated team of industry experts who are on hand to provide valuable independent testing, application and formulation advice for all products offered in our plastics portfolio as well as regulatory support for introducing the end products into the market.

This information and all technical and other advice is based on Grolman's present knowledge and experience. However, Grolman assumes no liability for such information or advice, including the extent to which such information or advice may relate to third-party intellectual property rights. Grolman reserves the right to make any changes to information or advice at any time, without prior or subsequent notice. Grolman disclaims all representations and warranties, whether express or implied, and shall have no liability for the merchantability of the product or its fitness for a particular purpose (even if Grolman is aware of such purpose), or otherwise. Grolman shall not be responsible for consequential, indirect or incidental damages (including loss of profit) of any kind. It is the customer's sole responsibility to arrange for the inspection and testing of all products by qualified experts. Reference to trade names used by other companies is neither a recommendation nor an endorsement of the corresponding product, and does not imply that similar products could not be used.





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