Additives for Adhesives and Sealants

Additives for top performance

BASF
The Chemical Company

Portfolio of BASF Additive Product Forms

Various products are offered in different forms, enabling better handling and different ways of processing for customers.

The abbreviations for liquid and solid products used in this guide are:

- Aqueous Dispersion (DW)
- Durable Dust Free Form (DD)
- Easy Dosage Form (ED)
- Free Flowing Form (FF)
- Powder (P)

Table of contents

Additives for adhesives and sealants

The wide range of additives produced by BASF, the world's leading chemical company, includes performance and formulation additives for a huge number of demanding adhesive and sealant applications.

Performance additives

Performance additives such as light stabilizers and antioxidants protect the finished products from oxygen-radical and thermal-related degradation. Manufacturers of adhesives and sealants can choose from a variety of additives from our comprehensive range that best meet their specific requirements.

We are constantly improving our portfolio by developing new technologies for innovative processes, more sustainable innovative solutions and high-performance additives. This way, we help our customers improve the efficiency, durability and appearance of their products.

Formulation additives

BASF is a key supplier of formulation additives for the adhesive and sealant industry. These unique raw materials help enable performance-driven products which meet the latest and most stringent environmental regulations. Our portfolio comprises a broad technology base of dispersing agents, wetting and surface modifiers, defoamers, rheology modifiers and film-forming agents.

Sub-industry and technology segmentation

The segmentation of the sub-industries and technologies (i.e. product categories and market segments) in this brochure is in accordance with the 'The FEICA-ASC Adhesives & Sealants Classifications Manual 2008'. The classification manual defines the market segments and the product categories of adhesives and sealants mainly used in Europe and the US.

Where possible, segments have been grouped for better overview of the technology. Each product category in this brochure features a technology highlight that describes one or two main additive classes applicable to each category. Together they build a complete description of the additive technologies in adhesive and sealant use. The grouping in product categories does not imply that other additives are not applicable to this market segment but merely functions as a guideline for focusing the technology.

Adhesives

An adhesive is a compound that has the purpose of bonding two items together. Adhesive is a general term and includes among others types of materials such as cement, glue, mucilage and paste. All of these terms are used interchangeably.

Adhesives can be formulated based on a variety of different chemistries either natural or synthetic based. Structural adhesives can be extremely strong, and are becoming increasingly important in modern light weight construction and a variety of other industries.

The strength of an attachment or adhesive depends on many factors. Adhesion may occur either by mechanical means, in which the adhesive works its way into small pores of the substrate or by one of several mechanisms:

- An actual chemical bond occurs between adhesive and substrate.
- Electrostatic forces as in static electricity, hold the substances together.
- Van der Waals forces between molecules.
- Moisture-aided diffusion of the glue into the substrate, followed by hardening.[1]

[1] The FEICA-ASC Adhesives & Sealants Classifications Manual 2008

Polymer dispersion and emulsion adhesives

FOAMASTER®, RHEOVIS®

Dispersions can be obtained from several chemistries such as polyacrylates, polyurethanes (PUD), polyvinylacetate (PVAC), ethylvinylacetate (EVA) polymers, rubbers (SBR) and many more. Adhesive applications include pressure sensitive adhesives (PSA), office and packaging tapes, tapes for wrapping pipes, wires and cables, masking tapes and diaper tabs.

This is the largest class of adhesives. Dispersions can be obtained from a variety of chemistries, both thermosetting and air-drying. Typical examples of these classes of adhesives are pressure-sensitive adhesives, adhesive tapes and overlay adhesives.

Figure 1 **Dispersions of acrylic binder systems in water are also called latex because of their natural rubber-like appearance.**

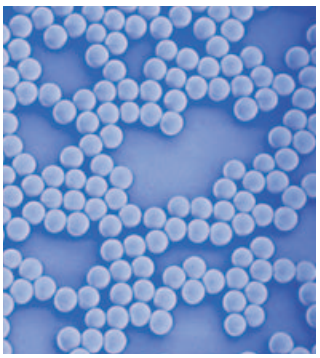


Figure 2 **Microscopic picture of latex particles.**

With its water-based dispersions for adhesives, BASF already offers new options to the packaging industry. These are environmentally friendly and approved for food packaging. In addition, they can make an essential contribution to the optimization of production processes: laminates based on water-based adhesives can immediately be processed and, thus, help reduce costs.

With high-quality products and innovative system solutions, BASF provides an ideal combination that is both environmentally friendly and at the same time economical.

Pressure sensitive adhesives

A pressure sensitive adhesive is a sub class of the general term adhesive which in dry form are permanently tacky at room temperature. They firmly adhere to a variety of dissimilar surfaces upon mere contact without the need of more than finger or hand pressure.

These require no activation by water, solvent or heat in order to form a strong adhesive force toward such materials as paper, plastic, glass, wood, cement and metals. They have a sufficiently cohesive force and elastic nature such that, despite their extensive tackiness, they can be handled with fingers and removed from smooth surfaces without leaving a residue.

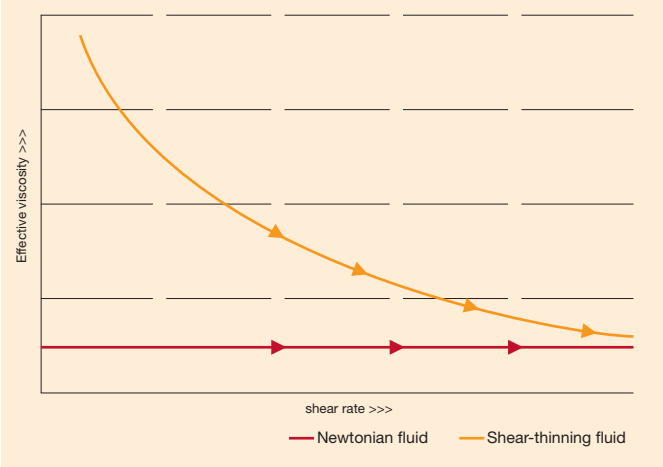
[2] The FEICA-AASC Adhesives & Sealants Classifications Manual 2008

Rheology modifiers

Rheology modifiers enable formulators to adjust the flow behavior of adhesives. Adhesive formulators benefit from improved viscosity and application characteristics. The sag resistance of an adhesive is improved by a rapid but controlled viscosity increase after application.

During transport and storage of the adhesive dispersion, the rheology modifiers prevent sedimentation of the fillers within a formulation. Dispersing agents are used to wet and stabilize pigments and other particles within adhesive formulations. For formulators they represent an essential component as they provide viscosity stability and prevent sagging.

Figure 3 **Newtonian vs. non-newtonian effective viscosity comparison**



At a glance

- Broad portfolio of synthetic rheology modifiers, including non-ionic associative (HEUR/HMPE), anionic associative (HASE) and non-associative thickener (ASE) technologies
- Focus on water-based systems with highly effective products that provide additional functionality such as wetting properties and health or environmental aspects (free of VOC, odour, APEO and heavy metals)

The Rheovis® AS range (ASE – Alkali-Swellable Emulsions) provides shear-thinning rheology to give good suspending power and sag resistance, but low high-shear viscosity for ease of application. This behaviour gives these products high added value in formulations that are applied through roller applications, for example.

The Rheovis® HS range (HASE – Hydrophobically modified Alkali- Swellable Emulsions) offers less shear-thinning than Rheovis® AS or more Newtonian rheology (shear independent viscosity). This provides the best levelling for gloss systems while avoiding spattering problems.

Abbreviations:

HASE = hydrophobic modified alkali-swellable emulsions
ASE = alkali-swellable emulsions
HEUR = hydrophobic-modified polyurethane
HMPE = hydrophobic-modified polyether

Foam formation and defoaming

Foam is defined as a fine distribution of gas in a liquid phase. Almost all water-based dispersions foam during stirring and agitation as the dispersant is normally foam-stabilizing. Pure liquids, in contrast, do not foam.

Defoamers are low surface tension liquids which have the following three properties:

- Insoluble or partially soluble in the medium to be defoamed
- Positive entering coefficient (for entering the lamella)
- Positive spreading coefficient (in the lamella)

The selective incompatibility of the defoamer is determined by the solubility parameter (Hansen/Hildebrand).

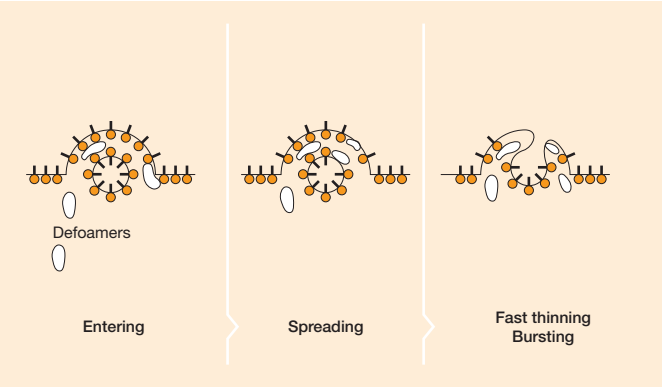
Defoamers

Defoamers are used to inhibit the build-up of foam and reduce foam or trapped air by causing the bubbles to burst and release the air. Defoamers can be generally divided into the following subgroups:

- Silicone-free
- Silicone-containing

Defoamers suppress and destroy foam and its negative effects prior to and during application. By removing or inhibiting air bubbles, they act as important process aids throughout the adhesive production as well as the application process. During application the build-up of foam has to be prevented to ensure an optimum surface without any remaining bubbles or other surface defects.

Figure 4 **Defoamers must have a lower surface tension than the surfactant, leading to an opposite Marangoni effect, i.e. fast thinning and collapse of the lamella.**



Waterborne adhesives

HYDROPALAT®, DISPEX®

The main polymers used to formulate waterborne adhesives are polyvinylalcohol (PVA), polyvinylpyrolidone (PVP) and cellulose ethers. Adhesive applications include packaging, retail consumer, construction and glue sticks.

Waterborne adhesives are based on water-soluble polymers, in contrast to dispersion and emulsion technology that is used to make originally non-water-soluble polymers compatible with water. Water-soluble polymers are often combined with dispersions and emulsions as the common carrier is water.

Water-based adhesives are an environmentally friendly and efficient alternative to solvent-based and solvent-free adhesives. Their main applications are present in all leading end-user markets such as construction, packaging and also pressure-sensitive adhesive labels.

Waterborne adhesives and sealants can benefit from wetting agents, dispersants and our viscosity and rheology control product lines, as well as defoamers and biocidal control during manufacture.

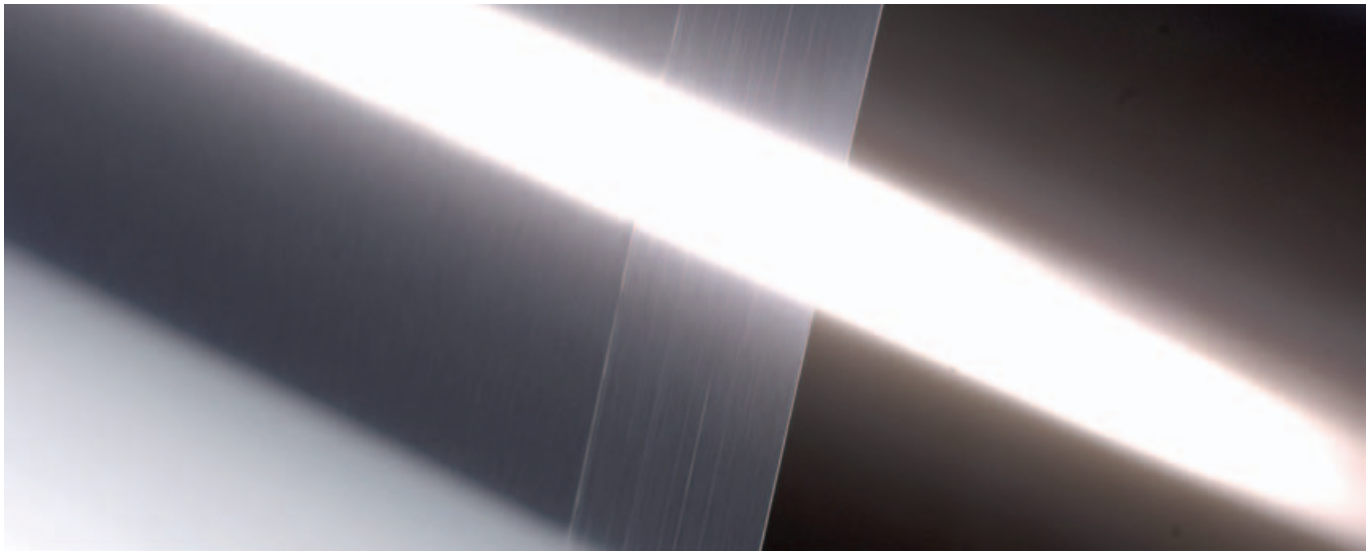
Substrate wetting

Water is a liquid that has a particularly high surface tension. Hence, under normal conditions, waterborne formulations need a substrate wetting additive to reduce the surface tension of the adhesive and sealant, preventing surface defects during the application and improving the levelling properties of the adhesive films and sealants.

Dispersion

The formation of stable dispersions is possibly the most time- and energy-consuming portion of the adhesive and sealant production process. This is due to the different surface tension between the liquids (e.g. resin, solvents) and the solids (e.g. fillers, additives).

A dispersing additive is necessary to generate a stable formulation and provide storage stability, thereby eliminating viscosity change and phase separation. The dispersants deflocculate solids and thus significantly reduce adhesive viscosity. As a result of this effect, solid loading can be increased accordingly. BASF offers a variety of polyacrylate dispersants.



Dispersing agents

Dispersing agents are used to wet and stabilize pigments and other particles within adhesive and sealant formulations. For formulators they represent an essential component as they provide viscosity stability and prevent sagging.

DISPEX® dispersants are narrowly defined dispersants based on acrylic chemistry. This is achieved via award-winning Controlled Free Radical Polymerization (CFRP) technology, which allows for higher efficiency and broader compatibility and creates optimal rheology.

Their narrow molecular weight distributions provide optimum dispersion efficiency, translating into maximum performance at the lowest possible formulation cost.

At a glance:

Novel Encapsulated Additive Technology (NEAT) for performance light stabilizers is designed for water-based adhesive and sealant applications. The NEAT-based preparations exhibit excellent long-term storage stability without any sedimentation or phase separation in their delivery form.

Key properties of the NEAT family:

- light stabilizer is “encapsulated” / dissolved in acrylic matrix
- particle size D50 < 150 nm
- active content of 20 % to 40 % (product-specific)
- total solids around 40 % to 50 % (product-specific)

Figure 5 **Dispersion mechanism: example based on electrostatic and steric repulsion caused by the surfactant**

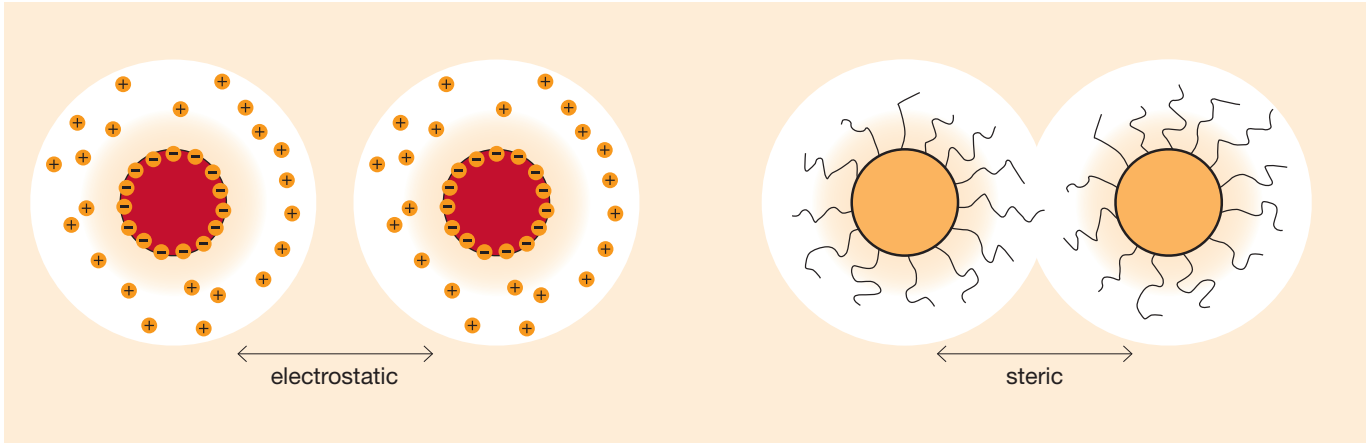


Table 1 **Additive selection guide for waterborne adhesives, dispersions and emulsions**

Products	Phys. form	Classification / chemistry	Description	Pot. food contact	Polymer dispersions and emulsions	Vinyl acetate polymers (PVAc)	Ethylene vinylacetate (EVA) co-polymers	Acrylics and acrylic copolymers	Styrene butadiene rubber (SBR)	Other synthetic rubber lattices	Natural rubber latex (waterborne)	Polyurethane (PUR, PUD)	Waterborne	Polyvinyl alcohol	Cellulose ethers	Methylcellulose	Carboxymethylcellulose	Polyvinylpyrrolidone
Processing & thermal stability																		
IRGANOX® 245 DW	liq.	DW	Primary phenolic antioxidant	✓				■	■	■	■	■						
Dispersing agents																		
Dispex® AA S760	liq.		Solution of a sodium salt of an acrylic polymer in water			■		□	■									
Dispex® AA 4030	liq.		Ammonium polyacrylate (co-)polymer					■										
Dispex® AA 4040	liq.		Ammonium salt of acrylic polymer			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® AA 4140	liq.		Sodium salt of acrylic polymer			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® CX 4240	liq.		Ammonium salt of acrylic polymer			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® CX 4340	liq.		Sodium salt of acrylic polymer			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® CX 4910	sol.		Sodium salt of acrylic polymer			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® Ultra FA 4404	liq.		Partially neutralized chelating agent			■	■	■	■	■	■	■						
Dispex® Ultra FA 4420	liq.	FAME	Fatty acid modified polyester			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® Ultra FA 4425	liq.	FAME	Fatty acid modified polyester			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® Ultra FA 4430	liq.		Non-ionic fatty alcohol ethoxylate					■										
Dispex® Ultra FA 4431	liq.		Aliphatic polyether with acidic groups			□	□	□	□	□	□	□		□	□	□	□	□
Dispex® Ultra FA 4437	liq.		Modified natural oil					■				■						
Dispex® Ultra FA 4480	liq.		Monofunctional oleo alkylenoxide block copolymer			■	■	■	■	■	■	■						
Dispex® Ultra PA 4560	liq.		High-molecular polyacrylate			□	□	□	□	□	□	□		□	□	□	□	□
Defoamers																		
Foamaster® MO 2108	liq.		Proprietary organic blend	✓		■	■	■	■	■	■	■						
Foamaster® MO 2110	liq.		Proprietary organic blend	✓		■	■	■	■	■	■	■						
Foamaster® MO 2111	liq.		Proprietary hydrophobic blend	✓		■	■	■	■	■	■	■						
Foamaster® MO 2134	liq.		Mineral-oil-based defoamer					■										
Foamaster® MO 2135	liq.		Proprietary blend of oil and silica derivatives	✓		■	■	■	■	■	■	■						
Foamaster® MO 2172	liq.		Proprietary blend of oils and silica derivatives	✓		□	□	□	□	□	□	□						
Foamaster® MO NDW	liq.		Proprietary organic blend	✓		■	■	■	■	■	■	■						
Foamaster® NO 2306	liq.		Proprietary blend of oils and hydrophobes	✓		■	■	■	■	■	■	■						
Foamaster® WO 2323	liq.		White-oil-based defoamer					■				□						
Foamaster® WO 2350	liq.		White-oil-based defoamer					■										
FoamStar® ED 2526	liq.		Modified polydimethylsiloxane			□	□	□	□	□	□	□		□	□	□	□	□
FoamStar® PB 2706	liq.		Polyether derivate of fatty acid					■										
FoamStar® PB 2770	liq.		Polymer defoamers / special defoamers					■										
FoamStar® PB 2922	sol.		Powder defoamers									■						
FoamStar® SI 2210	liq.		Polysiloxane, polyol blend									□						
FoamStar® SI 2213	liq.		Polysiloxane, polyol blend									□						
FoamStar® SI 2227	liq.		Modified polydimethylsiloxane-based defoamers	✓				□				□						
FoamStar® SI 2250	liq.		Modified polydimethylsiloxane			□	□	□	□	□	□	□		□	□	□	□	□
FoamStar® SI 2292	liq.		Polysiloxane									□						
FoamStar® ST 2441	liq.		Star polymer-based defoamers					■				■						

Products	Phys. form	Classification / chemistry	Description	Pot. food contact	Polymer dispersions and emulsions	Vinyl acetate polymers (PVAc)	Ethylene vinylacetate (EVA) co-polymers	Acrylics and acrylic copolymers	Styrene butadiene rubber (SBR)	Other synthetic rubber lattices	Natural rubber latex (waterborne)	Polyurethane (PUR, PUD)	Waterborne	Polyvinyl alcohol	Cellulose ethers	Methylcellulose	Carboxymethylcellulose	Polyvinylpyrrolidone
Rheology modifiers																		
Rheovis® AS 1956	sol.	ASE	Ammonia-based polyacrylate					■										
Rheovis® AS 1180	liq.	ASE	Acrylic thickener, water-in-oil emulsion					■										
Rheovis® PU 1270	liq.	HEUR	Solution in water/isopropanol/propylene glycol					■				■						
Rheovis® PU 1280	liq.	HEUR	Solution in water/butyldiglycol					■				■						
Rheovis® AS 1420	liq.	ASE	Special hydrophobic modified vinylpyrrolidone/ vinylacetate copolymer					■						■				■
Rheovis® AS 1125	liq.	ASE	Non-associative thickener: anionic polyacrylate copolymer					□				□						
Rheovis® AS 1130	liq.	ASE	Anionic polyacrylate copolymer			□	□	■	□	■	■	■			□	□	□	□
Rheovis® AS 1135	liq.	ASE	Anionic polyacrylate copolymer			□	□	■	□	■	■	■						
Rheovis® AS 1188	liq.	ASE	Anionic polyacrylate copolymer					■		■	■	■						
Rheovis® AS 1920	liq.	ASE	Anionic polyacrylate copolymer					■										
Rheovis® HS 1152	liq.	HASE	Anionic polyacrylate copolymer					■	■	■	■							
Rheovis® HS 1162	liq.	HASE	Polyacrylate			□	□	□	□	□	□	□			□	□	□	□
Rheovis® HS 1169	liq.	HASE	Associative thickener: anionic polyacrylate copolymer, hydrophobically modified					■	■									
Rheovis® HS 1980	liq.	HASE	Polyacrylate			□	□	■	□	■	■	■			□	□	□	□
Rheovis® PU 1214	liq.	HEUR	Associative thickener	✓		■	■	■	■	■	■	■						
Rheovis® PU 1250	liq.	HEUR	Associative thickener	✓		■	■	■	■	■	■	■						
Rheovis® PU 1256	liq.	HEUR	Associative thickener						■		■	■						
Wetting agents and surface modifiers																		
Hydropalat® WE 3110	liq.		Alkoxylated surfactants					■			■	■						
Hydropalat® WE 3120	liq.		Alkoxylated surfactants					■				■						
Hydropalat® WE 3188	liq.		Non-ionic surfactant/emulsifier			■	■	■	■	■	■	■						
Hydropalat® WE 3240	liq.		Silicone surfactant					■				■						
Hydropalat® WE 3370	liq.		Fluorpolyacrylate			□	□	□	□	□	□	□		□	□	□	□	□
Hydropalat® WE 3475	liq.		Dioctyl sulfosodiumsuccinate			■	■	■	■	■	■	■						
Hydropalat® WE 3485	liq.		Sulfosuccinates					■				■						
Hydropalat® WE 3486	liq.		Sulfosuccinates					■				■						
Light stability / weather resistance																		
TINUVIN® 99-DW	liq.	DW	Benzotriazole (BTZ) for water-based systems			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 123-DW	liq.	DW	N-alkoxy HALS			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 292	liq.	HALS	Multipurpose HALS for various applications			□	□	□	□	□	□	□						
TINUVIN® 384-2	liq.	BTZ	Benzotriazole (BTZ) multipurpose					□						□	□	□	□	□
TINUVIN® 400-DW	liq.	DW	Blue-shifted hydroxyphenyltriazine			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 477-DW	liq.	DW	Red-shifted hydroxyphenyltriazine			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 479-DW	liq.	DW	Hydroxyphenyltriazine suited for thin film application			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 1130	liq.	BTZ	Hydrophilic modified benzotriazole			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 5151	liq.	Blend	BTZ / N-alkyl HALS			□	□	□	□	□	□	□		□	□	□	□	□
TINUVIN® 5333-DW	liq.	Blend	UVA / low alkaline HALS			□	□	■	□	□	□	■		□	□	□	□	□
Other additives																		
IRGAGUARD® B 1000	sol.	Microbial control	Organic antimicrobial			■	■	■	■	■	■	■		■	■	■	■	■
Loxanol® CA 5308	liq.	Coalescing agents	Dicarbonic acid-diisobutyl ester					■	■									
Loxanol® PL 5060	liq.	Plasticizer	Polypropylene glycol alkylphenylether					■	■									
TINOPAL® SFP	sol.	Optical brightener	Triazine-stilbene, water-soluble brightener			■	■	■	■	■	■	■			□			
TINOPAL® NFW	liq.	Optical brightener	Solution of an optical brigthener sodium salt					■	■		■	■						
MELAPUR® MC range	sol.	Flame retardant	Melamine cyanurate flame retardant								□	■						

✓ Potential selection for Food Contact Approval. Please contact BASF to clarify exact registration status ■ preferred selection □ possible selection

Tackifiers and natural polymers

IRGANOX®, IRGAFOS®, TINUVIN®, IRGAGUARD®

This technology segment includes resin systems like casein, colophon resin, rosin ester and natural rubber. Examples of adhesive applications are hard packaging and general hot melt adhesives.

Natural-based adhesives undergo like any other synthetic polymers in adhesives and sealants induced discoloration as a result of degradation. Natural rosin resins are even more prone to oxidation as there are several susceptible sites in the molecule that are predisposed to oxidation.

Figure 6 **Harvesting of natural rubber latex.**

Figure 7 **Tackifiers build up to 30% of the hot melt formulation used in paper board packaging.**

Packaging Market

Natural-based adhesives are very popular and are growing in volume. They will be used for many years to come in the packaging market. They are the adhesives of choice in hard packaging where water-removable paper labels are required.

BASF offers additives to improve the performance of tackifiers, i.e. durability, prolonged open time, shorter reaction times, improved initial color of rosin esters and superior high temperature and storage stability. The use of the right tackifier resin helps the formulators find the right balance between adhesion and cohesion properties.

Technology focus

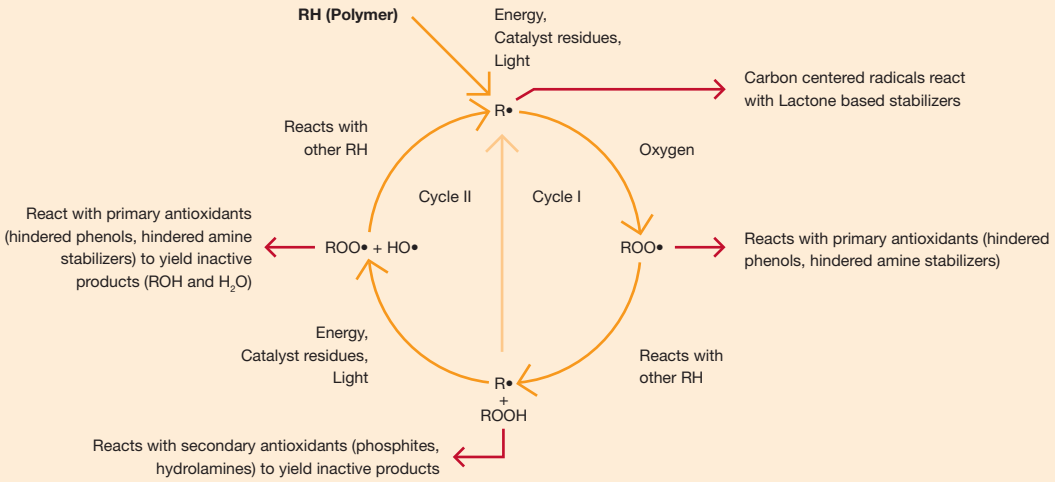
Antioxidants play a key role in adhesive formulation. They preserve adhesion performance and rheological behavior during processing and aging, which are critical to guarantee the high level of quality and performance needed in industrial bonding applications.

Antioxidants interrupt the degradation process

Autoxidation may be initiated by heat, high energy radiation (UV light), mechanical stress, catalyst residues or through reaction with other impurities. Free radicals (Figure 8) are generated which react rapidly with oxygen to form peroxy radicals. These peroxy radicals may further react with the polymer chains leading to the formation of hydroperoxides (ROOH). On exposure to heat or light, hydroperoxides decompose to yield more radicals that can reinitiate the cycle.

The use of primary antioxidants such as Irganox® suppresses the formation of free radical species and hydroperoxides in polymers both during storage and conversion. UV absorbers and hindered amine stabilizers such as Tinuvin® and Chimassorb® protect polymers from UV light-induced oxidation.

Figure 8 **Polymer degradation and stabilization**



Irganox® and Irgafos® antioxidants (AO) protect adhesives, sealants and fibers against thermal degradation during processing, production and service life. Irganox® thereby represents a complete range of AO's based on sterically hindered phenols or thioethers, as well as blends of different AO classes. Irgafos® are so-called secondary AO process stabilizers based on phosphite chemistry.

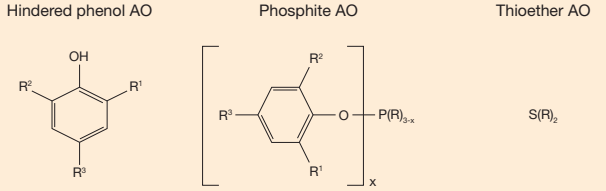
Primary Antioxidants

mainly acting in Cycle I of Figure 8 as chain-breaking antioxidants, are sterically hindered phenols (Figure 9). Primary antioxidants react rapidly with peroxy radicals (ROO•) to break the cycle. Irganox®1010, Irganox® 1076, Irganox® 1098, Irganox® 1135 and Irganox® 245 are examples of primary antioxidants.

Secondary Antioxidants

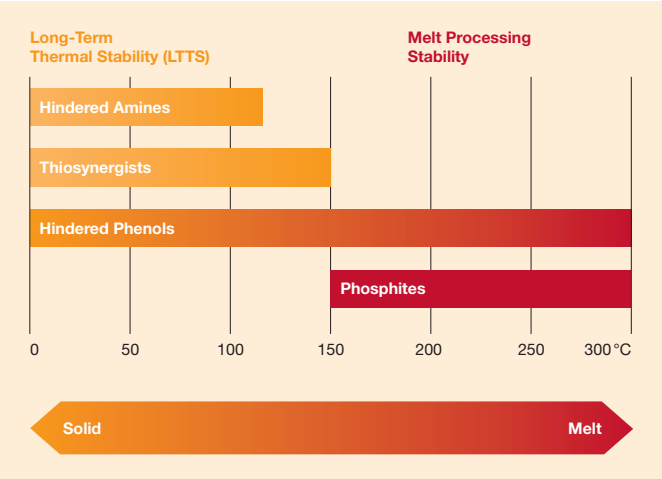
acting in Cycle II of Figure 8, react with hydro-peroxide (ROOH) to yield non-radical, non-reactive products and are therefore frequently called hydro-peroxide decomposers. Secondary antioxidants are particularly effective in synergistic combination with primary antioxidants. Typical secondary antioxidants are phosphites and thioethers.

Figure 9 **Types of antioxidants**



Hindered Phenols can be used in a wide temperature range. The use of the secondary antioxidant is temperature dependent. Phosphites are largely used in high temperature processes such as compounding, while thiosynergists can also be used at lower temperatures.

Figure 10 **Effective use temperatures for the different classes of stabilizers.**



For product details please see table 2 on page 14.

Hot melt adhesives

IRGANOX®, CHIMASSORB®, TINUVIN®, TINOPAL®

Hot melts can be based on polyacrylates, polyurethane (PU), polyolefins (PP, EP), ethylvinylacetate (EVA) polymers, polyamide (PA), saturated polyesters and styrene block polymers (SIS, SBS). Adhesive applications include packaging, book binding and product assembly.

Hot melt adhesives are thermoplastics that are applied in a molten state. They achieve their bond strength on resolidification during cooling. Typically hot melt adhesives are formulated with about 30% tackifiers and other raw materials to tailor the processing. They are a very versatile group of adhesives which are capable of bonding many different materials in major applications such as automotive, packaging, electrical / electronic, footwear and woodworking.

Many of these applications require products that have good adhesion to a variety of substrates, as well as medium to long-term aging performance. In order to match these requirements, hot melt adhesives have to be protected during the manufacturing, the application process and product lifecycle. There are a number of hot melt adhesive technologies in use and antioxidants and light stabilizers play a key role in ensuring superior product performance.

Figure 11 **AcResin®, a UV curable binder system for hot melt application.**

Figure 12 **Pressure sensitive adhesives are one of the main applications of hot melts.**

Technology focus

UV absorbers

According to Lambert-Beer's Law, the absorbance A, i.e. the filter effect of a UV absorber (UVA), is in linear relationship to the optical filter concentration (c), the film thickness (= light path length) (d) and the extinction coefficient (ε). Thus the Lambert-Beer's Law makes it possible to calculate/estimate the necessary amount of UVA needed for proper light protection at a given film thickness (d). Increased (c) or (d) values result in increased filter effect and therefore increased protection against harmful UV radiation.

Figure 13 **Beer-Lambert Law**

Transmittance T decreases exponentially, absorbance A increases by straight proportion with

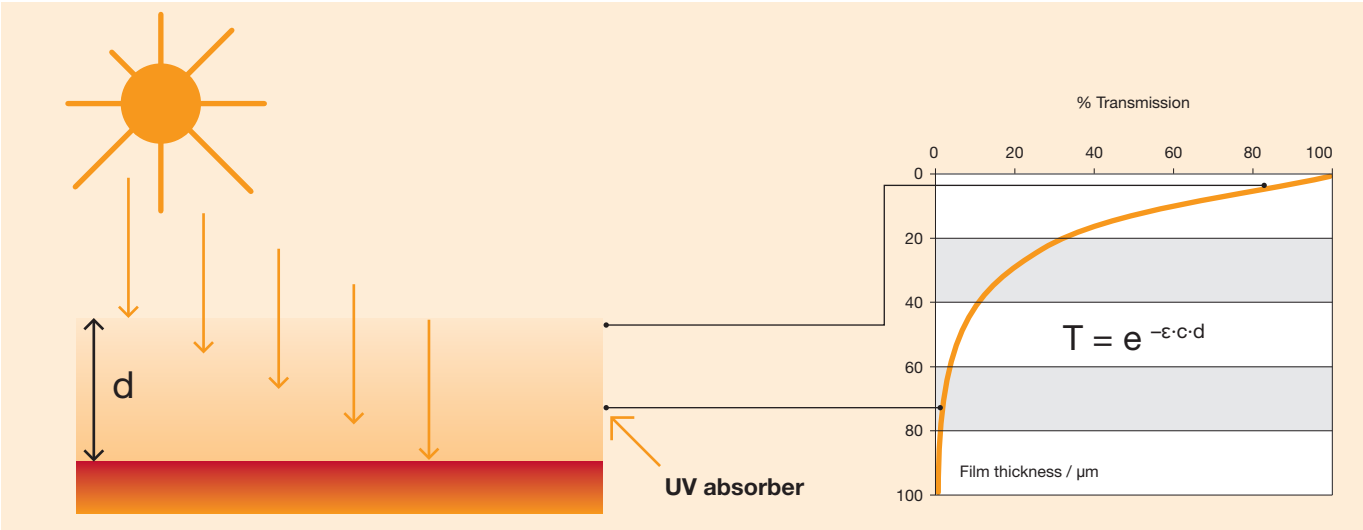
- chromophore concentration c
- light path length or film thickness d
- extinction coefficient ε

$$A = \log_{10}\left(\frac{1}{T}\right) = \varepsilon \cdot c \cdot d$$

On the other hand, it means that the filter effect is strongly influenced by the adhesive thickness; the thinner the adhesive thickness the more UVA is necessary. Hence, the UVA alone is not sufficient to protect the very surface of an adhesive. In conclusion they cannot effectively prevent the formation of surface defects as a result of photo degradation under exterior conditions.

For exterior conditions the combination of UVA and HALS provides synergistic effects, allowing excellent protection against surface defects and discolouration. For interior conditions the single use of UVA is largely sufficient in order to prevent both the fading of material properties as well as the yellowing of the adhesive.

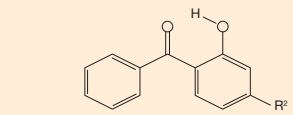
Figure 14 **The transmission is dependent of the film thickness at a defined UV absorber concentration.**



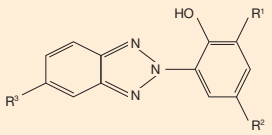
UV absorber requirements:

- Must absorb strongly in the UV Region (290 – 400 nm)
- Must have a sharp cut-off to visible light (>400 nm)
- Must be photostable
- Must dissipate the photoexitation in a harmless way

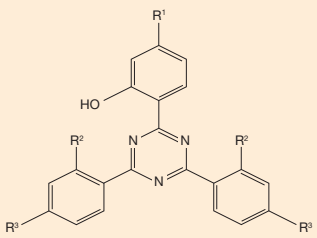
Figure 15 **Types of UV absorbers**



Benzophenone (BP)



Benzotriazole (BTZ)



Hydroxyphenyltrianzine (HPT)

Optical brighteners

Special types of UVA are optical brighteners. They convert UV light into the visible spectra. Optical brighteners are dyes working by a fluorescent mechanism. They absorb light in the ultraviolet region (usually 340 – 370 nm) of the electromagnetic spectrum, and emit light in the blue region (typically 420 – 470 nm).

With this special feature they are designed to brighten adhesives, sealants and fibers or to mask yellowing. Tinopal® types can also be used where fluorescence can provide a means of detecting film thickness, registration and identification, e.g. in adhesives and sealants as fluorescent tracer in-line assurance inspections.

Figure 17 **Hot melt adhesives for DIY use are largely based on EVA polymer.**

Table 2 **Additive selection guide for tackifier, natural polymers and hot melt adhesives**

Products	Phys. Form	Classification / chemistry	Description	Food Contact	Tackifier	Hydrocarbons	Polyprene	Rosin ester	Hot melt	Polyolefin (PE, PP, APP)	Ethylene vinyl acetate (EVA)	Polyamide (PA)	Polyester, saturated	Styrene block copolymers (e.g. SBS, SIS, SEBS)	Polyurethane (PUR)	Acrylics and acrylic copolymers
Processing & thermal stability																
IRGAFOS® 126	sol.	P	Secondary antioxidant/phosphite	✓						■		■		■		
IRGAFOS® 168	sol.	(ED) / FF	Secondary antioxidant/phosphite	✓						■		■		■		■
IRGANOX® 1010	sol.	(ED) /FF	Primary phenolic antioxidant	✓		■	■	■		■	■	■	■	■	■	
IRGANOX® 1035	sol.	FF	Primary phenolic antioxidant	✓						■	□				□	□
IRGANOX® 1076	sol.	(ED) / FD	Primary phenolic antioxidant	✓		■	■	■		■	■			■		
IRGANOX® 1098	sol.	ED	Primary phenolic antioxidant									■			■	
IRGANOX® 1330	sol.	P	Primary phenolic antioxidant			■	■	■		■	■	■	■	■	■	
IRGANOX® 1425	sol.	FF	Calcium phosphate	✓				■								
IRGANOX® 1726	sol.	P	Primary phenolic antioxidant	✓		■		■						■	■	
IRGANOX® 245	sol.	P	Primary phenolic antioxidant	✓								■			■	
IRGANOX® 3114	sol.	P	Primary phenolic antioxidant	✓		■	■	■		■	■	■	■	■	■	
IRGANOX® 565	sol.	P	Primary phenolic antioxidant	✓				■						■		
IRGANOX® B 215	sol.	DD/ED/FF	Blend of antioxidants	✓		■		■		■	■			■		
IRGANOX® B 225	sol.	DD/ED/FF	Blend of antioxidants	✓		■		■		■	■			■		
IRGANOX® B 561	sol.	FF	Blend of antioxidants	✓		■		■		■	■			■		
IRGANOX® B 612	sol.	P	Blend of antioxidants	✓		■		■		■	■			■		
IRGANOX® MD 1024	sol.	P	Metal deactivator (Primary phenolic antioxidants)	✓						□	□	□	□	□	□	□
IRGANOX® PS 800	sol.	FL	Secondary antioxidant/thiosynergist	✓							■			■	■	
Dispersing agents																
Efka® FA 4644	liq.		Unsaturated polyamide and acid ester salts			□		□				□	□			
Efka® FA 4665	liq.		High-molecular carboxylic acid/polysiloxane			□	□	□				□	□			
Efka® FA 4642	liq.		Unsaturated polyamide and acid ester salts			□		□				□	□			
Dispex® Ultra FA 4420	liq.	FAME	Fatty acid modified polyester									□	□		□	□
Dispex® Ultra FA 4425	liq.	FAME	Fatty acid modified polyester									□	□		□	□
Dispex® Ultra FA 4431	liq.		Aliphatic polyether with acidic groups			□		□		□	□	□	□	□	□	□
Defoamers																
Efka® PB 2020	liq.		Polyolefin			□	□	□		□	□	□	□	□	□	□
FoamStar® SI 2280	liq.		Polyolefin			□	□	□		□	□	□	□	□	□	□
Wetting agents and surface modifiers																
Efka® SL 3030	liq.		Modified polysiloxanes			□	□	□		□	□	□	□	□	□	□
Efka® SL 3034	liq.		Fluorocarbon modified polysiloxanes			□	□	□		□	□	□	□	□	□	□
Efka® SL 3035	liq.		Modified polysiloxanes										■			
Efka® SL 3236	liq.		Modified polysiloxanes			□	□	□		□	□	□	□	□	□	□
Efka® FL 3277	liq.		Fluorpolyacrylate			□	□	□		□	□	□	□	□	□	□
Efka® SL 3883	liq.		Reactive polysiloxanes										■			
Efka® SL 3886	liq.		Reactive polysiloxanes										■			

Products	Phys. Form	Classification / chemistry	Description	Food Contact	Tackifier	Hydrocarbons	Polyprene	Rosin ester	Hot melt	Polyolefin (PE, PP, APP)	Ethylene vinyl acetate (EVA)	Polyamide (PA)	Polyester, saturated	Styrene block copolymers (e.g. SBS, SIS, SEBS)	Polyurethane (PUR)	Acrylics and acrylic copolymers
Light stability/weather resistance																
CHIMASSORB® 81	sol.	BP	Benzophenone			□	□	□		□	□	□	□	□	□	□
CHIMASSORB® 90	sol.	BP	Benzophenone			□	□	□		□	□	□	□	□	□	□
CHIMASSORB® 944 LD	sol.	HALS	Oigomeric hindered amine light stabilizer			□	□	□		□	□	□	□	□	□	□
CHIMASSORB® 2020 FDL	sol.	HALS	Oligomeric hindered amine light stabilizer			□	□	□		□	□	□	□	□	□	□
TINUVIN® 99-2	liq.	BTZ	Benzotriazole (BTZ) multipurpose			□	□	□		□	□	□	□	□	□	□
TINUVIN® 123	liq.	HALS	N-alkoxy HALS (non-basic)			□	□	□		□	□	□	□	□		□
TINUVIN® 152	sol.	HALS	Non-migrating N-OR HALS for powder and plastic coatings			□	□	□		□	□	□	□	□	□	□
TINUVIN® 171	liq.	BTZ	Benzotriazole (BTZ)			□	□	□		□	□	□	□	□	□	□
TINUVIN® 292	liq.	HALS	Multipurpose HALS for various applications			□	□	□		□	□	□	□	□	□	□
TINUVIN® 326	sol.	BTZ-Cl	Chlorinated benzotriazole (red-shifted)			□	□	□		□	□	□	□	□	□	□
TINUVIN® 328	sol.	BTZ	Benzotriazole (BTZ)			□	□	□		□	□	□	□	□	□	□
TINUVIN® 384-2	liq.	BTZ	Benzotriazole (BTZ) multipurpose			□	□	□		□	□	□	□	□	□	□
TINUVIN® 400	liq.	HPT	Multipurpose hydroxyphenyltriazine			□	□	□		□	□	□	□	□	□	□
TINUVIN® 477	liq.	HPT	Red-shifted hydroxyphenyltriazine			□	□	□		□	□	□	□	□	□	□
TINUVIN® 479	sol.	HPT	Hydroxyphenyltriazine (highest extinction)			□	□	□		□	□	□	□	□	□	□
TINUVIN® 622	liq.	HALS	Low-basic HALS for powder coatings			□	□	□		■	■	■	■	■	■	■
TINUVIN® 770 DF	sol.	HALS	HALS for adhesives and sealants applications with food-contact approval	✓		□	□	□		□	□	□	□	□	□	□
TINUVIN® 783 FDL	sol.	HALS	HALS blend for solvent-based adhesives and sealants applications			□	□	□		□	□	□	□	□	□	□
TINUVIN® 900	sol.	BTZ	Benzotriazol (low volatility)			□	□	□		□	□	□	□	□	□	□
TINUVIN® 928	sol.	BTZ	Benzotriazole			□	□	□		■	■	■	■	■	■	■
TINUVIN® 1130	liq.	BTZ	Hydrophilic modified benzotriazole			□	□	□		□	□	□	□	□	□	□
TINUVIN® 1577 ED	sol.	HPT	For adhesive and sealant			□	□	□		□	□	□	□	□	□	□
TINUVIN® 5050	liq.	Blend	BTZ / N-alkyl HALS			□	□	□		□	□	□	□	□	□	□
TINUVIN® 5060	liq.	Blend	Blend of BTZ and NOR HALS			□	□	□		□	□	□	□	□	□	□
TINUVIN® 5151	liq.	Blend	BTZ / N-alkyl HALS			□	□	□		□	□	□	□	□	□	□
TINUVIN® B 75	liq.	Blend	Blend of antioxidant, UVA and N-alkyl HALS			□	□	□		□	□	□	□	□	□	□
Other Additives																
IRGAGUARD® B 1000	sol.	Microbial control	Organic antimicrobial			□	□	□		■	■	■	■	■	■	■
IRGAGUARD® B 6000	sol.	Microbial control	silver glass/zeolite based antimicrobial			□	□	□		■	■	■	■	■	■	■
IRGASTAB® PVC 76	liq.	Stabilizer	Liquid Thermal Stabilizer Package for Plasticizers and PVC Compounds							□	□	□	□	□		
TINOPAL® OB CO	sol.	Optical Bright-ener	Thiophenedyil-benzoxazole optical bright-ener				■	■		■	■	■	■	■	■	■
MELAPUR® MC range	sol.	Flame Retardant	Melamine cyanurate flame retardant								□	■	■		■	□
MELAPUR® MP	sol.	Flame Retardant	Melamine phosphate flame retardant							□	□	■				
MELAPUR® 200 range	sol.	Flame Retardant	Melamine polyphosphate flame retardant									■	■			□
FLAMESTAB® NOR 116 FF	sol.	Flame Retardant	Triazine derivative							■						

✓ Potential Selection for Food Contact Approval. Please contact BASF to clarify exact registration status ■ preferred selection □ possible selection

Solvent-based adhesives

IRGANOX®, CHIMASSORB®, TINUVIN®

Solvent-based adhesives include the following resins systems: acrylic- and co-polymers, polyurethanes (PUR), polychloroprenes (CP), silicones, natural and synthetic rubber. Adhesive application examples are retail consumer (DIY), construction, woodwork and joinery.

Solvent-borne adhesives are soluble in volatile organic solvents. The main solvents used for adhesive systems are aromatic, aliphatic, esters, ketones, mineral spirits and methylene chloride.

The main types of solvent-based adhesives are:
- Solvent-borne pressure sensitive adhesives (mainly based on acrylic polymers, styrene block copolymers, natural rubber, styrene-butadiene rubber),
- Solvent-borne for non-pressure sensitive adhesives and
- Solvent-borne contact adhesives based on polychloroprene rubber.

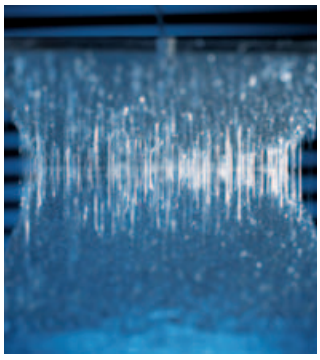


Figure 18 **Glue strips on a pressure sensitive adhesives**

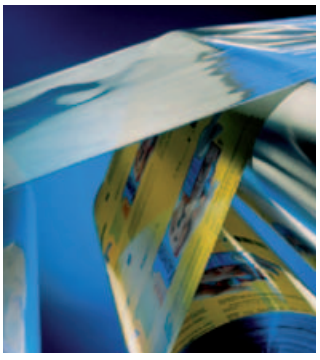


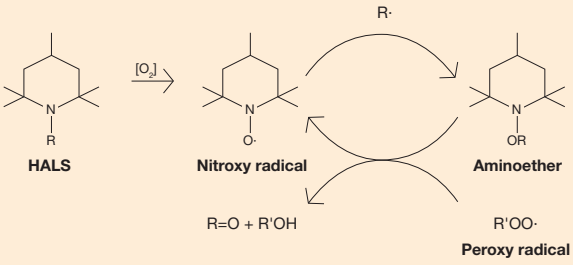
Figure 19 **Film to film lamination and clear film labeling**

Hindered amine light stabilizers (HALS)

The mode of action of HALS is largely independent of the film thickness applied, which in turn means that they can also act at the adhesive surface where minor protection is provided by the UVA (see Beer-Lambert Law). In clear systems they protect against surface defects such as loss of gloss or cracking, whereas in pigmented systems chalking and discolouration can be prevented. Finally, these surface defects lead to increased water permeability, loss of physical and protective properties followed by substrate erosion.

Today a large variety of different HALS representing the mono-, di- or oligo-functional tetramethylpiperidine-group (TMP) containing polymers are available, which – due to their different physical and chemical properties – fulfill the requirements of the adhesive industry.

Figure 20 **Denisov Cycle. A mode of action of hindered amine light stabilizers (HALS)**



For product details please see table 3 on page 19.

Reactive adhesives (2-component system and radiation curing)

IRGACURE®, TINOPAL®, MELAPUR®

Reactive adhesive systems are formulated using the following chemistries: acrylics, polyurethanes (PUR), epoxies (EP), polyesters, silicones and formaldehyde condensates. Adhesive applications for reactive adhesives are construction, transportation, assembly, woodwork and joinery.

Reactive adhesives react either with a hardener (2-component system) or via a photoinitator with each other to build a cross-link network. The reaction occurs upon mixing of the 2-component system or via photoinitiation. Reactive adhesives can also react with the surface of the substrate they are applied on.

The performance advantage of reactive adhesives over thermoplastic materials such as hot melt is the excellent mechanical, temperature and environmental resistance. These types of adhesives are thus preferred for structural bonding as can be found in automotive, transportation, electronics and energy application.

Figure 21 **Reactive systems are used in structural adhesives where high mechanical loads need to be transferred**

UV/EB cure adhesives

UV cure adhesives are generally based on free radical curing of acrylate monomers and oligomers in the presence of a photoinitiator. UV/EB technology is one of the most rapidly growing technologies in recent times due to its undisputed advantages such as:

- UV cure adhesives allow curing on demand: formulators can adjust the curing speed of the related application.
- Curing speed of UV/EB adhesives is much faster than that of many alternatives, thereby generating large production cost savings.
- UV/EB technology exhibits environmental benefits, such as zero emission/low VOC, which addresses sustainability as a general concern nowadays.

Photoinitiators

The photoinitiator is a key component of an energy-curable formulation, as it largely determines the spectral sensitivity and cure response of the system. BASF offers a broad range of highly effective photoinitiators for energy curable adhesives and sealants. Energy-cured adhesives provide performance attributes such as excellent solubility in acrylate monomers, low yellowing, low odour/low migration, surface cure and through-cure properties.

The following classes of photoinitiators can be differentiated:

- AAK: Alpha amino ketones
- AHK: Alpha hydroxy ketones
- APO: Acyl phosphine oxides
- BDK: Benzyldimethyl ketals
- BP: Benzophenone
- CP: Cationic Photoinitiator
- PG: Phenylglyoxylate

Flame retardancy

Demanding fire safety levels in the construction, aerospace and transportation markets have generated a need for flame retardant adhesives, sealants and putties. MELAPUR® products are a line of halogen-free, melamine-based flame retarding additives designed to meet these markets' safety needs and can be used in applications that place special focus on flame protection.

For product details please see table 3 on page 19.

Sealants

CHIMASSORB®, TINUVIN®, IRGAGUARD®

Sealants can be formed from various chemistries including: acrylics, polyurethanes (PUR), polyvinylacetate (PVAC) caulks, polysulfides, silicones, silane-modified (MS) polymers and others. Sealant applications include insulated glass, window and door caulking, bathroom tiles, fixtures in transportation, assembly, retail and consumer (DIY) industries.

Figure 22 **Application of a filled silicone window sealant**

Sealants and caulks are used to fill joints, gaps and cavities between two or more similar or dissimilar substrates. Today, the number of applications for sealants in construction, industrial and consumer markets is growing.

These materials are required to seal and adhere to the appropriate surfaces over a wide range of temperatures, environmental stress and joint movement conditions. To ensure that the physical properties of sealants are maintained, it is necessary to prevent or retard the degradation of the sealant. Window sealants are usually exposed to direct sun light. Thus they need light stabilization to serve their purpose for extended periods.

Sanitary requirements are also becoming increasingly more important for sealants and caulks. As a result, there is a rising demand to protect adhesives and sealants from exposure to bacteria and microbes. BASF offers a wide range of stabilizers and specialty additives that are used in adhesives, sealants and caulks.

Antimicrobial protection

Microbial contamination of an adhesive or sealant can lead to unpleasant odours, biofilm formation, discolouration and staining as well as degradation. This is why effective biocides are necessary for both preventive and protective measures and essential for protecting the adhesive or sealant itself.

Irgaguard® antimicrobials are highly specific and effective growth inhibitors for gram-positive and gram-negative bacteria, mold and yeast on organic surfaces. They also effectively inhibit the photosynthesis of algae.

Table 3 **Additive selection guide for solvent-based and reactive adhesives and sealants**

Products	Phys. Form	Classification / chemistry	Description	Food Contact	Solvent-based	Polychloroprene (CP)	Polyurethane (PUR)	Natural and synthetic rubber (solvent-based)	Acrylics	Silicones	Reactive	Epoxy (EP)	Polyurethane (PUR)	Polyester, unsaturated	Acrylics	Silicones	Formaldehyde condensates	Sealants	Acrylics	Polyvinylacetate caulks (PVAc)	Butyls(polyisobutylene, PIB)	Polysulfides	Polyurethane (PUR)	Silicones	Silane-modified polymers	Others, e.g. bitumens, PVC body
Processing & Thermal stability																										
IRGAFOS® 126	sol.	P	Secondary antioxidant/ phosphite	✓				■	■						□				□				■			
IRGAFOS® 168	sol.	(ED) / FF	Secondary antioxidant/ phosphite	✓					■						□				□						□	
IRGANOX® 1010	sol.	(ED) /FF	Primary phenolic antioxidant	✓			■		■				□		□				□				■		■	
IRGANOX® 1035	sol.	FF	Primary phenolic antioxidant	✓			□		□			□	□		□				□				□		□	
IRGANOX® 1076	sol.	(ED) / FD	Primary phenolic antioxidant	✓			■		■						□				□						□	
IRGANOX® 1098	sol.	ED	Primary phenolic antioxidant										□													
IRGANOX® 1330	sol.	P	Primary phenolic antioxidant				■		■				□		□				□				■		■	
IRGANOX® 1425	sol.	FF	Calcium phosphate	✓																						
IRGANOX® 1520 L	liq.		Primary phenolic antioxidant	✓			■	■	■				□		□				□						□	
IRGANOX® 1726	sol.	P	Primary phenolic antioxidant	✓			■	■					□		□											
IRGANOX® 245	sol.	P	Primary phenolic antioxidant	✓		■			■				□						□				■		□	
IRGANOX® 3114	sol.	P	Primary phenolic antioxidant	✓			■		■				□		□				□				■		■	
IRGANOX® 565	sol.	P	Primary phenolic antioxidant	✓																						
IRGANOX® MD 1024	sol.	P	Metal deactivator (Primary phenolic antioxidants)	✓		□	□	□	□	□		□	□	□	□	□	□									
IRGANOX® PS 800	sol.	FL	Secondary antioxidant/ thiosynergist	✓			□																			
Dispersing agents																										
Efka® FA 4642	liq.		Unsaturated polyamide and acid ester salts				□		□			□	□	□	□		□		□		□	□	□			□
Efka® FA 4644	liq.		Unsaturated polyamide and acid ester salts				□		□			□	□	□	□		□		□		□	□	□			□
Efka® FA 4665	liq.		High-molecular carboxylic acid/polysiloxane			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
Efka® PA 4401	liq.		Modified polyacrylate polymer			■	■					■														
Efka® PA 4401	liq.		Modified polyacrylate polymer				■																			
Efka® PU 4010	liq.		New generation of modified polyurethane polymer			■	■					■	■													
Efka® PX 4320	liq.		Acrylic block copolymer made by controlled free radical polymerization (CFRP)				■																			
Rheology Modifiers																										
Efka® RM 1900	liq.		modified hydrogenated castor oil			■	■					■	■	■												
Efka® RM 1920	liq.		hydrogenated castor oil			■	■					□	□													
Defoamers																										
Efka® PB 2020	liq.		Polyolefin			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	
Efka® PB 2720	liq.		Solvent-based solution of defoaming substances with modified silicone compounds									■		■												
Efka® SI 2025	liq.		Modified polysiloxanes			□	□	□	□	□		□	□	□	□	□	□		□	□	□		□	□	□	□

Products	Phys. Form	Classification / chemistry	Description	Food Contact	Solvent-based	Polychloroprene (CP)	Polyurethane (PUR)	Natural and synthetic rubber (solvent-based)	Acrylics	Silicones	Reactive	Epoxy (EP)	Polyurethane (PUR)	Polyester, unsaturated	Acrylics	Silicones	Formaldehyde condensates	Sealants	Acrylics	Polyvinylacetate caulks (PVAc)	Butyls(polyisobutylene, PIB)	Polysulfides	Polyurethane (PUR)	Silicones	Silane-modified polymers	Others, e.g. bitumens, PVC body
Wetting agents and surface modifiers																										
Efka® FL 3277	liq.		Fluorpolyacrylate			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
Efka® FL 3740	liq.		Copolyacrylate			■	■		■			■	■	■	■											
Efka® SL 3030	liq.		Modified polysiloxanes			■			■																	
Efka® SL 3031	liq.		Fluorocarbon modified polysiloxanes			□	■	□	□	□		■	■	□	□	□	□		□	□	□		□	□	□	□
Efka® SL 3034	liq.		Modified polysiloxanes				■					■														
Efka® SL 3035	liq.		Modified polysiloxanes			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
Photoinitiators																										
IRGACURE® 1173	liq.	AHK	Radical photo initiator/a-hydroxy ketone											■	□											
IRGACURE® 184	sol.	AHK	Radical photo initiator/a-hydroxy ketone											■	□											
IRGACURE® 250	liq.	CP	Cationic photo initiator/iodonium salt									■					■									
IRGACURE® 2959	sol.	AHK	Radical photo initiator/a-hydroxy ketone n	✓										□	□											
IRGACURE® 500	liq.	blend	Blend of radical photo initiators											□	□											
IRGACURE® 651	sol.	BDK	Radical photo initiator/benzoine ether											□	□											
IRGACURE® 754	liq.	PG	Radical photo initiator/phenyl glyoxolate											□	□											
IRGACURE® 819	sol.	APO	Radical photo initiator/BAPO											■	□											
IRGACURE® TPO	sol.	APO	Radical photo initiator/MAPO											■	□											
Light stability/weather resistance																										
CHIMASSORB® 81	sol.	BP	Benzophenone			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
CHIMASSORB® 90	sol.	BP	Benzophenone			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
CHIMASSORB® 2020 FDL	sol.	HALS	Oligomeric hindered amine light stabilizer			□	□	□	□	□		□	□	□	□	□	□		□		□		□	□	□	□
CHIMASSORB® 944 LD	sol.	HALS	Oligomeric hindered amine light stabilizer			□	□	□	□	□		□	□	□	□	□	□		□		□		□	□	□	□
TINUVIN® 99-2	liq.	BTZ	Benzotriazole (BTZ) multipurpose			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 123	liq.	HALS	N-alkoxy HALS (non-basic)			□		□	□	□		□	□	□	□	□	□		□	□	□	□		□	□	□
TINUVIN® 144	sol.	HALS	Antioxidant-functionalized HALS with triboelectric charging activity for powder coatings			□	□	□	□	□		□	□	□	□	□	□		□		□		□	□	□	□
TINUVIN® 152	sol.	HALS	Non-migrating N-OR HALS for powder and plastic coatings			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 292	liq.	HALS	Multipurpose HALS for various applications			□	□	□	□	□		□	□	□	□	□	□		□	□	□		□	□	□	□
TINUVIN® 326	sol.	BTZ-Cl	Chlorinated benzotriazole (red-shifted)			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 328	sol.	BTZ	Benzotriazole (BTZ)			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 384-2	liq.	BTZ	Benzotriazole (BTZ) multipurpose			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 400	liq.	HPT	Multipurpose hydroxyphenyltriazine			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□

Products	Phys. Form	Classification / chemistry	Description	Food Contact	Solvent-based	Polychloroprene (CP)	Polyurethane (PUR)	Natural and synthetic rubber (solvent-based)	Acrylics	Silicones	Reactive	Epoxy (EP)	Polyurethane (PUR)	Polyester, unsaturated	Acrylics	Silicones	Formaldehyde condensates	Sealants	Acrylics	Polyvinylacetate caulks (PVAc)	Butyls(polyisobutylene, PIB)	Polysulfides	Polyurethane (PUR)	Silicones	Silane-modified polymers	Others, e.g. bitumens, PVC body
TINUVIN® 171	liq.	BTZ	Benzotriazole (BTZ)			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 477	liq.	HPT	Red-shifted hydroxy-phenyltriazine			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 479	sol.	HPT	Hydroxyphenyltriazine (highest extinction)			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 622	liq.	HALS	Low-basic HALS for powder coatings			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 783 FDL	sol.	HALS	HALS blend for solvent-based adhesives and sealants applications			□	□	□	□	□		□	□	□	□	□	□		□		□		□	□	□	□
TINUVIN® 900	sol.	BTZ	Benzotriazol (low volatility)			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 928	sol.	BTZ	Benzotriazole			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 1130	liq.	BTZ	Hydrophilic modified benzotriazole			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 1577 ED	sol.	HPT	For adhesive and sealant			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
TINUVIN® 5050	liq.	Blend	BTZ / N-alkyl HALS			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 5060	liq.	Blend	Blend of BTZ and NOR HALS			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 5151	liq.	Blend	BTZ / N-alkyl HALS			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® 5866	sol.	Blend	AO / N-alkyl HALS / UVA			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
TINUVIN® B 75	liq.	Blend	Blend of antioxidant, UVA and N-alkyl HALS			□	□	□	□	□		□	□	□	□	□	□		□	□	□		□	□	□	□
TINUVIN® P	sol.	BTZ	Benzotriazole (BTZ)			□	□	□	□	□		□	□	□	□	□	□		□		□	□	□	□	□	□
Other Additives																										
Efka® PL 5544	liq.	Film-forming	Dimethyl cyclohexyl phthalate			■																				
Efka® PL 5520	liq.	Film-forming	Butylester of a fatty acid mixture			■																				
Efka® PL 5381	liq.	Film-forming	Epoxidized soybean oil			■						■	■													
Efka® PL 5382	liq.	Film-forming	Epoxidized soybean oil									■														
IRGAGUARD® B 1000	sol.	Microbial control	Organic antimicrobial			■	■	■	■	■		■	■	■	■	■	■		■	□	■	■	■	■	■	■
IRGAGUARD® B 6000	sol.	Microbial control	Ag/Zn glass based antimicrobial							■		■	■	■	■	■	■				■		■	■	■	■
IRGASTAB® UV 22	liq.	Stabilizer	Polymerization inhibitor												□											
TINOPAL® OB CO	sol.	Optical bright-ener	Thiophenedyil-benzox-azole optical bright-ener			□	□	□	□	□		□	□	□	□	□	□		□	□	□	□	□	□	□	□
MELAPUR® MC range	sol.	Flame retardant	Melamine cyanurate flame retardant				□						□	□								■				
MELAPUR® MP	sol.	Flame retardant	Melamine phosphate flame retardant									□	□									■				
MELAPUR® 200 range	sol.	Flame retardant	Melamine polyphos-phate flame retardant									□	□	□								■				

✓ Potential Selection for Food Contact Approval. Please contact BASF to clarify actual registration status. ■ preferred selection □ possible selection

Nomenclature

Formulation additives brands and nomenclature

	Water-based systems	Letters	Numbers
Rheology modifiers	**Rheovis®** HS 1xxx **Rheovis®** AS 1xxx **Rheovis®** PU 1xxx **Rheovis®** PE 1xxx	HS = Polyacrylic (HASE) AS = Polyacrylic (ASE) PU = Polyurethane (HEUR) PE = Polyether (HMPE) RM = Rheology modifiers	11xx = Low shear 12xx = Mid shear 13xx = High shear 19xx = Solids } Waterbased
Defoamers	**Foamaster®** MO 2xxx **FoamStar®** SI 2xxx **Foamaster®** NO 2xxx **FoamStar®** PB 2xxx **Foamaster®** WO 2xxx **FoamStar®** ST 2xxx **FoamStar®** ED 2xxx	MO/NO = Mineral/natural oil WO = White oil-based SI/PB = Silicone/polymer-based ST = Star-shape polymer ED = Emulsion defoamer	2xxx = Serial number 29xx = Solids
Wetting and surface modifiers	**Hydropalat®** WE 3xxx **Hydropalat®** FL 3xxx **Hydropalat®** SL 3xxx	WE = Wetting agent FL = Flow & leveling SL = Slip and mar agent	31xx = Alkoxylates 32xx = Silicone 33xx = Polymer 34xx = Sulfosuccinates 35xx = Polyacrylates 36xx = Miscellaneous 37xx = PEG/PPG based 39xx = Solids } Waterbased
Dispersing agents	**Dispex®** AA 4xxx **Dispex®** Ultra PA 4xxx **Dispex®** CX 4xxx **Dispex®** Ultra PU 4xxx **Dispex®** Ultra PX 4xxx **Dispex®** Ultra FA 4xxx	AA = Polyacrylic acid CX = Carboxylic acid copolymers PA = Polyacrylates PU = Polyurethanes PX = Controlled polymer (CFRP) FA = Low molecular weight dispersants and compatibilizers	4xxx = Serial number 49xx = Solids
Film-forming agents	**Loxanol®** CA 5xxx **Loxanol®** OT 5xxx **Loxanol®** PL 5xxx	CA = Coalescent agents OT = Open time extenders PL = Plasticizers	5xxx = Serial number 59xx = Solids
Miscellaneous	**Loxanol®** MI 6xxx	MI = Miscellaneous	6xxx = Serial number 69xx = Solids

Non-aqueous sormulations nomenclature

	Water-based systems	Letters	Numbers
Rheology modifiers	**Efka®** 1xxx	RM = Rheology modifiers	14xx = Serial number 19xx = Solids
Defoamers	**Efka®** MO 2xxx **Efka®** SI 2xxx **Efka®** PB 2xxx	SI = Silicone-based PB = Polymer-based MO = Mineral oil	2xxx = Serial number 29xx = Solids
Wetting and surface modifiers	**Efka®** WE 3XXX **Efka®** FL 3XXX **Efka®** SL 3XXX	WE = Wetting agent FL = Flow & leveling SL = Slip & mar agent	30xx = Modified polysiloxanes 31xx = Water emulsifier/stabilizers 32xx = Solvent-free polyacrlylates/-siloxanes 36xx/37xx = Modified polyacrylates 38xx = Reactive polysiloxanes 39xx = Solids
Dispersing agents	**Efka®** PA 4XXX **Efka®** PU 4XXX **Efka®** PX 4XXX **Efka®** FA 4XXX	PA = Polyacrylates PU = Polyurethanes PX = Controlled & advanced polymers FA = Fame, amine-based and fatty alcohol alkoxylates	40xx = Polyurethane types 41xx = Polyacrylate grinding resins 43xx = CFRP-based coating types 44xx = Polyacrylates 46xx = Low molecular weight types 47xx = CFRP-based P&P types
Film-forming agents	**Efka®** PL 5XXX	PL = Plasticizers	5xxx = Serial number
Miscellaneous	**Efka®** MI 6xxx	MI = Miscellaneous	6xxx = Serial number 69xx = Solids

Glossary

Old Name	New Name	Table
CHIMASSORB® 81	CHIMASSORB® 81	2, 3
CHIMASSORB® 90	CHIMASSORB® 90	2, 3
CHIMASSORB® 944 LD	CHIMASSORB® 944LD	2, 3
CHIMASSORB® 2020 FDL	CHIMASSORB® 2020 FDL	2, 3
COLLACRAL® DS 6256	Rheovis® AS 1956	1
COLLACRAL® HP	Rheovis® AS 1180	1
COLLACRAL® PU 70	Rheovis® PU 1270	1
COLLACRAL® PU 80	Rheovis® PU 1280	1
COLLACRAL® VAL	Rheovis® AS 1420	1
DAROCURE® 1173	IRGACURE® 1173	3
DEHYDRAN® 1227	FoamStar® SI 2227	1
DEHYDRAN® 1293	FoamStar® SI 2292	1
DEHYDRAN® 1513	FoamStar® SI 2213	1
DEHYDRAN® 1620	FoamStar® SI 2210	1
DEHYDRAN® 1922	FoamStar® PB 2922	1
DEHYDRAN® D	FoamStar® PB 2770	1
DEHYDRAN® P 3215	Foamaster® WO 2350	1
DEHYSOL® 344	Efka® PL 5544	3
DEHYSOL® BS 20 N	Efka® PL 5520	3
DEHYSOL® D 81	Efka® PL 5381	3
DEHYSOL® D 82	Efka® PL 5382	3
DISPEX® A40	Dispex® AA 4040	1
DISPEX® G40	Dispex® CX 4340	1
DISPEX® GA40	Dispex® CX 4240	1
DISPEX® N 100	Dispex® CX 4910	1
DISPEX® N40	Dispex® AA 4140	1
DSX® 1514	Rheovis® PU 1214	1
DSX® 1550	Rheovis® PU 1250	1
DSX® 3256	Rheovis® PU 1256	1
EFKA® 2020	Efka® PB 2020	2, 3
EFKA® 2025	Efka® SI 2025	3
EFKA® 2526	FoamStar® ED 2526	1
EFKA® 2550	FoamStar® SI 2250	1
EFKA® 2580	FoamStar® SI 2280	2
EFKA® 2720	Efka® PB 2720	3
EFKA® 3030	Efka® SL 3030	2, 3
EFKA® 3031	Efka® SL 3031	3
EFKA® 3034 N	Efka® SL 3034	2, 3
EFKA® 3035	Efka® SL 3035	2, 3
EFKA® 3236	Efka® SL 3236	2
EFKA® 3277 N	Efka® FL 3277	2, 3
EFKA® 3570 N	Hydropalat® WE 3370	1
EFKA® 3777 N	Efka® FL 3777	2, 3
EFKA® 3883	Efka® SL 3883	2
EFKA® 3886	Efka® SL 3886	2
EFKA® 4010	Efka® PU 4010	3
EFKA® 4320	Efka® PX 4320	3
EFKA® 4401	Efka® PA 4401	3
EFKA® 4401	Efka® PA 4401	3
EFKA® 4560	Dispex® Ultra PA 4560	1
EFKA® 5044	Efka® FA 4644	2, 3
EFKA® 5065	Efka® FA 4665	2, 3
EFKA® 5244	Efka® FA 4642	2, 3
EFKA® 6220	Dispex® Ultra FA 4420	1, 2
EFKA® 6225	Dispex® Ultra FA 4425	1, 2
EFKA® 6230	Dispex® Ultra FA 4431	1, 2
Rilanit® HT Extra	EFKA® RM 1900	3
Rilanit® Special Micro	EFKA® RM 1920	3
FF FLAMESTAB® NOR 116	FF FLAMESTAB® NOR 116	2
FOAMASTER® 111	Foamaster® MO 2111	1
FOAMASTER® 223	Foamaster® WO 2323	1
FOAMASTER® 306	Foamaster® NO 2306	1
FOAMASTER® 8034	Foamaster® NO 2134	1
FOAMASTER® 8034 E	Foamaster® MO 2135	1
FOAMASTER® AP	Foamaster® MO 2172	1
FOAMASTER® H 2	Foamaster® MO 2108	1
FOAMASTER® JMY	Foamaster® MO 2110	1
FOAMASTER® NDW	Foamaster® MO NDW	1
FOAMASTER® PD 1	FoamStar® PB 2941	1
FOAMSTAR® A 410	FoamStar® ST 2441	1
HYDROPALAT® 1080	Dispex® Ultra FA 4480	1
HYDROPALAT® 110	Hydropalat® WE 3110	1
HYDROPALAT® 120	Hydropalat® WE 3120	1
HYDROPALAT® 140	Hydropalat® WE 3240	1
HYDROPALAT® 1706	Dispex® AA S760	1
HYDROPALAT® 188-A	Hydropalat® WE 3188	1
HYDROPALAT® 3037	Dispex® Ultra FA 4437	1
HYDROPALAT® 3204	Dispex® Ultra FA 4404	1
HYDROPALAT® 875	Hydropalat® WE 3475	1
HYDROPALAT® 885	Hydropalat® WE 3485	1
HYDROPALAT® 886	Hydropalat® WE 3486	1
IRGACURE® 184	IRGACURE® 184	3
IRGACURE® 250	IRGACURE® 250	3
IRGACURE® 2959	IRGACURE® 2959	3
IRGACURE® 500	IRGACURE® 500	3
IRGACURE® 651	IRGACURE® 651	3
IRGACURE® 754	IRGACURE® 754	3
IRGACURE® 819	IRGACURE® 819	3
IRGAFOS® 126	IRGAFOS® 126	2, 3
IRGAFOS® 168	IRGAFOS® 168	2, 3
IRGAGUARD® B 1000	IRGAGUARD® B 1000	3
IRGAGUARD® B 6000	IRGAGUARD® B 6000	1, 2, 3
IRGANOX® 1010	IRGANOX® 1010	2, 3
IRGANOX® 1035	IRGANOX® 1035	2, 3
IRGANOX® 1076	IRGANOX® 1076	2, 3
IRGANOX® 1098	IRGANOX® 1098	2, 3
IRGANOX® 1135	IRGANOX® 1135	3
IRGANOX® 1330	IRGANOX® 1330	2, 3
IRGANOX® 1425	IRGANOX® 1425	2, 3
IRGANOX® 1520 L	IRGANOX® 1520 L	2, 3
IRGANOX® 1726	IRGANOX® 1726	2, 3
IRGANOX® 245	IRGANOX® 245	2, 3
IRGANOX® 245 DW	IRGANOX® 245 DW	1, 3
IRGANOX® 3114	IRGANOX® 3114	2, 3
IRGANOX® 565	IRGANOX® 565	2, 3
IRGANOX® B 215	IRGANOX® B 215	2
IRGANOX® B 225	IRGANOX® B 225	2
IRGANOX® B 561	IRGANOX® B 561	2
IRGANOX® B 612	IRGANOX® B 612	2
IRGANOX® MD 1024	IRGANOX® MD 1024	2, 3
IRGANOX® PS 800	IRGANOX® PS 800	2, 3
IRGASTAB® PVC 76	IRGASTAB® PVC 76	2
IRGASTAB® UV 22	IRGASTAB® UV 22	3
LATEKOLL® D	Rheovis® AS 1125	1
LATEKOLL® DS 6269	Rheovis® HS 1169	1
LOXANOL® K 12 P	Loxanol® CA 5912	1
LUCIRIN® TPO	IRGACURE® TPO	3
LUMITEN® EL	FoamStar® PB 2706	1
LUMITEN® I-SC	LUMITEN® I-SC	1
LUMITEN® N-OC 30	Dispex® Ultra FA 4430	1
LUSOLVAN® FBH	Loxanol® CA 5308	1
MELAPUR® 200 range	MELAPUR® 200 range	2, 3
MELAPUR® MC range	MELAPUR® MC range	1, 2
MELAPUR® MP	MELAPUR® MP	2, 3
PERENOL® F 40	Efka® FL 3740	3
Pigment disperser® A	Dispex® AA 4030	1
PLASTILIT® 3060	Loxanol® PL 5060	1
RHEOVIS® 152	Rheovis® HS 1152	1
RHEOVIS® 162	Rheovis® HS 1162	1
TINOPAL® OB CO	TINOPAL® OB CO	2, 3
TINOPAL® SFP	TINOPAL® SFP	1
TINUVIN® 1130	TINUVIN® 1130	1, 2, 3
TINUVIN® 123	TINUVIN® 123	2, 3
TINUVIN® 123-DW	TINUVIN® 123-DW	1
TINUVIN® 144	TINUVIN® 144	2, 3
TINUVIN® 152	TINUVIN® 152	2, 3
TINUVIN® 1577 ED	TINUVIN® 1577 ED	2, 3
TINUVIN® 171	TINUVIN® 171	2, 3
TINUVIN® 292	TINUVIN® 292	1, 2, 3
TINUVIN® 326	TINUVIN® 326	3
TINUVIN® 328	TINUVIN® 328	2, 3
TINUVIN® 384-2	TINUVIN® 384-2	1, 2, 3
TINUVIN® 400	TINUVIN® 400	2, 3
TINUVIN® 400-DW	TINUVIN® 400-DW	1
TINUVIN® 477	TINUVIN® 477	2, 3
TINUVIN® 477-DW	TINUVIN® 477-DW	1
TINUVIN® 479	TINUVIN® 479	2, 3
TINUVIN® 479-DW	TINUVIN® 479-DW	1
TINUVIN® 5050	TINUVIN® 5050	2, 3
TINUVIN® 5060	TINUVIN® 5060	2, 3
TINUVIN® 5151	TINUVIN® 5151	1, 2, 3
TINUVIN® 5333-DW	TINUVIN® 5333-DW	1
TINUVIN® 5866	TINUVIN® 5866	2, 3
TINUVIN® 622	TINUVIN® 622	2, 3
TINUVIN® 770 DF	TINUVIN® 770 DF	2, 3
TINUVIN® 783 FDL	TINUVIN® 783 FDL	2, 3
TINUVIN® 900	TINUVIN® 900	2, 3
TINUVIN® 928	TINUVIN® 928	2, 3
TINUVIN® 99-2	TINUVIN® 99-2	2, 3
TINUVIN® 99-DW	TINUVIN® 99-DW	1
TINUVIN® B 75	TINUVIN® B 75	2, 3
TINUVIN® B 97	TINUVIN® B 97	2, 3
TINUVIN® P	TINUVIN® P	3
VISCALEX® AT88	Rheovis® AS 1188	1
VISCALEX® HV100	Rheovis® AS 1910	1
VISCALEX® HV200	Rheovis® AS 1920	1
VISCALEX® HV30	Rheovis® AS 1130	1
VISCALEX® LO 30	Rheovis® AS 1135	1
VISCALEX® VM	Rheovis® AS 1237	1

® = registered trademark of BASF

BASF SE
Dispersions for Adhesives and Construction Europe
E-EDK/KP – H201
67056 Ludwigshafen

www.basf.com/adhesives
additives-adhesives@basf.com