# Radcure ADDITIVES

Product Guide - Worldwide

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The Coating Resins Company

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## Facts & Figures

- Global company with over €2.1 billion in sales
- Broad technology portfolio: liquid coating resins, energy curable resins, powder coating resins, crosslinkers and additives, composites and construction materials
- Approximately 4000 employees
- Customers in more than 100 countries
- 32 manufacturing facilities
- 23 research and technology centers
- 5 joint ventures
- Extensive range of solutions for key coating segments: automotive, industrial, packaging coating and inks, protective, industrial plastics and specialty architectural

With manufacturing, R&D and technical facilities located throughout Europe, North America, Asia Pacific and Latin America, allnex offers global and reliable supply of resins and additives combined with local, responsive customer support.

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# About Additives

The Allnex additives portfolio is on the leading edge of performance. Our broad package enables our customers to solve problems and enhance surface properties of UV curing systems.

We offer a broad range of additives for the formulation of UV curing system. Our portfolio includes 100% active, monomer based, tin free and low VOC materials, suitable for 100% UV, solvent borne UV and water borne UV systems used in both, existing and emerging markets:

- Industrial coatings (wood, metal and plastics)
- Inks and overprint varnish
- Composites
- Adhesives
- Cosmetics
- 3D printing
- Automotive interior/exterior

Additives enhance performance by modifying rheological properties, improving flow and leveling, reducing foam, improving pigment dispersibility, accelerating cure and crosslinking, improving adhesion and reducing defects.

Our high performance dispersants are at the forefront of technology for the preparation of pigment concentrates and pastes. The highest level of pigment loadings without effects on other properties are achieved in UV systems using wetting and dispersing additives from allnex.

ADDITOL®, EBECRYL®, MODAFLOW® additive families serve the following applications:

- Wetting and Dispersing Additives
- Flow and Leveling Additives
- Defoamer and Deaerator
- Rheology Modifier
- Specialty products

## The magic drop to make all the difference

## Wetting and Dispersing Additives

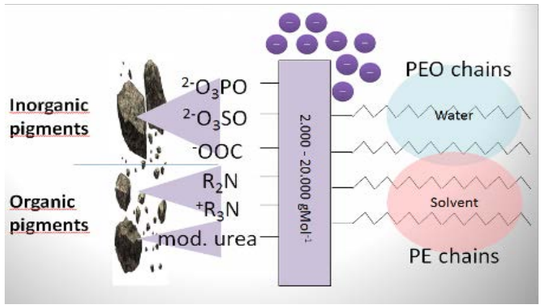
To reach a high level of performance it is important to disperse the solid components very well and to stabilize the distribution as homogeneously as possible.

Wetting agents are responsible for the first step in this process. They replace air from the surface of particles and support the liquid phase to cover pigments and extenders. Good wetting of pigments and fillers results in high gloss of coating systems. This kind of additive possesses surface activity character.

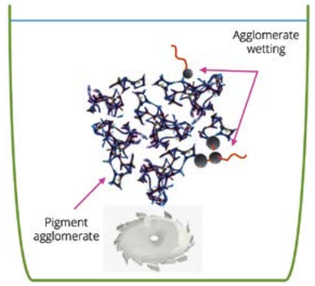
Dispersing agents are responsible for the stabilization of the homogeneous distribution of particles. These additives prevent re-agglomeration of pigments and fillers and the formation of flocculates.

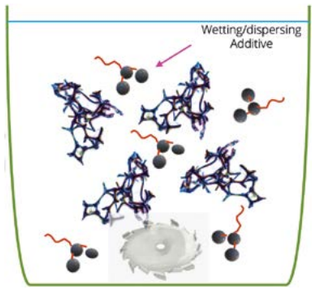
There are different kinds of stabilization, which have to be optimized in order to reach required properties of gloss, color strength, hiding power, corrosion protection and viscosity of the formulation.

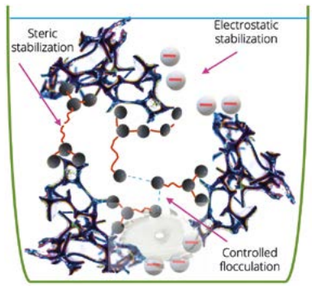
Often combinations of different types of pigments are used to obtain the desired color and hiding properties. However, combinations of organic and inorganic pigments which have different polarity and surface tensions have a tendency to separate. This separation can be horizontal, forming cell like structures (Benard cells), or vertical, which results in a color change. These effects can be evaluated by the rub out test. Multifunctional wetting agents with higher surface activity are useful to reduce these defects. These additives work as anti-floating agents.




Modern dispersing additives are built on high polymeric backbones modified with different anchoring groups. To protect particles from re agglomeration, either ionic repulsion or steric hindering is used. Entropic adsorption mechanism for application in sensitive binder systems.




### Steps of Pigment Grinding

**Wetting**
Replace air on the surface of pigments and fillers, help the resin to cover the “new” surface of the particles.

Wetting
Anchoring
↓↑
Flocculation
Agglomeration

**Disperging**
Break down pigment “agglomerates” into “aggregates” and primary Particles, by incorporating energy (stirrer, dispersion, bead mill...).

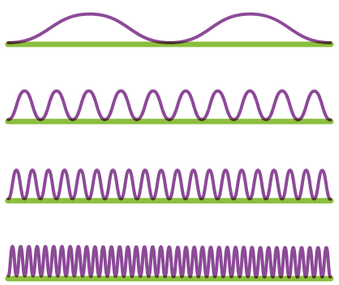
Stabilization
Color- development
↓↑
Floatation
Rub-out

**Stabilization**
Stabilize the homogeneous distribution of the pigments and avoid flocculation and re-agglomeration.


| Additive name | Dosage | w/b s/b 100% | Characteristics | % Active content | Monomer or/and solvent content | Description |
|---|---|---|---|---|---|---|
| **Wetting and dispersing agents** | | | | | | |
| EBECRYL® 331 | 0,5 - 5,0% inorg. Pigment / extender | s/b & 100% | Low molecular wetting additive with phosphoric acid modification | 65% | OTA 480 | Special pigment wetting additive for 100% UV formulations. It improves colour development and pigment stabilization through electrical charging. Recommended for high gloss formulations. |
| ADDITOL® XL 6577 | 2.5 - 10% on pigment / extender 15-60% on matting agent | s/b & 100% | Copolymer with acidic groups | 52% | MPAC and Solvent naphtha 150/180 | Excellent dispersant for SB and 100% UV paints and combined with inorganic pigments / filler preparations. Enables highest pigment loading with low viscosity. |
| ADDITOL XL 6592 | 1,0 – 5% inorg. 5 – 30% org. pigment | all | High molecular weight polymer; nonionic | 100% | - | High efficient, high molecular weight dispersing additive for all types of pigment. Recommended for direct grinding as well as for binder free pigment concentrates. |
| ADDITOL XL 6521 | 3,0 – 10 % inorg. 15 – 60 % org. pigment | s/b & 100% | Modified block copolymer; high molecular; cationic | 60% | MPAC | Powerful, high molecular weight dispersing additives for very difficult wettable pigments. Especially recommended for all carbon black pigments in order to achieve perfect color properties and extreme high gloss. |
| ADDITOL VXW 6394 | 10 – 30% inorg. 30 – 75% org. pigment | w/b | High molecular weight polymer; nonionic | 40% | Water | Very sufficient, high molecular weight dispersing additive for all types of pigment. Due to it's non ionic polymer structure it is highly recommended in formulations containing sensitive resins. Further it can be used for the production of highly loaded, binder free pigment concentrates. |
| ADDITOL XW 6588 | 3,0 – 10% inorg. 15 – 50% org. pigment | w/b | Nonionic, polymeric low ion migration (LIM) dispersant | 48% | Water | High molecular weight dispersing additive for all types of pigment. Due to it's non ionic polymer structure it is highly recommended in formulations containing sensitive resins. It is recommended for both, direct grinding and pigment concentrates. |

# Flow and Leveling Additives

Surface additives – Demands on optical performance and esthetic aspects are very high in most UV coating application areas. Defects in UV coating and inks are divergences from surface evenness and are proof of an imperfect process. Flow and Leveling agents are used to prevent or reduce surface defects like poor leveling, orange peel or cratering.
These additives are surface active materials with a tendency to concentrate at the air coating interface. Poly (methyl) acrylates, modified silicones and surfactants based on fluorine-containing compounds are used for this application.



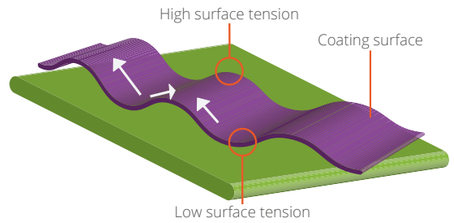

## Surface topography

- The surface topography of coatings is established during the UV curing stage
- In the locations where the volatile components have evaporated in solvent borne and water borne UV, the surface tension increases, and the coatings flows towards these areas, **creating waves**

Typically the total wave amplitude is in the range of 1µm whereas the wave period varies from about 0,1mm up to 12mm. Wave lengths of less than 0,1mm create dullness or matte image.

## Silicones

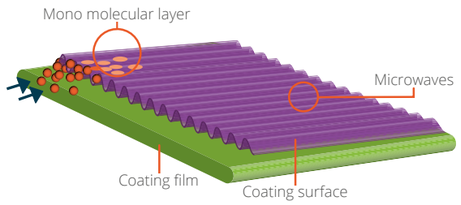
+ Reduce long wave (help to reduce orange peel)
+ Increase slip performance
+ Reduce surface tension
  (substrate wetting & film formation)
- Decease interlayer adhesion




- Silicones reduce and equilibrate the surface tension of coatings during the solvent evaporation phase and directly control the formation of **long waves**.

## (Meth-) Acrylics

+ Reduce micro structure
+ No impact on surface tension
+ No impact on interlayer adhesion
  (can be used in multilayer systems)



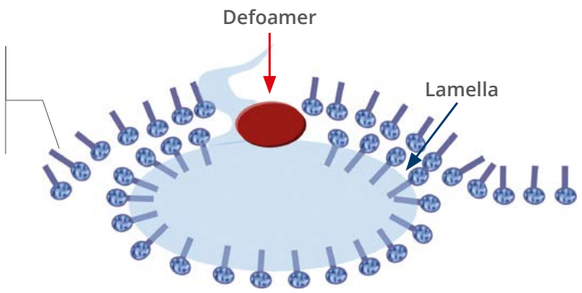

- (Meth-) Acrylics copolymers have tendency to concentrate on the liquid/air interface during the drying period and form a mono molecular layer that efficiently reduces the formation of **short waves** caused by the shrinkage.

| Additive name | Dosage | w/b s/b 100% | Characteristics | % Active content | Monomer or/and solvent content | Description |
|---|---|---|---|---|---|---|
| **Silicone containing – silicone free** | | | | | | |
| EBECRYL® 341 | 0,5-3% total | s/b & 100% | Silicone free master batch | 80% | TPGDA | Silicone free slip additive master batch. Improve slip between cured coatings and provide good intercoat adhesion and glueability. Can be uses to avoid show through in shrink sleeves. |
| EBECRYL 350 | 0,5 – 3% total | s/b & 100% | Silicone diacrylate | 100% | - | EBECRYL®350 is a silicone diacrylate material which contributes slip, substrate wetting and flow properties when used as an additive in formulations cured by ultraviolet light (UV) or electron beam (EB). Cured films containing EBECRYL 350 will exhibit a smooth, tack free surface, with good blocking resistance. Because of its acrylate functionality, the silicone cures into the polymeric backbone, thus eliminating the migration that free silicones often display in coatings. |
| EBECRYL 1215 | 0,5 – 3% total | s/b & 100% | Modified silicone oil derivate | 100% | - | Silicone modified oil derivative that is improving slip and scratch resistance in EB cure coatings |
| EBECRYL 1360 | 0,5 – 3% total | s/b & 100% | Silicone hexa-acrylate material | 100% | - | EBECRYL 1360 is a silicone hexa-acrylate material which contributes slip, substrate wetting and flow properties when used as an additive in formulations cured by ultraviolet light (UV) or electron beam (EB). Cured films containing EBECRYL 1360 will exhibit a smooth, tack free surface, with good blocking resistance. Because of its acrylate functionality, the silicone cures into the polymeric backbone, thus eliminating the migration that free silicones often display in coatings. |
| EBECRYL 1365 | 1-10% | s/b & 100% | Silicone hexa-acrylate material | 100% | - | High compatibility resulting in clear films. Provides anti-stain and easy-to-clean properties. It can be used as a processing agent in matt and excimer curable formulations, facilitating a uniform film creation. |
| MODAFLOW® 2100 | 0,1 – 1,0 % total | s/b & 100% | Acrylic copolymer; medium molecular weight | 100% | - | Medium molecular weight, highly efficient flow modifier. Good compatibility and easy incorporation, fast mode of action. Recommended also in clear coat applications. |
| MODAFLOW 9200 | 0,1 – 0,5% total | s/b & 100% | Modified acrylic copolymer; low molecular weight; crosslinkable | 100% | - | Low molecular weight, high efficient and all solventborne and 100% high end UV applications flow modifier. It reduces film defects and strongly increases gloss levels. Recommended for all solventborne high end applications. |
| MODAFLOW LAMBDA | 0,1 – 0,5% total | s/b & 100% | Hydroxyl functional acrylic-silicone polymer | 100% | - | Highly efficient, hybrid flow promoter for improved surface characteristics such as gloss, DOI, brilliancy, anti-orange peel effect. Contains no free silicone due to chemical anchoring. |
| MODAFLOW AQ 3025 | 1,0 – 2,0% total | w/b | Acrylic copolymer; neutralized by amine; silicone-free | 25% | Water | Medium molecular weight flow and leveling additive. It supports pigment wetting and allows a fast degassing process. |
| ADDITOL® XL 482 | 0,1-1% | s/b & 100% | Acrylic flow promoter | 100% | - | Medium molecular weight, highly efficient flow modifier. Good compatibility and easy incorporation, fast mode of action. Recommended also in clear coat applications. |
| ADDITOL XL 121 N | 0,1 – 0,5% total | s/b & 100% | Modified silicone | 14% | Toluene | Silicone leveling additive that strongly increases slip and scratch resistance. Further it improves material flow. |
| ADDITOL XL 123N | 0,05 – 0,5 % total | all | Modified silicone | 50% | Naphtha | Silicone leveling additive to improve slip and scratch resistance. It has degassing properties and is thermostable up to 400°C |
| ADDITOL VXL 4930 | 0,05 – 0,3% total | all | Polyether-modified silicone | 40% | Ethylhexanol | Universal, silicone leveling additive with very good compatibility. It is very well balanced in order to improve spray mist absorption, orange peel, cratering and leveling. Highly efficient and not foam stabilizing. |
| ADDITOL VXW 6396 | 0,1 – 1,0 % total | w/b | Highly fluoro-modified acrylic copolymer; neutralized by amine; low molecular weight | 55% | Butanol, Methoxypropanol, water | Silicone free, substrate wetting and leveling additive for difficult wettable substrates or not perfect cleaned surfaces. Very low molecular weight allows fast mode of action. It is not foam stabilizing and does not harm intercoat adhesion. |
| ADDITOL XW 6580 | 0,05 – 0,5% total | all | Silicone tenside | 100% | - | Special silicone tenside with very strong influence on surface tension and excellent substrate wetting performance. It is not foam stabilizing and does not show problems in recoatability. |
| ADDITOL XW 6586 | 0,05 % to 1 % total | all | Organomodified polysiloxane type | 100% | - | Multipurpose silicone additive for improved surface quality and substrate wetting quality, substrate wetting and slip. |

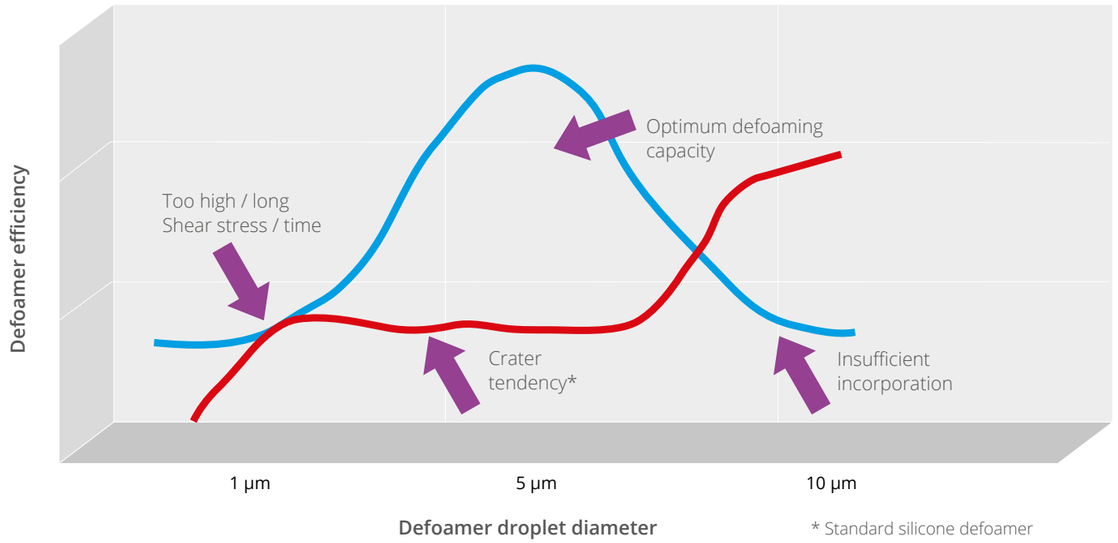
## Defoamer and Deaerater

Surface Additives – In many stages of production, handling and application, air is incorporated and finally dispersed into resins, coatings and inks. During production and handling, the increase of volume by foam and the incorporated air will cause handling and filling problems. After application of UV coatings, air inside the system should leave the film while the viscosity is low enough to allow bubble marks to reflow. These larger bubbles are macro foam, which is eliminated by Defoamers. The dispersed air in the system which remains is called micro foam. Deaeraters or air release agents are used to carry these very small bubbles to the surface of the liquid phase. The technique of defoaming is based on controlled incompatibility in the system and it is important to calculate the right balance between activity and compatibility to avoid defects.

**Defoamer mechanism**
Best efficiency can be achieved when defoamer is distributed in fine droplets to be able to migrate into the foam lamella




## Defoamer efficiency related to droplet size

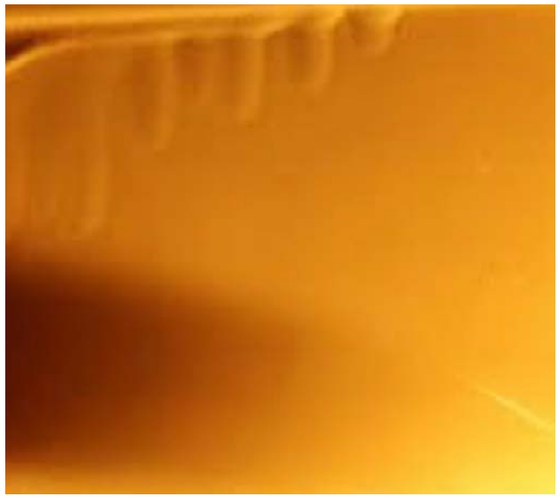


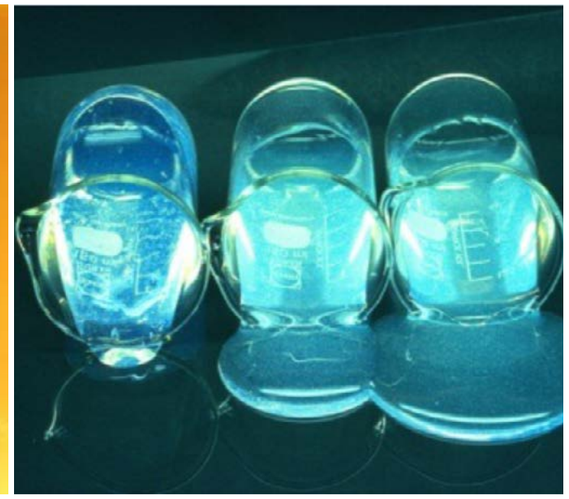

Optimum defoaming capacity is achieved when defoamer droplet size is about 5µm. Effect is strongly depending on shear conditions.

| Additive name | Dosage | w/b s/b 100% | Characteristics | % Active content | Monomer or/and solvent content | Description |
|---|---|---|---|---|---|---|
| **Defoamers** | | | | | | |
| MODAFLOW® RESIN | 0,1 – 1,0% total | s/b & 100% | Acrylic copolymer; high molecular weight; FDA-approved | 100% | - | Highly efficient flow promoter with excellent degassing properties. Recommended for all solventborne and 100% UV Systems, especially for pigmented top coats. |
| ADDITOL® VXL 4951N | 0,05 – 1,0% total | s/b & 100% | Fluoro-modified silicone | 20% | MPAC | Very efficient defoamer for solventborne paints and lacquers. Strong anti blistering effect during processing and application. |
| ADDITOL XL 6531 | 0,1 - 0,5 % total | s/b & 100% | Polymer defoamer | 40% | Solvent naphtha | Special polymer defoamer/deaerator, recommended for pigmented systems. |
| ADDITOL XL 6507 | 0,1 – 1,5 % total | s/b & 100% | Degassing / defoaming polymers; silicone free | 10% | Xylene, Ethylbenzene | Defoamer and deaerater for all industrial paints and lacquers, high efficient. |
| ADDITOL XW 6584 | 0,05 – 0,5% total | w/b | Emulsifier free silicone emulsion, hydrophobic solid particles | 20% | Water | Highly efficient defoamer for transparent and high gloss systems. Suitable for high and low PVC formulations. No interference with associative thickeners - no impact on rheological profile. |
| ADDITOL VXW 6386 | 0,5 – 1,5 % total | w/b | Hydrocarbons, waxes | 100% | Dodecane | Defoamer for high quality lacquers with good compatibility. Homogenize prior use! |
| ADDITOL VXW 6211 | 0,05 – 0,5 % total | w/b | Hydrocarbons; hydrophobic solid particles | 100% | - | Very strong defoamer for highly pigmented paints or pigment pastes. |
| ADDITOL VXW 4926 | 2,0 – 15,0 % binder | w/b | Special fatty acid ester | 100% | - | Defoamer and deaerater with rheology improvement in order to allow better film build-up. Very fast mode of action. |
| ADDITOL XW 376 | 0,05 – 0,5 % paint | w/b | Mineral oil / wax emulsion | 50% | - | High efficient, easy to incorporate defoamer emulsion. |

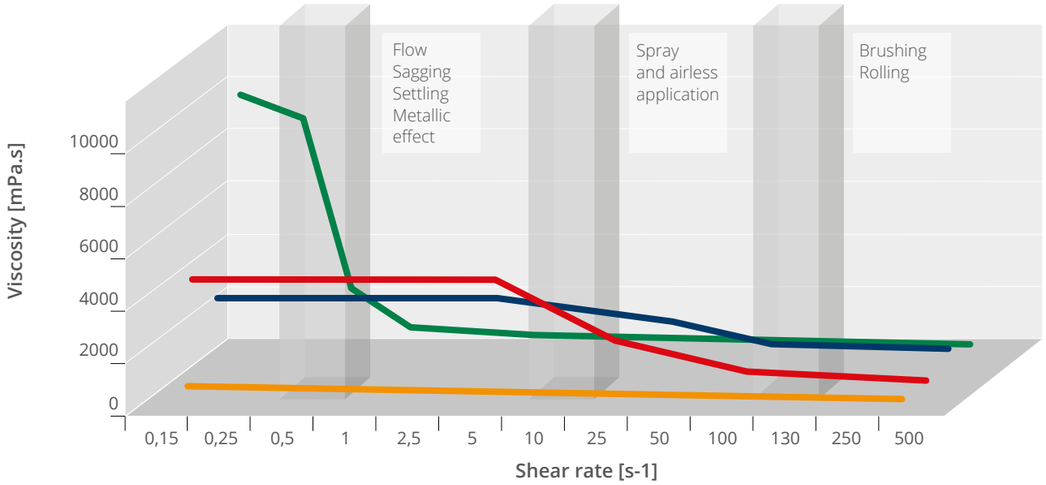
## Rheology Modifier

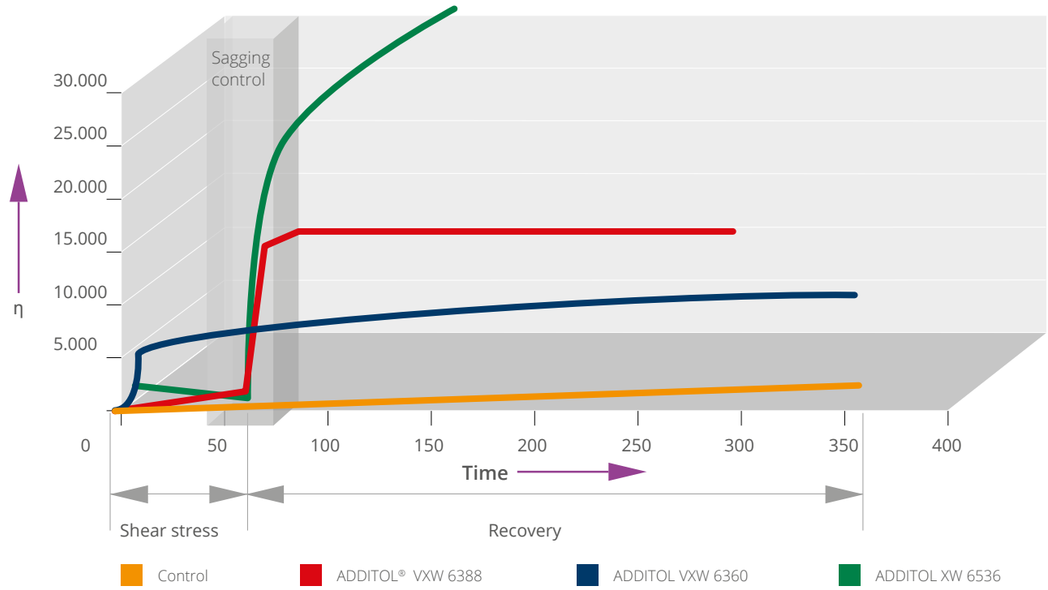
The rheological properties of UV coating systems primarily are designed to improve handling, application and leveling properties. Rheology modifiers are compounds which interact with formulation components, building up a three dimensional network or modifying the fluid phase only. These additives optimize the viscosity profile of UV coating systems.
However viscosity control is also very important to shelf storage stability, to reduce the tendency of pigment and extender sedimentation in the container. During storage, pigments and extenders may show a tendency to settle into a soft or hard layer in the container. This is caused by the higher density of these components in relation to the liquid phase. Sedimentation can be overcome by using additives which form three dimensional networks. Anti-settling agents modify the viscosity at extremely low shear rates which governs sedimentation.





**How to select rheology modifiers**
**Rheology profile of a water-based acrylic clear coat**



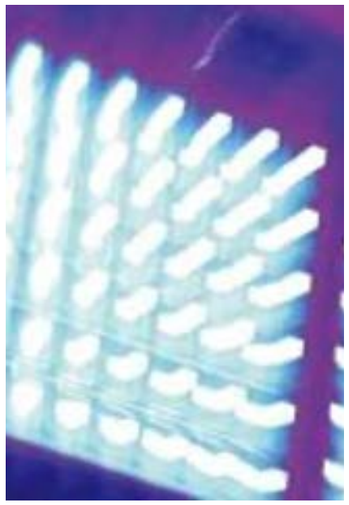




| Additive name | Dosage | w/b s/b 100% | Characteristics | % Active content | Monomer or/and solvent content | Description |
|---|---|---|---|---|---|---|
| Rheology modifiers | | | | | | |
| ADDITOL® VXW 6360 | 0,1 – 3,0% total | w/b | Polyurethane thickener | 30% | 2-(2-Butoxyethoxy)ethanol | Associative thickener to control rheology and flow. It improves applicability by roller or brush. Easy to incorporate. |
| ADDITOL VXW 6388 | 0,1 – 3,0% total | w/b | Polyurethane thickener | 35% | 2-(2-Butoxyethoxy)ethanol | Assosiative thickener to control rheology at low shear stress. Recommended for spray application. Excellent against sedimentation and sagging. |
| ADDITOL VXW 6387 | 0,1 – 5,0 % pigment | all | Special fatty acids; amine neutralized; silicone free | 60% | Methoxypropanol | Rheology modifier to prevent pigment sedimentation, sagging and storage stability. |
| ADDITOL XW 6536 | 0,2 -0,8 % total | w/b | Special organic activated clay | 37% | Methoxypropanol | Special rheology modifier with extremely fast viscosity recovery. Recommended for all high wet film thicknesses e.g. in case of airless application. Prevents sagging and settling at zero and low shear stress sufficiently. |
| ADDITOL XL 280 | 5,0 – 10,0 % pigment | s/b & 100% | Special modified montmorrilonite clay | 36% | Solvent naphtha (light arom.) | Rheology modifier to prevent powerful settling of pigments and extenders, reduces sagging. |

* ADDITOL additives

## Specialty Additives

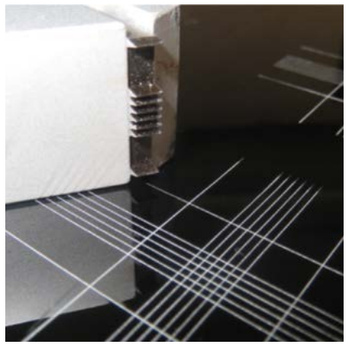
allnex offers a selection of specialty additives which can be used to improve special requirements in UV systems.



**LED Boosters:**

- EBECRYL® LED product range can be added as a co-resin to UV curable formulations, that transforms formulations into UV LED, UVA, or low energy curable systems by providing better surface cure.
  In addition, this co-resin can also be used to obtain better surface cure in high energy cure formulations.

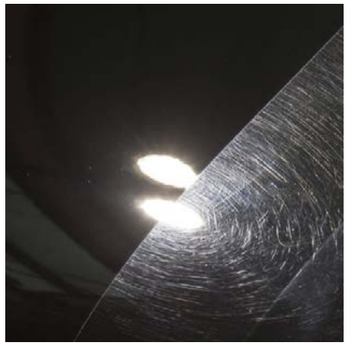
**EBECRYL LED 01** and **EBECRYL LED 02** provides better surface cure by mitigating oxygen inhibition of the free radical process.
**EBECRYL LED 03** improves surface cure by mitigating oxygen inhibition of the free radical process and/or by being an amine synergist for Norrish type II.
**EBECRYL LED 04** shows excellent surface cure reactivity with UV LED lamps by combining a high amine content with a high acrylate functionality. This binder is suitable for offset ink applications and offers an alternative to aminobenzoates such as EHA or EDB. BECRYL LED 04 shows no negative impact on pigment wetting and ink flow and is Swiss / Nestle compliant.



**Adhesion promoters:**

- Adhesion is often a challenge as soon as required on critical substrates such as plastics, special metals and melamine treated wood surfaces. Interlayer adhesion in multilayer systems requires special attention and sometimes the addition of certain additives. Adhesion can be also adjusted by lowering the cross-linking Density, using mono-functional Monomers – see Industrial coatings brochure

Good chemical anchoring on difficult substrates can be achieved by using EBECRYL® 168 or EBECRYL 171. On corona treated plastics, especially EBECRYL 367 showed an improvement of adherence. Additionally ADDITOL® VXL 4950® can be used as flash primer on all types of plastic to provide better adhesion.



**Nano based materials:**

- Films which contain nano-silica exhibit outstanding hardness, chemical, scratch and abrasion resistance coupled with very low haze development after abrasion.

**EBECRYL 154** is a functionalized nanocomposite acrylate that Exhibits low viscosity and high reactivity in ultraviolet (UV) light or electron beam (EB) curable coatings coupled with outstanding abrasion resistance.
**MODAFLOW® NSR 100** is a concentrated dispersion of nanosilica for improving scratch resistance and Easy to Clean properties for UV based clearcoats as well as pigmented topcoats.

| Additive name | Dosage | w/b s/b 100% | Characteristics | % Active content | Monomer or/and solvent content | Description |
|---|---|---|---|---|---|---|
| **Specialty Additives: Adhesion promoters** | | | | | | |
| EBECRYL 168 | 0,1 – 5,0% total | s/b & 100% | Acid modified methacrylate | 100% | - | EBECRYL 168 is a methacrylate modified acidic adhesion promoting agent designed as a modifier for ultraviolet (UV) and electron beam (EB) curable coatings on metals. |
| EBECRYL 171 | 0,1 – 5,0% total | s/b & 100% | Aacid modified methacrylate | 100% | - | EBECRYL 171 is a methacrylate modified acidic adhesion promoting agent designed as a modifier for ultraviolet (UV) and electron beam (EB) curable coatings. |
| EBECRYL 367 | 1-15% | 100% (s/b) | Polyester acrylate | 100% | - | Excellent adhesion on corona treated polyolefin substrates. |
| ADDITOL VXL 4950 | Flash primer | all | Halogenated polyolefin | 43% | Xylene, naphtha | Flash primer for plastic substrates; recommended dilution 1:8 in aromatic solvents |
| **LED Booster** | | | | | | |
| EBECRYL LED 01 (Not for EMEA) | 15 – 20% total | s/b & 100% | Mercapto modified polyester acrylate resin | 100% | - | ADDITOL® LED 01 is used as co-resin, in order to increase the surface cure of a formulation when cured with an UV LED lamp. ADDITOL LED 01 has been developed for UV LED applications, but is equally suitable for other low energy curing applications (e.g. UV-A curing). ADDITOL LED 01 can also be used for reduction of oxygen inhibition in UV/EB curable systems, when cured with the standard medium pressure Hg lamps |
| EBECRYL LED 02 | up to 25% total | s/b & 100% | Mercapto modified polyester acrylate resin | 100% | - | EBECRYL LED 02, a mercapto modified polyester acrylate resin, can be added as a co-resin to UV curable formulations. EBECRYL LED 02 transforms formulations into UV LED, UVA, or low energy curable systems by providing better surface cure. In addition, this co-resin can also be used to obtain better surface cure in high energy cure formulations. EBECRYL LED 02 provides better surface cure by mitigating oxygen inhibition of the free radical process. |
| EBECRYL LED 03 | 5 – 20% total | s/b & 100% | Amine modified polyether acrylate oligomer | 100% | - | UV/EB cured products based on EBECRYL LED 03 are characterized by the following performance properties: Good (surface) cure response, good flexibility, adhesion promotion, high gloss, low odor, low migration potential. In addition, this effect is also seen in high energy cure formulations. The improved surface cure is obtained by mitigating oxygen inhibition of the free radical process and/or by being an amine synergist for Norrish type II photoinitiators. |
| EBECRYL LED 04 | 5 – 20% | s/b & 100% | Acrylated polyamine | 100% | - | Provides improved surface cure in LED. EBECRYL LED 04 can also be used in offset inks applications as a replacement of aminobenzoate synergists. |
| **Nano Additive** | | | | | | |
| EBECRYL 154 | 5-10% on solid | s/b & 100% | Functionalized nanocomposite acrylate | 50% | - | Nanocomposite based material that provides high crosslinking sensity, outstanding scratch and abrasion resistance. It has also low haze and improves chemical resistance |
| MODAFLOW® NSR 100 | 1,5%-5% solid on solid | s/b & 100% | Solvent based dispersion of modified nanosilica | 35% | MEK | Concentrated dispersion of nanosilica for improving scratch resistance and Easy to Clean properties of automotive OEM, vehicle refinish, plastic and wood clearcoats as well as pigmented topcoats. |

# Product index



# For further questions related to additives please contact

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# Notes