

Curing Agents for Thermoset Resins



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.

That's why our 60,000 employees – who are based in more than 80 countries – are committed to excellence and delivering **Tomorrow's Answers Today™**.

AkzoNobel: Looking beyond horizons



We have a long history in organic peroxides, starting with dibenzoyl peroxide for the bleaching of flour in the early 1920s. Since then, we have added many new organic peroxides to our product portfolio, with the growth of plastics in everyday life.

Our range of organic peroxides for the curing of thermoset resins, coatings and specialty monomers is the world's largest. We cover classes such as ketone peroxides, diacyl peroxides, peroxyesters, peroxyketals, hydroperoxides and peroxy(di)carbonates. These products are marketed under well-known trademarks such as Butanox, Cadox, Cyclonox, Trigonox and Perkadox.

We also have a whole range of auxiliary products, such as accelerators and promoters, to meet your specific production requirements.

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 your curing systems. We offer you the technological answers you need.

Today we lead the world in organic peroxides and are determined to maintain our status. As a company of innovation we have a stream of new, high-value products to maintain our leadership.



AkzoNobel Polymer Chemicals is a leading global producer of innovative organic peroxides, metal alkyls, organometallic specialties and polymer additives. Headquartered in Chicago in the United States, we supply essential products used in the production of thermoplastic resins, and thermoset and elastomeric materials.

Focused on addressing our customers' future needs, we operate sites all around the world and adopt the highest HSE standards while remaining committed to developing sustainable processes and technologies.

You and AkzoNobel: Shaping the world around us

Our expertise is your expertise

Much of our success is due to our philosophy of creating close partnerships with our customers. What do you want to achieve? From optimizing applications, improving efficiencies, resolving difficulties or even designing new curing systems, we're happy to meet with you to discuss your requirements.

From bathtubs to Formula 1 racing cars and fishing rods to chemical storage tanks, AkzoNobel helps shape the world around us.

Sharing our thermoset experience is one of the biggest resources we offer. Whatever your particular requirements, we can develop the product to match.

A secure partner

Our manufacturing sites and distribution centers are found all over the globe, with joint ventures in Japan and China. Our global distribution network allows us to deliver the 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 better distribution systems.



- Regional headquarters
- Manufacturing sites
- R&D sites

We know a lot about organic peroxides and we're always trying to find out more. Our thorough understanding and knowledge of free radical chemistry and thermoset technology is the basis for the development of innovative and sustainable products, designed with you in mind.

Safety, Research and Development

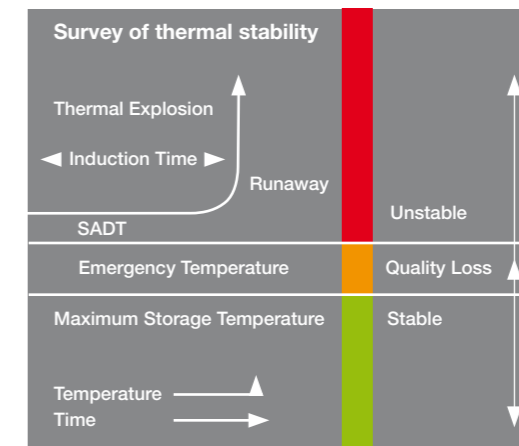


Technical support is mainly provided from laboratories in Deventer - the Netherlands, Pasadena - TX USA, Los Reyes - Mexico and Tianjin - China. Deventer is the site of AkzoNobel's fundamental organic peroxide R&D. We have a team of Technical Development Managers, who are the liaison between the market and R&D. They understand your future needs and are committed to contributing to the success of our customers.

We are always striving for the right solution. For instance our Butanox P-50. This innovative, high reactivity methyl isopropyl ketone peroxide does not contain any polar compounds and has a guaranteed low percentage of water. It is the latest generation of our curing technology for marine applications. Not to forget AkzoNobel's Butanox M-50. This glycol free, low water methyl ethyl ketone peroxide continues to prove to be the best possible answer to the problem of osmosis in boat building.

AkzoNobel is recognized as the global leader in organic peroxide safety. Our proven success in safely handling organic peroxides is due to our long-term commitment to safety. We at AkzoNobel always place safety as our top priority. Our Safety Research laboratory in Deventer is heavily involved in R&D, ensuring the development of safe products and processes. Studies are carried out, in order to ensure a high level of safety in manufacturing, handling and transport of dangerous goods.

Our safety programs combine classroom learnings and live demonstrations with on-site consulting, to assist you in receiving and using our products. We also offer design and maintenance services at your sites to support your handling and storage of hazardous materials. Please contact us if you are interested in such services.



Storage temperatures

The T_s max. is the recommended maximum storage temperature at which the product is stable and quality loss will be minimal.

A minimum storage temperature (T_s min.) is given if phase separation, crystallization or solidification of the product is known to occur below the temperature indicated. Also for safety reasons we recommend that you store the product above the T_s min. indicated.

SADT: Self-Accelerating Decomposition Temperature

The thermal stability of an organic peroxide is characterized by its SADT. The SADT is the lowest temperature at which self-accelerating decomposition may occur with the product in the packaging as used in transport. Safe transportation temperatures and emergency temperatures are derived from the SADT according to the recommendations by the United Nations Committee of Experts on the Transport of Dangerous Goods.

On request we can also provide specific directives for the safe handling and storage of organic peroxides.

UN Number

All products accepted for transport are assigned to generic entry numbers according to classification principles as described in the recommendations by the United Nations Committee of Experts on the Transport of Dangerous Goods. An explanation of all relevant UN numbers is given in the table below.

Table 1. Classification of organic peroxides

UN NO.	CLASSIFICATION	AKZONOBEL HAZARD RATING	MAXIMUM CONTAINER SIZE
Organic Peroxides			
3103	type C; liquid	High	50 kg
3113	type C; liquid, temperature controlled	High	50 kg
3114	type C; solid, temperature controlled	High	50 kg
3105	type D; liquid	Medium	50 kg
3106	type D; solid	Medium	50 kg
3107	type E; liquid	Low	400 kg
3108	type E; solid	Low	400 kg
3109	type F; liquid	Very Low	IBC's / Tanks
none	Non-dangerous good	No	Unrestricted

Packaging



We offer a variety of packaging options for both liquid and solid organic peroxides. The maximum package size for each organic peroxide is regulated by the United Nations, based on the hazard classification of the peroxide as shown in table 1 on page 5.

Liquid organic peroxides

Liquid peroxides from AkzoNobel are available in packages shown in table 2.

We also understand the need to innovate our packaging. In 1989 AkzoNobel introduced the first Nourytainer®. Since then we have improved many features to optimize safe transport, handling and storage of liquid organic peroxides.

Solid organic peroxides

Standard packages for our solid and paste-form peroxides are shown in table 3.

For the availability of our products in non-standard packages, please consult your AkzoNobel account manager.

Table 2. Standard packages for liquid peroxides

Package	Volume	Net Weight	Comments
Bottle	0.5 - 1 liter	0.5 - 1 kg	packaged as 12 or 28 polyethylene bottles per non-returnable carton
HDPE can	20 - 30 liter	15 - 30 kg	single component, polyethylene container (Nourytainer®)

Table 3. Standard packages for solid and paste-form peroxides

Package	Net Weight	Comments
Tube	5 - 150 g	for Perkadox paste products
Sachet	25 - 100 g	for Perkadox paste products
Bag	25 - 5000 g	for Perkadox CH-50 formulations
Pail	15 - 20 kg	for Perkadox paste products
Pastebox	15 - 25 kg	for Perkadox paste products
Carton	varies with product	polyethylene bags inside non-returnable cardboard box

We are marking the road ahead

From road paints to windmills and car repair to marine applications, we understand the future needs of our customers. Whatever your application, we are committed to bringing you solutions to tomorrow's problems.

We have specific publications for each thermoset market segment. Please contact your AkzoNobel account manager for more information.

www.akzonobel.com/polymer



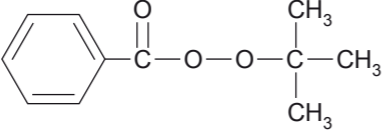
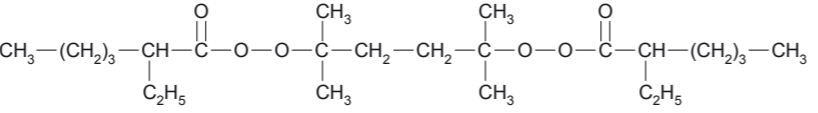
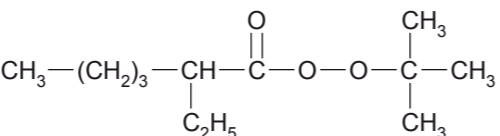
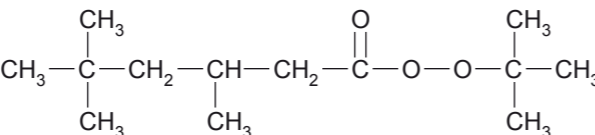
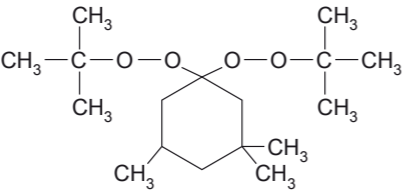
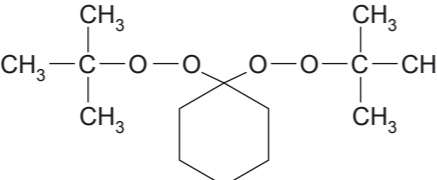
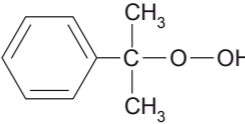
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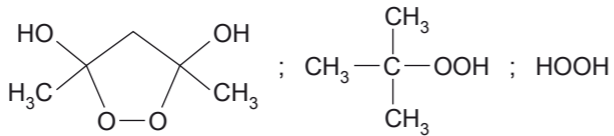
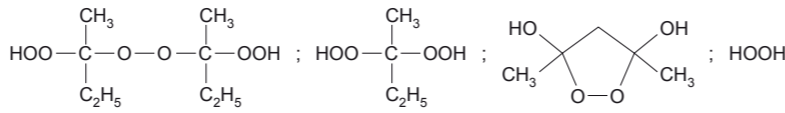
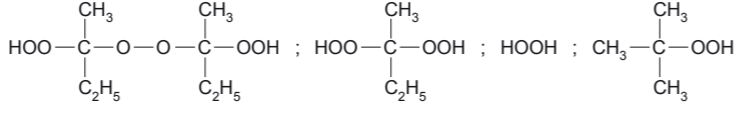
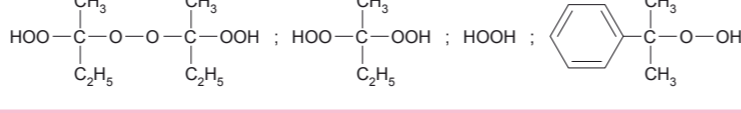
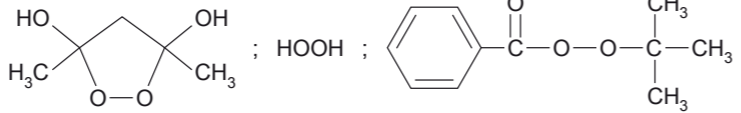
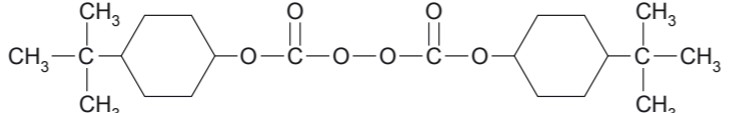
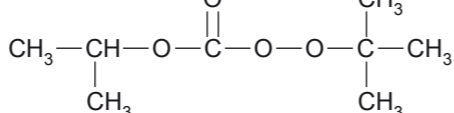
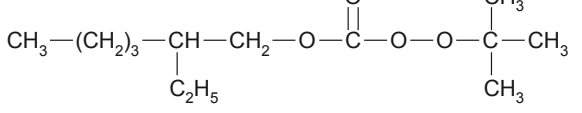
Our Curing Agents

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	STORAGE TEMPERATURES		SADT (°C)	UN NO.	FEATURES
					Ts MAX. (°C)	Ts MIN. (°C)			
Ketone peroxides									
Methyl ethyl ketone peroxide [1338-23-4]									
BUTANOX 28		8.9		solution in phthalate	25		60	3105	very high reactivity
BUTANOX HBO-50		9.9		solution in phthalate	25		60	3105	high reactivity
BUTANOX LA		8.7		solution in phthalate mixture	25		60	3105	low reactivity
BUTANOX LPT		8.5		solution in phthalate	25		60	3105	very low reactivity
BUTANOX LPT-IB94		8.0		solution in phthalate	25		60	3105	very low reactivity
BUTANOX M-50		8.9		solution in phthalate	25		60	3105	standard, medium reactivity
BUTANOX M-50VR		8.9		solution in phthalate	25		60	3105	vanishing red version
BUTANOX M-60		9.9		solution in phthalate	25		60	3105	standard, medium reactivity
BUTANOX M-60VRD		9.9		solution in phthalate	25		60	3105	vanishing red version
CADOX M-50A		8.9		in aliphatic solvent	25		60	3105	medium reactivity, phthalate free
Methyl isopropyl ketone peroxide [33372-83-7]									
BUTANOX P-50		6.4		solution in phthalate	25		50	3109	fast cure
Acetylacetone peroxide [37187-22-7]									
TRIGONOX 44B		4.1		in solvent mixture	25	-10	60	3107	fast cure
Methyl isobutyl ketone peroxide [37206-20-5]									
TRIGONOX 233		8.0		solution in odorless mineral spirits	25		50	3105	medium reactivity
TRIGONOX HM		8.8		solution in phthalate	25		50	3105	high reactivity
Cyclohexanone peroxide [12262-58-7]									
CYCLONOX 11		4.9		solution in solvent mixture	25		50	3105	high reactivity
CYCLONOX GT-50 LP		7.0		gel with phlegmatizers	25		50	3106	low reactivity
CYCLONOX LE-50		5.3		in solvent mixture	25		50	3105	medium reactivity
CYCLONOX LR		5.1		in solvent mixture	25		60	3105	low reactivity
CYCLONOX LR-50BA		2.5		in solvent mixture	25		60	3105	low reactivity
Diacyl Peroxides									
Dibenzoyl peroxide [94-36-0]									
PERKADOX 20S		20	1.4	powder with inert fillers	25		70		low reactivity
PERKADOX 33		33	2.2	powder with inert filler	25		60		medium reactivity
PERKADOX 40E		40	2.6	suspension in phthalate	25		50	3107	pumpable
PERKADOX BT-15		15	1.0	paste in phthalate	25		50		low reactivity, excellent stability
PERKADOX BT-25		25	1.7	paste in phthalate	25		45	3108	medium reactivity
PERKADOX BT-50		50	3.3	paste in phthalate	25		50	3108	high reactivity
PERKADOX BTW-50		50	3.3	paste in dipropylene glycol dibenzoate	25		50	3108	phthalate free
PERKADOX CH-50		50	3.3	powder with phthalate	25		55	3106	for standard applications
PERKADOX CH-50L		50	3.3	powder with phthalate	25		55	3106	for transparent applications
PERKADOX CH-50X		50	3.3	powder with phthalate	25		55	3106	standard, free flowing
PERKADOX CH-34RP		33	2.2	powder with phthalate and inert filler	25		55		for roadpaints
PERKADOX L-40SA		40	2.6	suspension in solvent mixture	25		50	3109	low viscosity
PERKADOX L-W40		40	2.6	suspension in water	30	0	60	3109	low viscosity

Our Curing Agents

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	STORAGE TEMPERATURES		SADT (°C)	UN NO.	FEATURES
					Ts MAX. (°C)	Ts MIN. (°C)			
Peroxyesters									
	tert-Butyl peroxybenzoate [614-45-9]								
TRIGONOX 93		79	6.5	solution with promoter	25		55	3103	high reactivity
TRIGONOX C		98	8.0	liquid	25	10	60	3103	medium reactivity
	2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy)hexane [13052-09-0]								
TRIGONOX 141		92	6.8	liquid	20	-20	35	3113	high reactivity and efficiency
	tert-Butyl peroxy-2-ethylhexanoate [3006-82-4]								
TRIGONOX 21S		97	7.2	liquid	20	-30	35	3113	high reactivity
TRIGONOX 21LS		88	6.5	solution with stabilizer	20		35	3113	for very long shelf life
	tert-Butyl peroxy-3,5,5-trimethylhexanoate [13122-18-4]								
TRIGONOX 42S		97	6.7	liquid	25	-20	55	3105	medium reactivity
TRIGONOX 42PR		89	6.2	solution with promoter	25	-20	55	3105	high reactivity
Peroxyketals									
	1,1-Di(tert-butylperoxy)-3,3,5-trimethylcyclohexane [6731-36-8]								
TRIGONOX 29-B50		50	5.3	solution in phthalate	25	-20	60	3107	for long compound shelf life
TRIGONOX 29-C50		50	5.3	solution in odorless mineral spirits	25		60	3107	for long compound shelf life
	1,1-Di(tert-butylperoxy)cyclohexane [3006-86-8]								
TRIGONOX 22-C50		50	6.1	solution in odorless mineral spirits	25		70	3105	for long compound shelf life
Hydroperoxides									
	Cumyl hydroperoxide [80-15-9]								
TRIGONOX 239		44	4.6	in solvent mixture	25		55	3109	high reactivity
TRIGONOX K-90		88	9.3	in aromatic solvent mixture	40	-30	70	3109	low reactivity

Our Curing Agents

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	STORAGE TEMPERATURES		SADT (°C)	UN NO.	FEATURES	
					Ts MAX. (°C)	Ts MIN. (°C)				
Peroxide mixtures										
Acetylacetone peroxide and tert-butyl hydroperoxide [37187-22-7; 75-91-2]										
TRIGONOX 51			5.8	in solvent mixture	25	-10	60	3105	low peak exotherm	
Mixture of methyl ethyl ketone peroxide and acetylacetone peroxide [37187-22-7; 1338-23-4]										
TRIGONOX 61			7.8	in solvent mixture	25	-10	50	3105	fast cure	
TRIGONOX 63			6.6	in solvent mixture	25	-10	55	3105	fast cure	
Methyl ethyl ketone peroxide and tert-butyl hydroperoxide [1338-23-4; 75-91-2]										
TRIGONOX 75			9.9	solution in phthalate	25		60	3105	medium reactivity, reduced peak exotherm	
TRIGONOX 82			8.5	in solvent mixture	25		60	3105	low reactivity, very low peak exotherm	
Methyl ethyl ketone peroxide and cumyl hydroperoxide [1338-23-4; 80-15-9]										
TRIGONOX 249 VR			8.5	solution in phthalate	25		60	3105	medium reactivity, reduced peak exotherm	
Acetylacetone peroxide and tert-butyl peroxybenzoate [614-45-9; 37187-22-7]										
TRIGONOX 219			2.7	in solvent mixture	25		60	3105	low reactivity, efficient cure	
TRIGONOX 269			3.5	in solvent mixture	25	-5	60	3105	medium reactivity, efficient cure	
TRIGONOX 279			4.5	in solvent mixture	25	-5	60	3105	high reactivity, efficient cure	
TRIGONOX 524			4.9	in solvent mixture	25	-5	60	3103	efficient cure	
Peroxy(di)carbonates										
Di(4-tert-butylcyclohexyl) peroxydicarbonate [15520-11-3]										
PERKADOX 16			96	3.9	powder	20		40	3114	high reactivity
tert-Butylperoxy isopropyl carbonate [2372-21-6]										
TRIGONOX BPIC-C75			75	6.8	solution in odorless mineral spirits	25	-20	70	3103	high efficiency
tert-Butylperoxy 2-ethylhexyl carbonate [34443-12-4]										
TRIGONOX 117			95	6.2	liquid	20		60	3105	high efficiency

Our Range of Auxiliaries

PRODUCT NAME	CHEMICAL NAME [CAS NO.]	ASSAY (%)	PHYSICAL FORM	STANDARD PACKAGE
Cobalt accelerators				
ACCELERATOR NL-48P	Cobalt octoate [136-52-7]	0.5	in solvent mixture	180 kg drum
ACCELERATOR NL-49P	Cobalt octoate [136-52-7]	1	in solvent mixture	25 kg HDPE can
ACCELERATOR NL-51P	Cobalt octoate [136-52-7]	6	in solvent mixture	25 kg HDPE can
ACCELERATOR NL-53	Cobalt octoate [136-52-7]	10	in aliphatic solvents	25 kg HDPE can
ACCELERATOR NL-23	Cobalt/Amine mix [136-52-7; 121-69-7]	3	in aliphatic solvents	25 kg HDPE can
ACCELERATOR 383	Metal complex [112-34-5; 71-48-7]	4	in solvent mixture	25 kg HDPE can
ACCELERATOR 553	Metal complex [71-48-7]	1.9	in solvent	25 kg HDPE can
ACCELERATOR 55028	Metal mix [2457-01-4; 136-52-7]	2.2	in aliphatic solvents	25 kg HDPE can
Amine accelerators				
ACCELERATOR NL-63-100	Dimethyl aniline [121-69-7]	99	liquid	25 kg HDPE can
ACCELERATOR NL-63-10P	Dimethyl aniline [121-69-7]	10	in aliphatic solvents	25 kg HDPE can
ACCELERATOR NL-64-100	Diethyl aniline [91-66-7]	99	liquid	25 kg HDPE can
ACCELERATOR NL-64-10P	Diethyl aniline [91-66-7]	10	in aliphatic solvents	25 kg HDPE can
ACCELERATOR NL-65-100	Dimethyl-p-toluidine [99-97-8]	99	liquid	25 kg HDPE can
ACCELERATOR NL-65-10P	Dimethyl-p-toluidine [99-97-8]	10	in aliphatic solvents	25 kg HDPE can
Vanadium accelerators				
ACCELERATOR VN-2	Vanadium monobutyl dihydrophosphite [1314-62-1]	0.2	in special solvent	25 kg HDPE can
Inhibitors				
INHIBITOR NLC-10	4-tert-Butyl-1,2-dihydroxybenzene [98-29-3]	10	in aliphatic solvents	25 kg drum
INHIBITOR NLC-1	4-tert-Butyl-1,2-dihydroxybenzene [98-29-3]	1	solution in styrene	20 kg drum
INHIBITOR NLD-20	2,6-Di-tert-butyl-4-methylphenol [100-42-5]	20	solution in styrene	25 kg drum
Promoters				
PROMOTOR C	2,4-Pentanedione [123-54-6]	99	liquid	25 kg HDPE can
PROMOTOR D	N,N-Diethylacetamide [2235-46-3]	97	liquid	25 kg HDPE can
Release agents				
RELEASE AGENT NL-1	Mixture of waxes [64742-82-1]		in odorless mineral spirits, paste	20 kg drum
RELEASE AGENT NL-2	Polyvinylalcohol [9002-89-5]	8	in solvent mixture	25 kg HDPE can
Electroconductive blacks				
KETJENBLACK EC-330 JMA	Electroconductive carbon black [1333-86-4]	30	on 2-hydroxy-ethylmethacrylate, powder	35 kg drum



Innovation does not stop with our organic peroxides. Our dedicated R&D efforts has also led to the development of a dust free, easy-to-process electroconductive carbon black. This unique product is available under the name Ketjenblack® EC-330 JMA. It is possible to produce antistatic and semiconductive composites by the addition of very small quantities of Ketjenblack EC-330 JMA (0.5-2%). Please contact us for more information.



Protection of human and animal health and the environment is an integral part of the way we do business. Demonstrated by our commitment to Responsible Care®, Product Stewardship and REACH, we believe that supplying the right chemistry goes beyond just selling products.

AkzoNobel is ranked as one of the chemicals industry leaders on the prestigious Dow Jones Sustainability World Indexes (DJSI), recognizing our ongoing commitment to improving our social responsibility performance.

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.

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