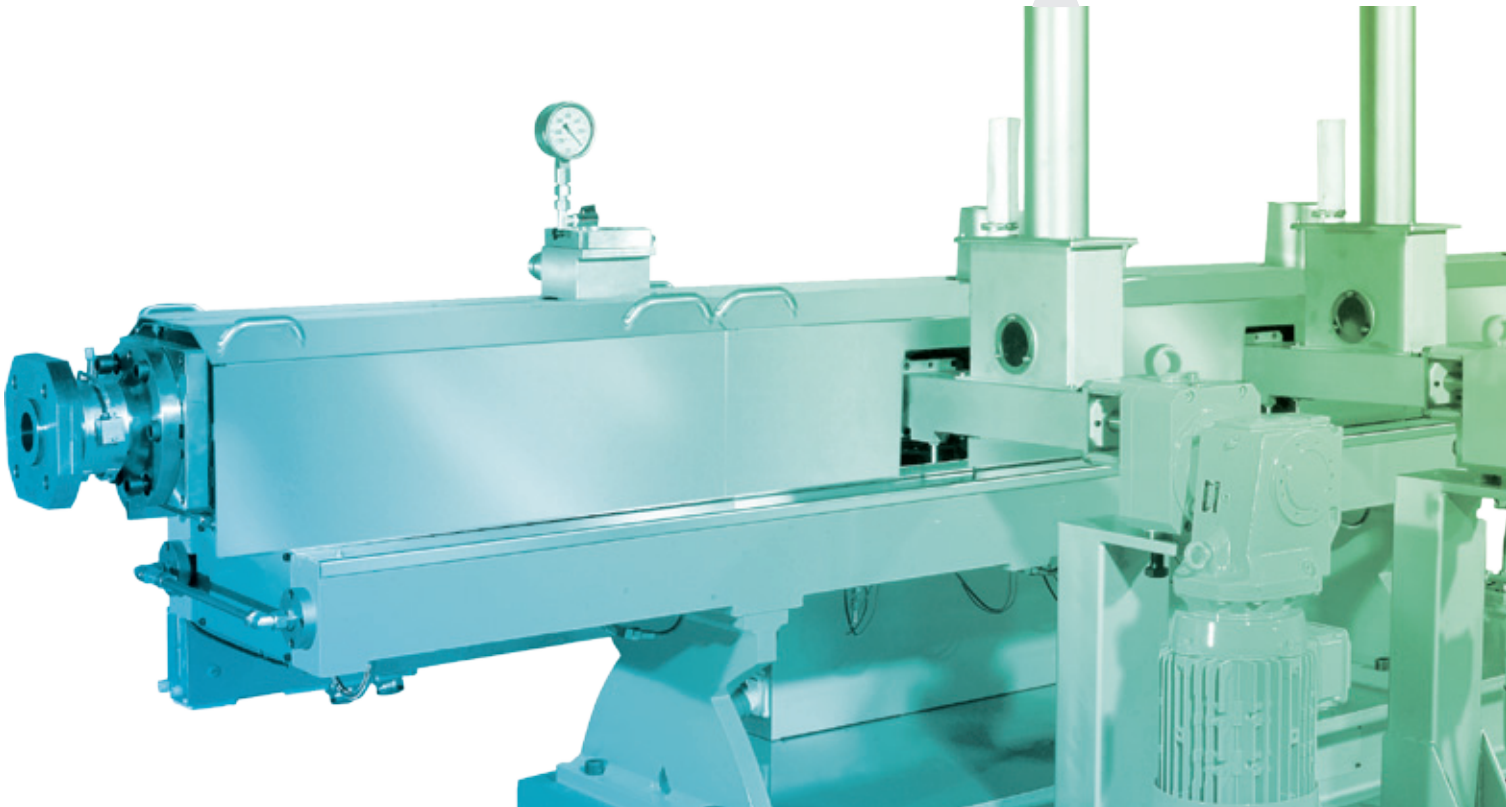
Your one-stop shop for polymer additives

Armid, Armoquell, Armoslip, Armostat, Armowax, Ketjenblack, Nourycryl, Nourymix, Perkadox, Perkalite, Perkastab, Trigonox

AkzoNobel

Tomorrow's Answers Today



AkzoNobel is proud to be one of the world's leading industrial companies

In fact, we are the largest global paints and coatings company. As a major producer of specialty chemicals we supply industries worldwide with quality ingredients for life's essentials. We think about the future, but act in the present. We're passionate about introducing new ideas and developing sustainable answers for our customers.

We have operations in more than 80 countries, and employ around 55,000 people, who are committed to excellence and delivering **Tomorrow's Answers Today™**.

Our Functional Chemicals business makes organic peroxides, metal alkyls, organometallic specialities and polymer additives. We supply essential products used in the production and processing of thermoplastic resins as well as thermoset and elastomeric materials.

AkzoNobel: Looking beyond horizons

We have a long history in polymer additives, starting with the world's first commercial production of fatty amines in 1949. Since then we have added many new additives to our product portfolio, with the growth of plastics in everyday life.

Today, we are one of the world's top producers with a broad range of polymer additives. Our products find their way into a wide range of plastic and rubber applications. These include caps and closures, bottles, films, foamed polymers, cables, clothing, flooring, pigment pastes and coatings, to name a few.

Our products play a vital role in modern plastics and coatings. They improve processing of polymers and enhance their properties. They make polymers antistatic or electroconductive, improve their flame retardancy or control the MFI and MWD of your polypropylene.

From antistatic additives to electroconductive blacks and heat stabilizers to high performance flame retardants and synergists and heat stabilizers, we offer a whole range of polymer additives in one stop. We are home to the best known brands in the business. Examples include Armostat, Armoslip, Ketjenblack, Perkalite, Perkastab, Trigonox, Perkadox and Armoquell.

This product guide provides an overview of our main, commercially available polymer additives.

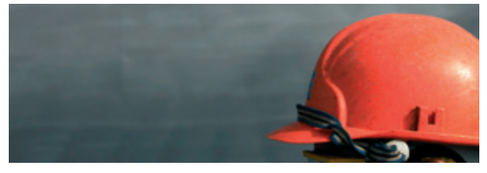
At AkzoNobel we look beyond horizons. We believe that what is good for you today is not necessarily good enough for you tomorrow. We are committed to helping you further improve the production, modification, compounding and processing of your polymers. We offer you the technological answers you need.

Our range of polymer additives

Security of supply

Sustainable solutions

Tomorrow's Answers Today

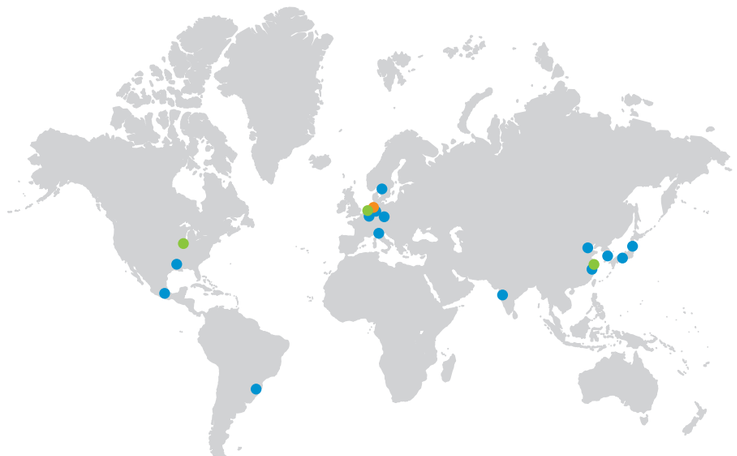


Safety: Our top priority

Our manufacturing sites and distribution centers are found all around the globe, including joint ventures in Japan and China. Our global distribution network allows us to deliver our products to you anywhere in the world. That's how we ensure security of supply and easy access to quality products wherever you are.

All our sites are ISO 9001 and ISO 14001 certified to ensure the highest product quality and strict compliance with environmental regulations. We continually invest in manufacturing techniques, high quality standards, safety, innovation, active technical support and a reliable supply chain.

A global partner



- Research and Development
- Regional headquarters
- Manufacturing sites

Food Approvals
Many applications of polymer additives, including toys, products intended to hold/transport drinking water and packaging materials for food and pharmaceuticals, are subject to food contact regulations. Detailed information with regards to food-contact approvals worldwide for our polymer additives is available per product in a Declaration of Compliance. These documents, which are frequently updated to reflect the latest changes, are available upon request.

We think about the future

Innovation has brought us to where we are today. We are a global leader in polymer additives and are determined to maintain our status. We look ahead and help our customers find sustainable answers to questions they will face tomorrow.

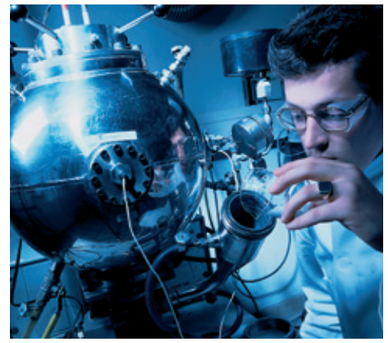
Our researchers are based in dedicated customer-focused business teams. They perform research, product and process development and technical support in order to translate market needs into new products. They understand the needs of our customers and are committed to contributing to their success.

We are always striving for the best solutions. For instance, our new Perkastab range of essential ingredients for more eco-friendly PVC heat stabilizer systems. They improve color stability during processing and during the lifetime of the final PVC article.

Or our tailor-made slip and antistatic additive concentrates and electroconductive carbon blacks. Formulations with carriers or concentrations other than those indicated in this product guide can be made available upon request. What do you need? We're happy to meet with you and discuss your specific formulations.

Safety: Our top priority

We at AkzoNobel always place safety as our top priority. Our proven success in safely handling hazardous materials such as organic peroxides is due to our long-term commitment to developing and maintaining high safety standards. Our Safety Laboratory in Deventer, the Netherlands is heavily involved in R&D, ensuring the development of safe products and processes. Studies are carried out, in order to provide a high level of safety in manufacturing, handling and transport of dangerous goods.



Slip and Anti-blocking Additives

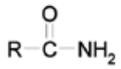
Armid®, Armoslip®

Our range of slip and anti-blocking additives, including super high concentrates, is one of the world's largest. These products are added to the polymer during the extrusion process and migrate to the polymer surface.

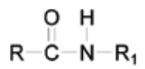
The solid lubricating layer formed reduces friction and adhesion with other materials, thereby solving problems with film and bag production or printing, wear of printed pictures and text, winding of films, packaging operations and mold release.

As processing of polymers is performed in the temperature range from 160 to 300°C, thermal stability is critical. TGA figures in the table on the right give an indication of the maximum processing temperatures.

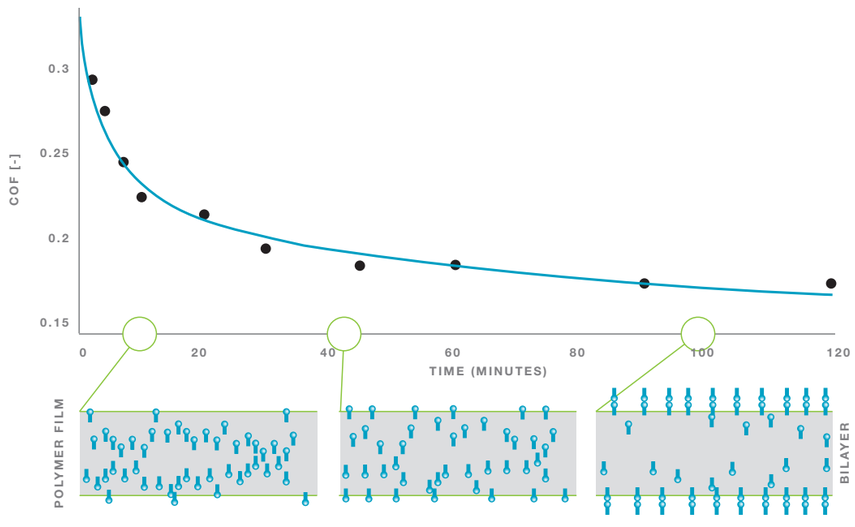
Primary amide



Secondary amide



ARMOSLIP WORKING PRINCIPLE



	CHEMICAL NAME [CAS NO.] PRODUCT NAME	PRIMARY EFFECT	MIGRATION SPEED	APPLICATIONS	DOSAGE (% w/w)	ORIGIN RAW MATERIAL	AMIDE PURITY (% w/w min.)	COLOR (Gardner)	THERMAL STABILITY (°C) [1]	PHYSICAL FORM	PACKAGING [2]
Primary amides	**Oleamide [301-02-0] C18F1**										
	Armid O	slip, mold release	+++	PE	0.05-0.3	animal/vegetable	95	3	226	pastilles	20 kg PE bag in cardboard box
	Armid OS	slip, mold release	+++	PE, PP, inks	0.05-0.3	animal/vegetable (lower C18)	95	3	226	pastilles	20 kg PE bag in cardboard box
	Armoslip CP	slip, mold release	+++	PE, PP, inks	0.05-0.3	animal/vegetable	98.5	< 1	228	beads, powder	20 kg PE bag
	Armoslip CPA	slip, mold release	+++	PE, PP	0.05-0.3	animal	98.5	< 1	228	beads	20 kg PE bag
	Armoslip CPV	slip, mold release	+++	PE, PP	0.05-0.3	vegetable	98.5	< 1	226	beads	20 kg PE bag
	Erucamide [112-84-5] C22F1										
	Armid E	slip, anti-block, mold release	++	PE, PP, BOPP	0.05-0.3	vegetable	95	3	258	pastilles, powder	20 kg PE bag in cardboard box
	Armoslip E	slip, anti-block, mold release	++	PE, PP, BOPP	0.05-0.3	vegetable	98.5	< 1	261	beads, powder	20 kg PE bag
	Armoslip EL	slip, anti-block	++	PE, PP, BOPP	0.05-0.3	vegetable (lower C22)	98.5	< 1	261	beads	20 kg PE bag
	Behenamide [3061-75-4] C22										
	Armoslip B	anti-block	+	PE, PP, BOPP	0.1-0.5	vegetable	98.5	< 1	258	beads	20 kg PE bag
	Stearamide [124-26-5] C18, C16										
	Armid HT	anti-block	+	PE, PP, BOPP, coatings, inks	0.05-0.3	animal	95	3	225	pastilles	20 kg PE bag in cardboard box
	Armoslip HT	anti-block	+	PE, PP, BOPP, coatings, inks	0.05-0.3	animal/vegetable	98.5	< 1	232	beads, powder	20 kg PE bag
	Armoslip 18 LF	anti-block	+	PE, PP, BOPP	0.05- 0.3	vegetable (higher C18)	98.5	< 1	241	beads	20 kg PE bag
Secondary amides	**Oleylpalmityl amide [16260-09-6] C18F1 / C16**										
	Armid OPA	medium slip, mold release	+	engineering plastics	0.1-1	animal/vegetable	95	3	275	pastilles	20 kg PE bag in cardboard box
	Stearyl erucamide [10094-45-8] C18 / C22F1										
	Armid SEA	medium slip, mold release, scratch resistance	+	engineering plastics	0.1-1	vegetable	95	3	337	pastilles	20 kg PE bag in cardboard box
	Stearyl stearamide [13276-08-9] C18 / C18, C16										
	Armid SSA	medium slip, mold release	+	engineering plastics	0.1-1	animal	95	3	303	pastilles	20 kg PE bag in cardboard box

[1] TGA 5% weight loss temperature
[2] Upon request, several products can also be supplied in big bags

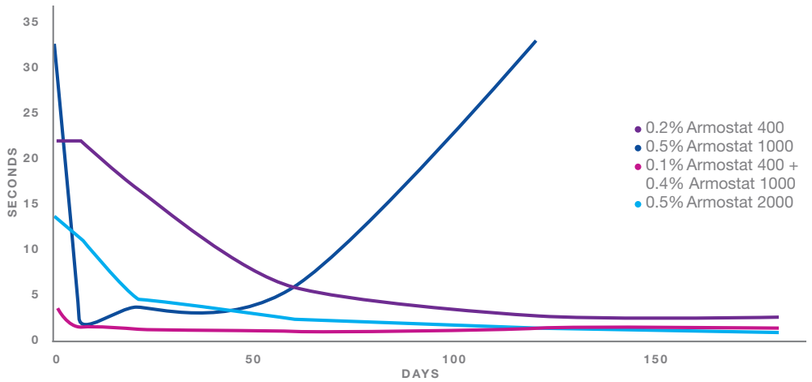
Our range of slip and anti-blocking high concentrates is listed on page 10.

Antistatic Additives

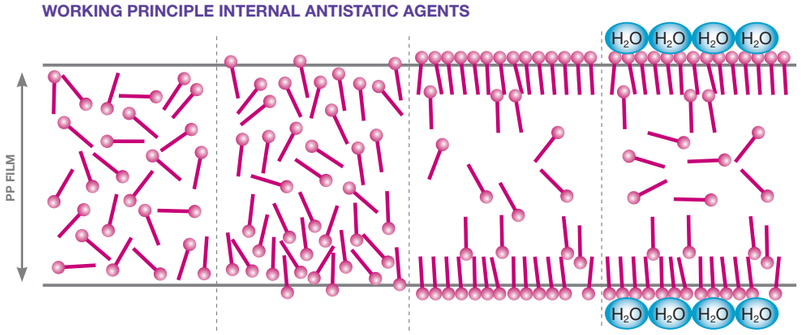
Armostat®

We offer a broad range of antistatic additives, including super high concentrates. Our products offer a solution to problems related to the accumulation of electric charges on plastic materials, such as static discharge during processing and dust attraction upon storage. Once added to the polymer in the extrusion process, our antistatic additives migrate to the polymer surface, giving the required effect through interaction with environmental humidity.

CHARGE DECAY VS STORAGE TIME IN CO-PP



WORKING PRINCIPLE INTERNAL ANTISTATIC AGENTS



PHASE 1
Homogeneous distribution of antistatic agent during the extrusion process

PHASE 2
Antistatic agent begins to migrate to the surface after extrusion

PHASE 3
Hours or days later antistatic agent covers the surface

PHASE 4
Moisture pick up from the surrounding air, giving the desired antistatic properties

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	CHAIN LENGTH	APPLICATIONS	DOSAGE (% w/w)	ORIGIN RAW MATERIAL	THERMAL STABILITY (°C) [1]	VISCOSITY AT 60°C (mPa.s)	PHYSICAL FORM AT 25°C	MIGRATION SPEED	DURABILITY	PACKAGING [2]
Glycerol monostearates											
Armostat 1000	Glycerol monostearate (90%) [31566-31-1]	C16, C18	PE, PP PVC	0.2-1 0.5-2	vegetable	247	38	powder, pastilles	+++	+	25 kg PE bag
Ethoxylated amines R-N-$(C_2H_4OH)_2$											
Armostat 300	Tallow bis(2-hydroxyethyl) amine [61791-44-4]	C18F1, C16F1	PE (film), PP	0.1-0.2	animal	243	33	paste	++	++	180 kg steel drum
Armostat 400	Coco bis(2-hydroxyethyl) amine [61791-31-9]	C12, C14	PE, PP (film/ CM), BOPP ABS, PS, HIPS	0.1-0.2 1.5-4	vegetable	207	24	liquid	++	++	180 kg steel drum
Armostat 600	Hydrogenated tallow bis(2-hydroxyethyl)amine [90367-28-5]	C18, C16	LLDPE, PP (IM), BOPP, ABS, PS, SAN	0.1-0.2 1.5-4	animal	241	36	solid	+	++	180 kg steel drum
Armostat 700	Oleylbis(2-hydroxyethyl) amine [25307-17-9]	C18F1	PE, PP (IM), ABS, PS, SAN	0.1-0.2 1.5-4	animal	240	30	liquid	++	++	180 kg steel drum
Armostat 1800	Octadecyl bis(2-hydroxyethyl)amine [10213-78-2]	C18	PE, PP, BOPP ABS, PS, SAN	0.1-0.2 1.5-4	vegetable	245	308	solid	+	++	180 kg steel drum
Ethoxylated amides R-(CO)-N-$(C_2H_4OH)_2$											
Armostat 2000 SB	N,N-Bis(2-hydroxyethyl) dodecanamide [120-40-1]	C12	PE and HDPE (film), PP (IM), BOPP ABS, PS, SAN	0.2-0.5 1-3	vegetable	210	140	solid block	+++	+++	24 kg PP pail
Armostat 2000	N,N-Bis(2-hydroxyethyl) dodecanamide [120-40-1]	C12	PE and HDPE (film), PP (IM), BOPP ABS, PS, SAN	0.2-0.5 1-3	vegetable	210	140	particulate solid	+++	+++	12.5 kg PE bag in cardboard box
Armostat 2002	N,N-Bis(2-hydroxyethyl) dodecanamide [120-40-1]	C12	PE and HDPE (film), PP (IM), BOPP ABS, PS, SAN	0.2-0.5 1-3	vegetable	210	140	free-flow-ing pellets	+++	+++	20 kg PE bag in cardboard box
Alkane sulfonates											
Armostat 3002 [3]	Sodium alkane sulfonate [68608-15-1]	C14, C16	PVC, PA, ABS, PS, engineering resins	0.5-3	mineral oil	393	N/A	flakes	++	+++	20 kg PE bag

[1] TGA 5% weight loss temperature
[2] Please contact us for availability in (heatable) IBC's or bulk
[3] Can also be used as external antistatic agent, hygroscopic material

Our range of antistatic high concentrates is listed on page 10.

Additive High Concentrates

Nourymix®

Dosing liquid or paste-form antistatic additives or sticky slip and anti-blocking additives can be a problem.

Cleaning of dosing systems is time consuming and the amount of waste generated can be substantial. We have developed a sustainable solution. Our Nourymix super high concentrates offer savings in operational costs and time, and have a lower environmental impact.

They reduce cleaning time and minimize waste, while giving all the advantages of our antistatic or slip and antiblocking additives.
Please contact us for formulations containing additives, concentrations or polymer types other than those indicated in the tables.

Slip and Anti-blocking High Concentrates

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	PRIMARY EFFECT	APPLICATIONS	ORIGIN RAW MATERIAL	COMPOSITION	PHYSICAL FORM	PACKAGING
Nourymix SP C60	Oleamide [301-02-0]	slip	PE, PP	animal/vegetable	60% Armoslip CP in PP	granules	30 kg PE bag in cardboard box
Nourymix SP E60	Erucamide [112-84-5]	slip, anti-block	PE, PP, BOPP	vegetable	60% Armoslip E in PP	granules	30 kg PE bag in cardboard box

Antistatic High Concentrates

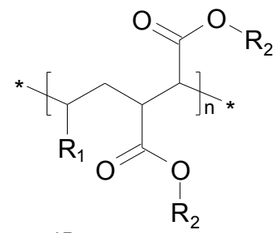
CHEMICAL NAME [CAS NO.] PRODUCT NAME	APPLICATIONS	ORIGIN RAW MATERIAL	COMPOSITION	PHYSICAL FORM	PACKAGING
Tallow bis(2-hydroxyethyl)amine [61791-44-4]					
Nourymix AE 350	PE	animal	50% Armostat 300 in LDPE	granules	20 kg PE bag in cardboard box
Nourymix AE 375	PE	animal	75% Armostat 300 in HDPE	granules	25 kg PE bag in cardboard box
Nourymix AP 380	PP	animal	80% Armostat 300 in PP	granules	25 kg PE bag in cardboard box
Coco bis(2-hydroxyethyl)amine [61791-31-9]					
Nourymix AE 450	PP, BOPP	vegetable	50% Armostat 400 in LDPE	granules	25 kg PE bag in cardboard box
Nourymix AP 475	PP, BOPP	vegetable	75% Armostat 400 in PP	granules	25 kg PE bag in cardboard box
Nourymix AS 450	ABS, PS, HIPS	vegetable	50% Armostat 400 in PS	granules	25 kg PE bag in cardboard box
Hydrogenated tallow bis (2-hydroxyethyl)amine [90367-28-5]					
Nourymix AE 665	PE	animal	65% Armostat 600 in HDPE	granules	25 kg PE bag in cardboard box
Nourymix AP 675	PP, BOPP	animal	75% Armostat 600 in PP	granules	25 kg PE bag in cardboard box

Armowax® W-440 Processing Aid

Armowax W-440 is a low-melting polymeric ester with a comb-like molecular structure. Showing a perfect balance between internal and external lubrication, it is the best dispersion and processing aid for highly filled polymer compounds available.

The unique characteristics of Armowax W-440 are based on a combination of hydrophilic and hydrophobic groups present in the molecule. This combination provides improved wetting of the filler surface by the polymer matrix, thereby ensuring optimum dispersion of inorganic fillers such as calcium carbonate, talcum, carbon blacks or glassfibers.

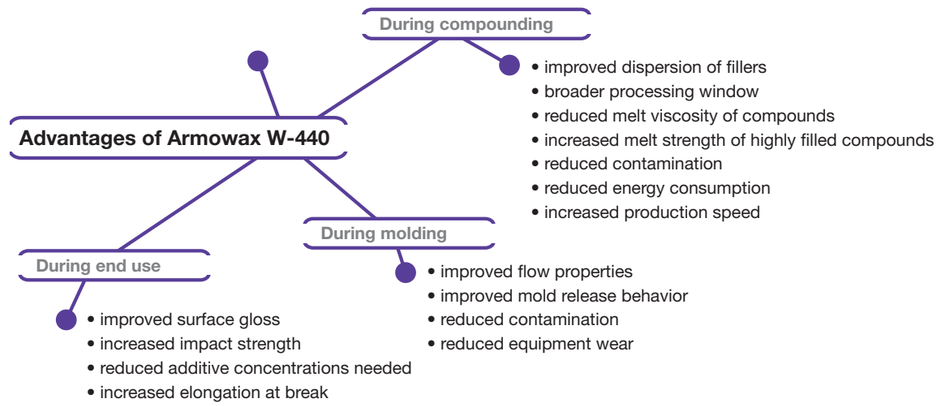
The good compatibility of Armowax W-440 with polymers, combined with its low melting point, improves flow properties of compounds during processing. If a standard dispersion aid does not give you the performance you need, try Armowax W-440.



n ~45
$R_1 = C_{20} - C_{22}$
$R_2 = C_{16} - C_{18}$

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	APPLICATIONS	DOSAGE (% w/w)	MELTING POINT (°C)	VISCOSITY AT 80°C (mPa.s)	THERMAL STABILITY (°C) [1]	PHYSICAL FORM	PACKAGING
Armowax W-440	Polymeric ester of long chain alcohol [134210-67-6]	PE, PP, PBT, PA	0.5-2	45-48	200-400	208	pastilles	20 kg PE bag in cardboard box

[1] TGA 5% weight loss temperature



Superconductive Carbon Blacks

Ketjenblack®

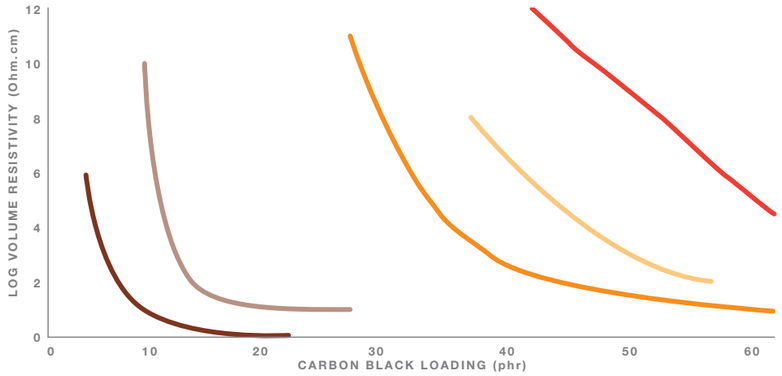
AkzoNobel has a leading position in the electroconductive carbon black market. Carbon blacks are the most frequently used materials for making electro-conductive polymers.

They provide a uniform effect through the entire polymer matrix and can achieve a volume resistivity of 1 ohm.cm. This effect is not dependent on migration or humidity as with antistatic agents. Our Armostat range of products provides excellent antistatic performance down to 10^{10} ohm surface resistivity. When a low volume resistivity is required, Ketjenblack EC is the best choice.

Our Ketjenblack EC superconductive carbon blacks (CAS No. 1333-86-4) are of the highest purity. Due to their unique morphology, substantially lower amounts of Ketjenblack EC are required to make plastics and elastomers electroconductive when compared to conventional carbon blacks. This results in improved processing and mechanical properties of the end product.

We also produce tailor-made superconductive carbon black formulations. Regardless of concentration or medium, please contact us with your specific needs.

RELATION VOLUME RESISTIVITY AND CARBON BLACK LOADING IN SBR



- Ketjenblack EC-600JD
- Ketjenblack EC-300J
- Superconductive furnace black
- Acetylene black
- HAF black

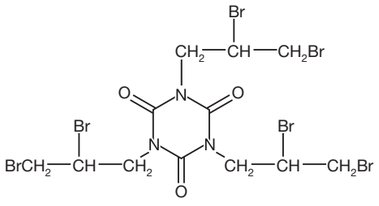
PRODUCT NAME	APPLICATIONS	CARBON CONTENT (%)	DOSAGE (% w/w) 10^2 ohm.cm	TOTAL SURFACE AREA BET (m^2/g)	IODINE ABSORPTION (mg/g)	PORE VOLUME DBP (ml/100 g)	GRIT CONTENT (mg/kg)	TOTAL METAL CONTENT (mg/kg)	ASH CONTENT (% w/w)	PHYSICAL FORM	PACKAGING
Ketjenblack EC-300J	PE, PP, BOPP, SBR, EPDM unsaturated polyesters, epoxy resins	100	8-10 0.5-2	800	740-840	310-345	<30	<10	<0.05	soft pellets	10 kg PE bag, 180 kg big bag
Ketjenblack EC-600JD	PE, PP, BOPP, SBR, EPDM unsaturated polyesters, epoxy resins	100	4-5 0.3-1	1400	1000-1100	480-510	<30	<20	<0.1	soft pellets	8 kg PE bag, 140 kg big bag
Ketjenblack EC-600JD P	conductive printing inks, conductive coatings, fuel cells, batteries	100	1-3	1400	1000-1100	480-510	<30	<20	<0.1	fluffy powder	4 kg PE bag
Ketjenblack EC-330JMA	unsaturated polyesters	30	0.5-2				<10	<5	<0.05	non-dusting powder, on 2-hydroxyethyl methacrylate	35 kg drum
Ketjenblack EC-310NW	water based conductive printing inks and coatings	10	1-3				<3	<2	<0.05	suspension in water	60 kg drum

Ain't no mountain high enough
We understand our customers' need for a dust-free, easy-to-process electroconductive carbon black. That's why we developed Ketjenblack EC330-JMA. This unique product makes thermo-set resins antistatic or electroconductive with the addition of very small quantities. It underlines our commitment to the success of our customers. We challenge the future and scale heights that have never been conquered before

Flame Retardant Additives

Armoquell®, Perkadox®, Perkalite®

Innovation continues unabated, but there's now more emphasis on developing new products which are more sustainable, without compromising on performance. This is partly due to legislation, but most of the demand is coming from our customers. Our approach is underlined by the development of, for example, Perkalite FR100, our latest flame retardant synergist.

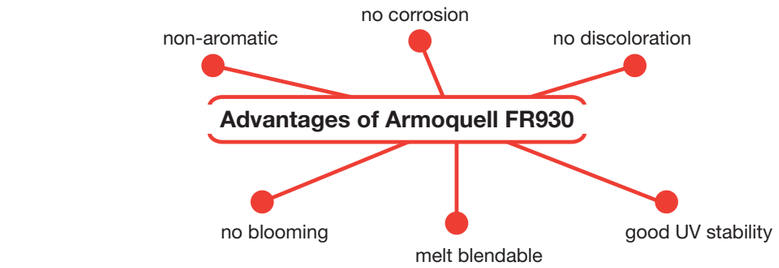


Armoquell FR930

Armoquell FR930 is a very efficient, non-aromatic, non-blooming flame retardant, specially developed for use in polypropylene. It also finds growing use in polyethylene and polystyrene. Stringent flame retardant specifications can already be reached with the addition of relatively low amounts of Armoquell FR930. It is a very cost-effective alternative to more commonly used brominated flame retardants such as HBCD and DECA.

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	TARGET APPLICATIONS	DOSAGE (% w/w) UL-94 / V0	MELTING POINT (°C)	DENSITY (kg/m³)	THERMAL STABILITY (°C) [1]	PHYSICAL FORM	PACKAGING
Armoquell FR930	1,3,5-Tris(2,3-dibromopropyl) isocyanurate [52434-90-9]	PP PS	4 + 2% Sb_2O_3 12 + 6% Sb_2O_3	102-109	2340	316	powder	25 kg PE bag

[1] TGA 5% weight loss temperature



Flame Retardant Synergists

Perkadox 30 and Perkadox BC-FF act as flame retardant synergists in combination with brominated flame retardants such as Armoquell FR930. They allow for the use of significantly lower amounts of flame retardant agents, while maintaining the same level of flame retardancy. Due to their relatively high thermal stability, they are particularly suitable for use in polyolefins and polystyrene.

Perkalite FR100, a synthetic organoclay, is used in combination with ATH or MDH, thereby allowing the reduction of these mineral flame retardants in compounds or enabling better flame retardant ratings. More information on our Perkalite range of synthetic organoclays can be found on page 16.

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	DOSAGE (% w/w)	MELTING POINT (°C)	HALF-LIFE 0.1 h (°C)	TARGET APPLICATIONS	PHYSICAL FORM	PACKAGING
Synergist for brominated flame retardants							
Perkadox 30	2,3-Dimethyl-2,3-diphenylbutane [1889-67-4]	0.25-1	90-110	284	PP, PS	flakes	20 kg in PE bag in cardboard box
Perkadox BC-FF	Dicumyl peroxide [80-43-3]	0.5-2	39.5	154	PS, EVA	crystals	25 (5x5) kg in PE bag in cardboard box
Synergist for ATH/MDH							
Perkalite FR100	Aluminum magnesium hydroxide modified with hydrogenated fatty acid [39366-43-3, 67701-03-5]	5			EVA, PP	powder	10 kg in PE bag in cardboard box

Effect of Armoquell FR930 and Perkadox 30 on flame retardant properties of homo polypropylene (MFI 3)

PRODUCT	CONCENTRATION (% w/w)				
Armoquell FR930	12	2	4	4	4
Antimony oxide	0	1	2	0.4	0
Perkadox 30	0	0	0	1	1
Zinc borate	0	0	0	0	1
Polypropylene	87.5	96.5	93.5	94.1	93.5
Stabilizer package	0.5	0.5	0.5	0.5	0.5
UL-94 rating [1]	V2	V2	V0	V0	V0

[1] 2 mm specimen, under ideal lab conditions, internal mixer 10 min. at 200°C

Synthetic Organoclays

Perkalite®

Our unique range of synthetic organoclays can, for example, improve gas barrier properties or act as a flame retardant synergist. These products, which trade under the name Perkalite, are based on organically modified layered double hydroxides.

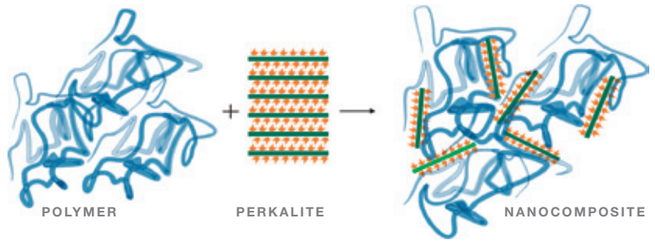
The high temperature stability compared to most organoclays and the excellent compatibility with many polymers, make Perkalite the product of choice for a wide range of applications. In addition, most Perkalite grades are in compliance with European regulations for materials coming into contact with foodstuffs.

Perkalite products consist of stacks of inorganic clay platelets, which have an individual thickness of approximately 0.5 nm and a width of 100-150 nm. With proper processing, the stacks, having micro dimensions themselves, can easily be melt dispersed into a polymer and delaminated (exfoliated), forming true nanocomposites. Commercially available grades are based on aluminum magnesium hydroxides. Various modifiers are used to tune the compatibility with the polymer matrix.

PRODUCT NAME	CAS NO. COMPONENTS	MODIFIER	APPLICATIONS	DOSAGE	DENSITY (kg/m³)	PARTICLE SIZE D99 (µm)	FUNCTIONS: GAS BARRIER PROPERTIES	MECHANICAL PROPERTIES	FLAME RETARDANT SYNERGIST	NUCLEATING AGENT
Organically modified aluminum magnesium LDH grades, not fully ion exchanged										
Perkalite A100	39366-43-3, 8050-09-7	rosin	elastomers	10-20 phr	1350-1400	<22		●		●
Perkalite AF50	39366-43-3, 8050-09-7, 67701-03-5	rosin and hydrogenated fatty acid	elastomers	10-20 phr	1320-1370	<22		●		●
Perkalite F100	39366-43-3, 67701-03-5	hydrogenated fatty acid	thermoplastics and elastomers	1-3% w/w	1350-1400	<22	●	●		●
Perkalite FR100 [1]	39366-43-3, 67701-03-5	hydrogenated fatty acid	thermoplastics and elastomers	5% w/w	1350-1400	<22	●	●	●	●
Organically modified aluminum magnesium LDH grades, fully ion exchanged										
Perkalite F100S	39366-43-3, 67701-03-5	hydrogenated fatty acid	thermoplastics	1-3% w/w	1350-1400	<22	●	●		●
Inorganically modified aluminum magnesium LDH grades										
Perkalite LD	39366-43-3	OH-	various	1-5% w/w	2120-2130	<22	●	●		●

[1] Not approved for food contact applications

The standard packaging is a 10 kg PE bag in a cardboard box.
Some Perkalite grades are available as aqueous slurry.



PVC Heat Stabilizers

Perkastab®

At AkzoNobel, sustainability is at the heart of everything we do. One of our latest products introduced to the marked is Perkastab, a range of essential ingredients for more eco-friendly PVC heat stabilizer systems.

The replacement of lead in PVC has resulted in a rapid growth of Calcium/Zinc (Ca/Zn) and Calcium-organic stabilizer systems. Calcium acetylacetonate and Zinc acetylacetonate are important ingredients for these stabilizer systems. They improve color stability during processing and during the lifetime of the final PVC article. The new Perkastab product range is our contribution to the drive for more eco-friendly, lead-free PVC heat stabilizer systems.

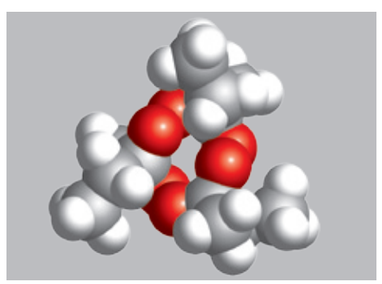
In the end product, Perkastab 3 ensures an excellent medium and long term color stability, while Perkastab 5 contributes to an improved short term color stability. Ca/Zn and Calcium-organic stabilizer systems containing Perkastab are mainly used in rigid PVC applications such as window profiles.

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	APPEARANCE	METAL CONTENT (W/W%)	PACKAGING
Perkastab 3	Calcium acetylacetonate [19372-44-2]	powder	Ca: 16.3-17.3%	20 kg paper bag / 20 kg PE bag in cardboard box [1]
Perkastab 5	Zinc acetylacetonate [14024-63-6]	powder	Zn: 23.0-26.0%	25 kg PE bag in cardboard box

[1] Perkastab 3 is also available in big bags.

Polymer Modification Additives

Perkadox®, Trigonox®

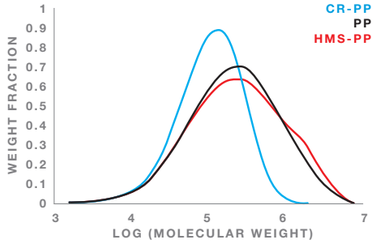


AkzoNobel is the world leader in free radical initiators used in the production of thermoplastic polymers such as polyvinyl chloride (PVC), low density polyethylene (LDPE), acrylics and styrenics. Our organic peroxides are also used to modify thermoplastics via reactive extrusion. The choice of peroxide depends on the type of polymer, desired reaction and extrusion temperatures applied.

Controlled rheology polypropylene (CR-PP)

Polypropylene produced with Ziegler-Natta catalysts typically has a broad molecular weight distribution (MWD). This results in a very high melt elasticity causing problems with high-speed equipment. By addition of specific organic peroxides to the PP in an extruder, these problems can be overcome, allowing for a controlled degradation of the polymer. This narrows MWD and at the same time reduces average molecular weight. The decrease in melt viscosity, expressed by an increase in MFI, is controlled by the amount of peroxide. Applications include PP film, extrusion coating, fibers (spunbond, meltblown) and injection molding.

Our range of organic peroxides for free radical polymerization and modification of polymers is the world's largest. It includes Trigonox 301, the latest generation of our organic peroxides for CR-PP. This AkzoNobel invention is patented and offers a number of advantages over commonly used modifiers. It is very cost-effective and releases low amounts of volatile decomposition products. It also shows very good organoleptic properties and has been approved for food contact applications by both BfR (0.25% max.) and FDA (0.375% max.).



High melt strength polypropylene (HMS-PP)

Polypropylene has a low melt strength and lack of strain hardening behavior, due to its linear chain structure. This may result in problems in applications that require melt extension. These problems include too narrow processing windows, non-uniform foam cell sizes, and pinholes in thermoformed sheet. AkzoNobel has developed and patented a new technology which overcomes these issues. Reaction of PP powder with a special class of organic peroxides, i.e. peroxydicarbonates, in an extruder introduces long chain branches and creates high melt strength PP (HMS-PP). HMS-PP exhibits a decreased MFI, a broader MWD by long chain branching, an increased melt strength and die swell, and an improved strain hardening and melt elasticity. This allows for applications such as PP foaming, thermoforming and blow molding.

The preferred peroxydicarbonate is Perkadox 24L. The best performance is obtained when mixing the product with either PP reactor grade (powder, beads) or milled PP pellets, prior to extrusion. Only carbon dioxide and cetyl alcohol are released, which add no smell to the final resin. FDA food contact approval (2.0% max.) has been obtained for all HMS-PP applications, including foamed food trays for microwave use.

CHEMICAL NAME [CAS NO.] / PRODUCT NAME	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	MAX. STORAGE TEMP. (°C)	MIN. STORAGE TEMP. (°C)	HALF-LIFE 0.1 h (°C)	SADT (°C) [1]	COLOR (Pt-Co max.)	DOSAGE (% w/w)	CR-PP	HMS-PP	MA-G-POLYOLEFINS	HMS-PLA
3,6,9-Triethyl-3,6,9-trimethyl-1,4,7-triperoxonane [24748-23-0]													
Trigonox 301	41	7.45	solution in isoparaffins	40	0	170	110	50	0.01-0.25 [2]	●			●
Trigonox 301-40PLA	16	2.98	40% Trigonox 301 on polylactic acid, pellets	40	0	170	90	white	0.25-1.25				●
Trigonox 301-20PP [3]	8	1.49	20% Trigonox 301 on PP, beads	40	0	170	90	white	0.05-1.25	●			
2,5-Dimethyl-2,5-di(tert-butylperoxy)hexane [78-63-7]													
Trigonox 101	92	10.14	liquid	40	10	156	80	50	0.01-0.25	●			
Trigonox 101-20PP [3]	18	2.03	20% Trigonox 101 on PP, beads	30		156	70	white	0.05-1.25	●			
Di(tert-butylperoxyisopropyl)benzene [25155-25-3]													
Perkadox 14S-FL [4]	96	9.08	flakes	20		156	80	white-yellow	0.01-0.25	●			
Dicetyl peroxydicarbonate [26322-14-5]													
Perkadox 24L	91	2.55	powder (m.p. 52°C)	20		84	40 [5]	white	0.5-2		●		
tert-Butyl monoperoxymaleate [1931-62-0]													
Perkadox PF-DBM25	25	2.12	pumpable suspension in di-n-butylmaleate	25	-10	142	60	white	1 [6]			●	

1 Self-Accelerating Decomposition Temperature
2 0.1-0.5 % w/w for HMS-PLA
3 Please contact us for other masterbatch concentrations
4 Masterbatches in polymers such as PE, PP and EVA can be made available in different concentrations
5 Emergency temperature 35°C, Control temperature 30°C
6 For glassfiber reinforced PP (GFR-PP) best performance is obtained by dosing 1% Perkadox PF-DBM25 together with the (aminopropyl silanized) glass fibers directly to the extruder, optionally with 1.8% TAC (triallyl cyanurate) as coagent

Maleic anhydride grafted polyolefins

Polymers such as PP, PE and EPDM can be grafted in an extruder with maleic anhydride (MA) using specific organic peroxides. When separately dosing organic peroxide and MA, the choice of peroxide depends on its solubility in the polymer and the extrusion temperature applied. AkzoNobel offers various organic peroxides which can be used for this separate dosing technique. One of our latest developments is Perkadox PF-DBM25, which has the MA moiety incorporated in the peroxide molecule.

This graft technology, developed by AkzoNobel, improves compatibility (solubility) of the raw materials with the polymer and avoids the presence of free MA in the end product.

MA grafted polymers can be used as adhesives in glass fiber reinforced PP (GFR-PP) and tie-layer PE film, and as compatibilizer for non-miscible polymers, nanocomposites and wood fiber PP composites.

High melt strength polylactic acid (HMS-PLA)

Polylactide or polylactic acid (PLA) is a compostable and biorenewable polyester having a low melt strength and lack of melt elasticity due to its linear chain structure. This results in problems in applications that require melt extension. Reaction of PLA with AkzoNobel's Trigonox 301 in an extruder, safely dosed as liquid to the hot PLA melt, or as masterbatch along with the PLA pellets, introduces long chain branches and creates high melt strength PLA (HMS-PLA), without gel formation.

HMS-PLA exhibits a near-unchanged MFI, a broader MWD by long chain branching and an increased melt strength. It also shows increased low shear viscosity and shear thinning behavior at higher shear, along with improved melt elasticity.

This technology, patented by AkzoNobel, can be used for PLA foaming, thermoforming, blow molding, extrusion coating, and cast and blown film.

Functional Methacrylates

Nourycryl®

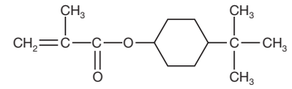
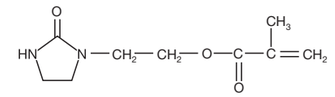
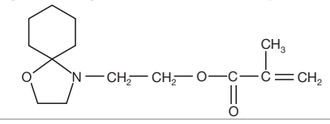
AkzoNobel's methacylate monomers are specialty chemicals developed for specific applications in coatings and adhesives.

Nourycryl MC 110 can be used as a low shrinkage reactive diluent in adhesive formulations. It serves as a solvent, which is incorporated into the polymer structure, resulting in low VOC emissions. Its combination of low viscosity and high glass transition temperature given to the final product, is unsurpassed. Nourycryl MC 110 can also be applied as a UV resistant (non-yellowing) comonomer in cast and optical resin systems, which will benefit from its excellent adhesion-promoting ability as well as its high glass transition temperature.

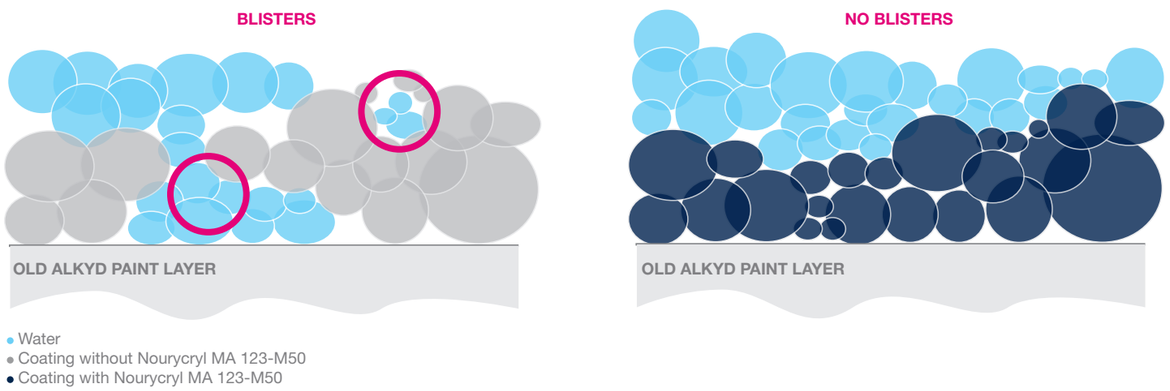
Nourycryl MA 123-M50 is an excellent wet adhesion promoter used, for example, to improve adhesion of water-based coatings to dried alkyd-based paint layers. In addition, it enhances the scratch resistance of coatings in moist conditions. Resins containing the Nourycryl MA 123 building block can also act as dispersion aids, which prevent coagulation of the pigment particles leading to a homogeneous pigment dispersion.

Nourycryl MA 128 is a methacrylate monomer containing a unique oxazolidine functionality. In this oxazolidine group, the potentially reactive hydroxyl and amine groups are temporarily blocked with cyclohexanone, preventing them from reacting prior to the final application. These groups can be released in the presence of water, allowing them to react with isocyanates.

Nourycryl MA 128 containing resins can be applied in urethane systems such as one-pack acrylic/urethane high performance coatings. They provide a long pot-life and short curing times under ambient conditions, while allowing for very high solid contents in durable polyurethane coatings, e.g. used in the aerospace industry.

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	PHYSICAL FORM	MELTING POINT (°C)	VISCOSITY (mPa.s)	REFRACTIVE INDEX	COLOR (Pt-Co)	DENSITY (kg/m³)	FUNCTIONS	PACKAGING
Nourycryl MC 110	4-tert-Butylcyclohexyl methacrylate [46729-04-1] 	clear liquid (40°C)	10-35	5 (40°C)	1.455 (40°C)	100 max. (40°C)	940 (40°C)	reactive diluent in adhesives, adhesion promoter	170 kg drum
Nourycryl MA 123-M50	Ethylene ureaethyl methacrylate [86261-90-7] 	50% solution in MMA		3.5-5.0 (20°C)	1.456 (20°C)	300 max.	1055	wet adhesion promoter dispersion aid	170 kg drum
Nourycryl MA 128	(2,2-Pentamethylene-1, 3-oxazolidyl) ethylmethacrylate [4203-89-8] 	clear to turbid liquid	<-15°C	20 (20°C)	1.4855 (20°C)	5 Gardner max.	1050	functional building block in polyurethane coatings	170 kg drum

NOURYCRYL MA 123-M50 PROMOTES WET ADHESION BY IMPROVING THE COALESCENCE OF THE POLYMER PARTICLES



PERFORMANCE OF NOURYCRYL MC 110 COMPARED TO OTHER REACTIVE DILUENTS

	CYCLOHEXYL METHACRYLATE	ISOBORNYL METHACRYLATE	3,3,5-TRIMETHYL METHACRYLATE	NOURYCRYL MC 110
PROPERTIES				
Low shrinkage	++	+++	NM	+++
Low viscosity	-	++	+	+++
High glass transition temperature	+	+++	+++	+++
Hardness	+	+++	+++	+++
UV Resistance	+++	NM	+++	+++

NM: not measured

We master science to provide sustainable solutions

We're passionate about introducing new ideas and developing sustainable answers for our customers. In fact, sustainability is at the heart of everything we do. Examples include our Nourymix® product range, Trigonox® 301 and Perkalite®. We mastered science and technology to develop these sustainable, innovative solutions that benefit our customers.

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AkzoNobel is consistently ranked as one of the Chemicals industry leaders on the Dow Jones Sustainability World Indexes (DJSI), showing that we take our obligations seriously - to the planet, to our customers, to our own people. We believe the only way to grow is by developing sustainable, innovative solutions that benefit our customers. And we're constantly looking for ways to reduce our impact on the environment.

For product inquiry and ordering information, please contact your AkzoNobel account manager or regional AkzoNobel sales office.

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Additional information
Product Data Sheets (PDS) and Material Safety Data Sheets (MSDS) are available at www.akzonobel.com/polymer
On request we also provide specific publications on the use and the safe handling and storage of our products.

Extruder image on cover courtesy of Leistritz Extrusionstechnik GmbH.

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