EVONIK INDUSTRIES

Smart Formulating Journal

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Crosslinkers

New Hydroxyalkylamide Crosslinker VESTAGON® HA-3XX

One-Shot Matt Powder Coatings

In weather-resistant powder coatings, hydroxyalkylamide (HAA) curing agents are becoming more popular as an alternative to triglycidyl isocycanurate (TGIC) products, although this trend varies greatly from one region to another. In recent years, enormous progress has been made with the use of this crosslinking system to influence reactivity, optimize gas oven stability, and improve degassing properties.

A key demand made on all powder coating systems is simple and reproducible gloss reduction. About 30 percent of all durable outdoor powder coatings need to be matt, especially for applications such as automotive accessories, facades and housings for electronic components.

Evonik has now developed a new cost-efficient matting principle for the important hydroxyalkylamide powder coating segment.

State-of-the-art

To reduce gloss in HAA systems to less than 60 units one must produce two separate powder coatings based on polyester resins with carboxyl end-groups using β-hydroxyalkylamides as the crosslinker. A dryblend is then produced from these two powder coatings, which are based on chemically identical systems.

Gloss reduction is generally based on different functionalities of the polyester, which result in different levels of reactivity in the matrix.

This process entails high costs and risks, not only because it is time-consuming and partly because of the risk that the entire batch will have to be rejected if the required gloss level is not achieved, as subsequent fine-tuning is virtually impossible.

Due to these facts all well-known powder producers supply HAA powder coatings with just a few gloss readings: a half-gloss version produced with the use of fillers and a semi-matt version with a gloss between 30 and 45 units, based on the time-consuming process outlined above.

Table 1

Polyester		Crylcoat® 2617-3 [1]	Crylcoat® E 36988	Pulverol® L 8123 [2]	Uralac® P 800 [3]	Uralac® P 865
Gloss	Unit	33	53	45	51	32
Ball impact	in lb	> 80	40	> 80	40	> 80
Gel time [200 °C]	s	165	163	140	144	–

1) Cytec Surface Specialties Inc. 2) Neochimiki S. A. 3) DSM Resins B. V.

Custom-tailored gloss

The new concept of shifting the gloss of hydroxylalkylamide powder coatings described here is simple. Initial laboratory trials indicate that replacing the standard curing agent in hydroxyalkylamide systems with the new matt hardener VESTAGON® EP-HA 3XX makes it possible to reduce gloss substantially and reliably using a single resin and a one-shot process.

A matt appearance is a key requirement for durable powder coatings for outdoor architectural applications

Varying the gloss

As may be expected, the reactive binder also has a major influence on the final gloss. Thus, one can adjust gloss within a wide range by selecting the reaction partner, as demonstrated by some examples in Table 1. This table shows only a small selection of the commercial polyester

Editorial

Dr. Thomas Haeberle
Member of the Board of Management
of Evonik Degussa GmbH

Dear Reader,

You're holding the seventh issue of our Smart Formulating Journal, which provides information to our coatings and colorants partners. We'd like to show you examples of some of our products and services for the coatings market. At the same time, we'd like to tell you about the products we've been developing recently and what's happening in the Group.

Last December, Evonik made some important decisions. The following strategic focus has been set for our future development:

1. We'll continue repositioning Evonik as a world-leading specialty chemicals company rather than a conglomerate.

2. The Energy Business Area will remain part of the Evonik Group, but operate as a largely independent entity. We'll be seeking one or more partners to finance growth projects in this business area.

3. We aim to combine our Real Estate Business Area with THS GmbH to form a new company, with the prospect of bringing it to the capital market on its own in the mid-term.

This long-term strategy paves the way for additional investment and further profitable and sustainable growth. In the Chemicals Business Area, we'll be investing systematically in growth businesses. Above all, we want to benefit from the emerging global developments: resource efficiency, health and nutrition, and the globalization of technologies.

Coatings is one of the most important markets for the Evonik Group. By maintaining close contact with our customers, we aim to go on developing innovative, environment friendly products and use resources efficiently. The start-up of our new integrated methacrylates facility in Shanghai last year shows that we intend to market these products globally.

In short, we want to shape profitable growth in cooperation with you, our customers. Besides launching new products, we provide support through our network of experts in the Coating and Bonding Technologies Competence Area, in an effort to offer you the fullest possible service. Our goals are to position ourselves as the expert address for all aspects of coatings, and to ensure our customers enjoy working with us.

Yours,

Thomas Haeberle

Continued from page 1: New Hydroxyalkylamide Crosslinker VESTAGON® HA-3XX

and acrylic products that can be used to reduce gloss in combination with this HAA matting hardener. All coatings tested were between 50 and 75 µm thick.

Evidently, another way to regulate gloss is to replace some of the matt hardener with a corresponding amount of a standard crosslinker such as VESTAGON® HA 320 (see Figure 1).This should make it easier and more cost-effective to meet end-users' requirements.

Development status

Currently the laboratories of Evonik are examining the general use of this new matting principle for powder coatings, while on the other hand optimizing the production process. Samples should be available in 2010.

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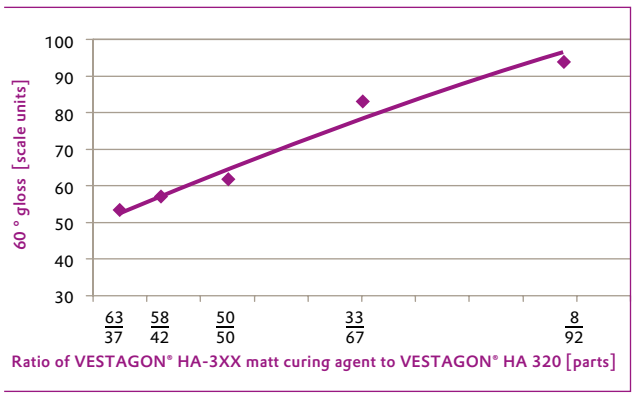
Figure 1



Spotlight on the America's:

Using COLORTREND® High Strength Colorants For Increased Opacity

We are all familiar with architectural tinting systems and paints, either as part of our professional activities or even more likely as consumers buying paint for our homes. As with any product, there is a desire for increased product quality and performance. One property of direct interest to the end user is the opacity of a colored paint.

In architectural point of sale (POS) tinting, paint bases with fixed TiO_2 levels are used. Because of this, there is not the opportunity to optimize pigment or TiO_2 loading for each individual color as is more the case for inplant coloring. A color is made in the highest TiO_2 level base possible but the limitation is the amount of colorant that can be added to a base. In addition, the colorants traditionally used in POS tinting systems do not necessarily contain a high level of pigment. The black colorants and most of the organic pigment colorants contain a fairly low level of pigment. This was originally done to facilitate precise color reproduction of light colors in small container sizes, e. g. quarts. If a colorant was too strong, that is, had a high level of pigment, it would be difficult to reproducibly make very light colors given the dispensing machine increments and accuracy originally available.

For many years most POS systems used the same lineup of colorants, with very infrequent changes in the set of colorants. It is very difficult to change the set of colorants because of the accumulation of color matching formulas using the set of colorants. Changes would necessitate developing new color formulas, not only for colors currently featured in store displays, but also for past color matches. However, now many users are considering changes to their colorant lineup. Evaluation of newer colorants to expand color space, provide better lightfastness, move to low or no VOC colorants, and achieve greater opacity, is taking place. Users are realizing the benefits to making changes rather than benefits to not making changes.

To meet this market interest Evonik has developed a series of higher strength colorants in both the traditional COLORTREND® 888 product line and in our new COLORTREND® 808 No-VOC line*. The pigment content and tinting strength of these colorants is from 1.5 to 3+ times as strong as traditional colorants. Therefore the amount of pigment in the 12 ounces of colorant added to a Neutral base can be about 2 – 3 times the amount of total pigment usually added, thereby achieving increased opacity. The same color is achieved because the overall proportions of the pigments are the same. In addition some colors can now be made in a base with higher TiO_2 level because less colorant is needed. For example a color using 3 – 4 ounces of colorant per gallon of Deep base (which would need, for example, 10 ounces in Medium base) can now be made in Medium because it requires only 4 – 5 ounces of stronger colorants in Medium base.

Another benefit is that as less colorant needs to be added to a base there is a decrease in any paint film effects caused by colorant because of the decreased level. There can also be a reduction in the cost of tinting by the use of high strength colorants.

Figure 1 contains a comparison of a conventional strength and a high strength colorant. On the left is the product 888-5511 D green added to a white base. On the right is the colorant 808-5555 DXE from the Colortrend® 808 product line. Equal amounts of the colorants were added to the paint base. The high strength green is three times stronger than the regular green. High strength counterparts are available for yellow, black, green, blue, red, magenta, and violet colorants (colorants AXX, B, D, E, R, V, J). Figure 2 shows a comparison of a red color matched both with conventional red 888-0836 R on the left side and on the right side using a higher strength red 808-0755 REE, (along with small amounts of other colorants needed to make the match). Here the drawdowns were made on black and white cards using paints tinted with 12 ounces of colorant per gallon of Neutral base. This picture illustrates the opacity difference achieved in a neutral base.

More comparisons can be made by measuring contrast ratio (CR). Figure 3 shows three paint samples. The lowest stripe in the photo is a paint with 12 ounces per gallon of 888 R red colorant in Neutral base drawn down with a 6 mil blade. A CR of 85 is reached. The middle stripe is 888-0843 high strength red at 12 ounces and 6 mils. The CR is 96. The top stripe shows conventional strength R colorant at 12 ounces and 10 mils. Its CR is 93, showing that at least twice the film thickness would be needed to achieve the hiding of the high strength red.

A similar comparison can be made with yellows, a color with which opacity is also a problem. Figure 4 contains the comparison of regular and high strength yellows. The lowest stripe in the photo is a paint with 12 ounces per gallon of 888 AXX Yellow colorant in Neutral base drawn down with a 6 mil blade. A CR of 78 is reached. The middle stripe is 888-2543 high strength yellow at 12 ounces and 6 mils. The CR is 90. The top stripe shows conventional strength AXX at 12 ounces and 10 mils. Its CR is 88, showing that approximately twice the film thickness would be needed to achieve the hiding of the high strength yellow.

Benefits of higher strength COLORTREND® colorants can include reduced effect on paint properties and reduced tinting costs, but increased opacity is of particular value. It is seen as a direct benefit to the end user. Low opacity is especially a problem in the red-orange-yellow area, and COLORTREND® high strength colorants address this problem. High strength colorants in the 888 and 808* product lines include colorants using the same pigment types as conventional colorants, so there are no limitations in matching colors previously made with regular colorants. The 808 product line also contains products using newer pigment types for expanded color space coverage and increased durability. To meet increased product quality and performance needs and to differentiate themselves in the market, paint companies are making changes from the traditional colorant lineups. High strength colorants, providing increased opacity, will be part of the colorant lineups for the future.

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* In Europe High Strength No-VOC colorants are offered from the COLORTREND® 807 No-VOC line

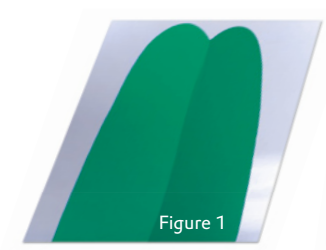
Figure 1

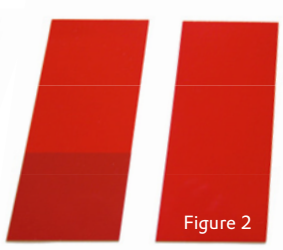
Figure 2


Figure 3


Figure 4

Spotlight on the America's:

Transitioning From Conventional Colortrend® To No-VOC COLORTREND® 808

One of the challenges in formulating No-VOC tinted coatings is transitioning from VOC containing colorants to No-VOC colorants, as well. A major advantage of COLORTREND® 808, over other No-VOC colorants, is that they were developed as "Drop-Ins" for COLORTREND® 888. Therefore, they are coloristically equivalent at the same dosage and paint film properties can be maintained, i.e. compatibility, color space, f/t stability, etc. A further advantage is that by using the same pigments as those in COLORTREND® 888 no changes to existing formula books are required. In addition to the standard 12 colorants, high performance and high durability pigments, which influences color space, durability, and opacity, have been added to the COLORTREND® 808 product line. To achieve this a modular system was developed, as shown in Figure 1. This allows the formulator to meet ever increasing demands for higher performance, better durability, more colors, ease of selection, and all with less application coats. The "Performance Module" has higher pigment loadings therefore requiring less colorant, resulting in minimal impact on film properties and increased opacity. The use of high strength colorants may also allow the reduction of paint bases and in tinting costs. Durability or fade resistance is improved with the addition of high durability pigments in both this and the "Performance Plus Module". For EIFS and Stucco applications the COLORTREND® Façade™ and Façade™ Plus Modules provide the option of even higher durable pigments.

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* In Europe performance modules and façade modules are offered from the COLORTREND® 807 No-VOC line

Figure 1: COLORTREND® 808 No-VOC Modules*

Standard Module
The "standard" traditional 12 colorants are formulated based on market specific pigments selected to ensure that basic tinting needs are met. Coloristically equivalent to the 12 COLORTREND® 888 System colorants, transitioning from conventional to environmentally-friendly colorants has never been easier.

AXX R T F C L I KX D E V B

Performance Module
For improved lightfastness and better opacity, replace AXX, R and T colorants with AGE, REE and ORE

AGE R ORE F C L I KX D E V B

Performance Plus Module
A cost-effective solution for higher performance. More durable colorants, in addition to 5 high strength colorants [BXE, DXE, EXE, QME, and JXE] for improved opacity, optimization of paint bases, and possible reduction in tinting costs.

AGE REE ORE F C L KX DXE EXE QME BXE JXE

COLORTREND® Façade™ Module
Contains 4 inorganic colorants [BVE, CGE, CBEm BOE] that are suitable for silicate and silicone paints. All colorants have alkali and acid resistance end excellent weather stability. When combined with C, F, L, and KX in a two-base system, color space is expanded over 70%. A fandeck containing 224 colors is available.

F C L KX BVE CGE CBE BOE

COLORTREND® Façade™ Plus Module
Contains 3 extra inorganic colorants [IOE, IGE, and UBE] offering an even further expansion of color space for façade applications. A fandeck containing 350 colors is available.

F C L KX BVE CGE CBE BOE IOE IGE

Easy-to-Solubilize Pigment Preparations in Granule Form for Water Borne Coating Applications

Since the European Coatings Show 2009 Evonik Industries offers a complete color line of granular pigment preparations for solvent based coating systems (INXEL™ A-series). Now first grades of a new easy-to-solubilize pigment preparation series for industrial waterborne coating systems (INXEL™ B-series) are offered.

These INXEL™ pigment preparations for industrial waterborne coatings offer comparable benefits like the preparations for solvent-based systems: while pigment powders have to be dispersed extensively to achieve satisfactory development of coloristic properties; the INXEL™ pigment preparations can be incorporated into water or a waterborne binder using a dissolver only. All it takes is a small amount of neutralizing agent and some time. The pigments do not have to be ground any more. They are just incorporated by solubilization of the resin matrix of the preparation (see figure 1). This significantly reduces incorporation time, energy and cleaning costs. Raw materials are used efficiently, and market demands can be met with much more flexibility.

The pigment preparation product range for industrial waterborne coating applications available at the moment is listed in table 1. The final system will consist of roughly 30 different color pigment preparations; 23 of them form a tinting system that allows matching of the RAL Classic Color Collection (not including metallics and neon colors). The pigment preparations for industrial waterborne coating systems (INXEL™ B-series) mainly consist of high quality color pigments, a tailor made acrylic carrier resin, barium sulfate and less than 5 wt% of additional additives.

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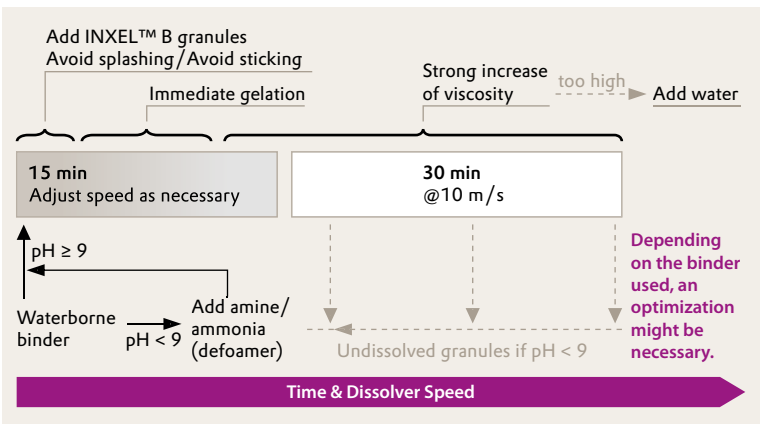

Figure 1: Solubilization of INXEL™ pigment preparations in a waterborne binder

Table 1
INXEL™ pigment preparations available for waterborne coatings and paints

Pigment Preparation	Pigment Class	Colour Index	Pigment Concentration [%]	Blanc Fixe-Concentration [%]
INXEL™ White B001	Titanium dioxide, Rutile	Pigment White 6	75	0
INXEL™ Yellow B101	Synthetic iron oxide α-FeOOH, opaque	Pigment Yellow 42	55	15
INXEL™ Yellow B102	Synthetic iron oxide α-FeOOH, transparent	Pigment Yellow 42	30	0
INXEL™ Yellow B103	Synthetic $ZnFe_2O_4$, heatresistant up to 220 °C	Pigment Yellow 119	50	10
INXEL™ Yellow B104	Bismuth Vanadate	Pigment Yellow 184	60	10
INXEL™ Yellow B106	Diarylide	Pigment Yellow 83	50	10
INXEL™ Yellow B108	Quinophthalone	Pigment Yellow 138	45	10
INXEL™ Yellow B109	Monoazo	Pigment Yellow 74	50	10
INXEL™ Yellow B110	Isoindoline	Pigment Yellow 139	45	10
INXEL™ Red B301	Synthetic iron oxide α-Fe_2O_3, opaque	Pigment Red 101	50	10
INXEL™ Red B302	Synthetic iron oxide α-Fe_2O_3, transparent	Pigment Red 101	30	0
INXEL™ Red B303	Diketo-pyrrol-pyrrole	Pigment Red 254	40	10
INXEL™ Red B304	Naphthol AS	Pigment Red 170	40	10
INXEL™ Red B305	Quinacridone	Pigment Red 122	30	10
INXEL™ Violet B401	Dioxazine	Pigment Violet 23	30	10
INXEL™ Black B901	Carbon black (PRINTEX® 35)	Pigment Black 7	45	10
INXEL™ Black B902	Carbon black (COLOUR BLACK FW171)	Pigment Black 7	25	0
INXEL™ Black B903	Carbon Black (PRINTEX® G)	Pigment Black 7	35	10
INXEL™ Black B904	Black Iron Oxide	Pigment Black 11	50	10

New Production Process Shines

Figure 1: Films of pigmented binders; left: base formulation 1 with continuously produced product; right: base formulation 2 with suspension polymer

A new continuous production process for methacrylate-based binders has opened the door to products which improves the properties of coating formulations. Coatings based on resins from the new process improve pigment wetting and stabilization, and the gloss and adhesion of coatings.

One very important field of application for methacrylate polymers is their use as binders in coatings and paints. Not only do the methacrylate polymers excel because of their good weathering resistance, color fastness, and brilliance, they also have very good pigmentability. Because of these positive properties, methacrylate-based binders are used especially in industrial metal coatings, particularly in those covering surfaces strongly exposed to the weather, such as container and marine paints. Other applications in which methacrylate binders have proven their value are coating systems for plastics, architectural coatings, road marking paints, and printing inks.

Continuous Direct Polymerization CDP™

A novel process has now made it possible to combine the desired excellent properties of a bulk polymer with the efficiency of a suspension polymer. In the CDP™ (Continuous Direct Polymerization) process, a monomer mixture is first brought to polymerize continuously in a reactor. The unreacted monomers in the resulting melt are then removed in a degassing step. What is remarkable about this process is that the reaction mixture nearly completely polymerizes up to very high conversions.

The CDP™ process was successfully tested in a pilot plant. The products developed in this way could easily be transferred to the industrial-scale polymerization plant that came on stream in Shanghai in 2009.

Future developments will be able to draw on other benefits of this process. For example, products are currently being developed for both solvent-based and aqueous systems. Work has also started on novel hybrid polymers.

Product form

The product form alone represents one significant difference. The granules produced by means of continuous polymerization are much coarser than the beads from suspension polymerization. The special feature of the new granules is their particle-size distribution, which is far narrower than that of the suspension polymers.

The dissolving time required for complete dissolution in organic solvents is not any longer for the granular product, despite its larger particle size.

Film quality of non-pigmented and pigmented films

Since the production process does not require any polymerization aids, such as suspension distributors, defoamers, and so forth, the products have a very high purity.

If the product is used for manufacturing binder solutions, the non-pigmented film produced does not contain any impurities. It is clear, transparent, and much more brilliant than a film that was made with a product produced by suspension polymerization.

Besides clear films, we also examined pigmented formulations. A binder produced by CPD™ results in a pigmented film with a gloss that is at least five, sometimes as much as 20 to 30 units higher than the pigmented film produced with an equivalent suspension polymer.

Forty percent binder solutions (solvent: Shellsol A 100) were prepared for the pigmentations presented here. The binder was pigmented 1:0.5 with a mixture of KRONOS® 2059 and Bayferrox 110. For assessment, the coatings were applied using an applicator frame, dried at room temperature for seven days and tested with a gloss meter at 60°.

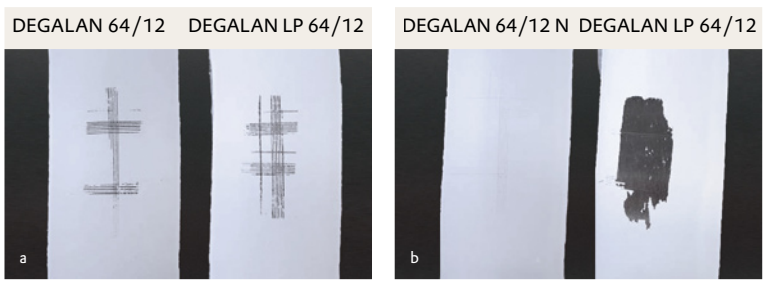

Figure 3: Metal adhesion after cross-cut; a) adhesion on iron (Q-panel); b) adhesion on zinc-coated surface; Left side of each: formulation with continuously produced binder (without Bayferrox 110 pigment); right side of each: formulation with suspension polymer

Figure 1 shows the films produced with this formulation. The film on the left was formulated with the continuously produced product. A suspension polymer was used for the film on the right. The increase in the gloss of the film can easily be seen by looking at the reflection of the bottles in the pigmented film.

Pigment stabilization

The new production process also has a positive effect on pigment wetting and pigment stabilization within the coating. Figure 2 shows rub-out tests. The light red formulation on the left was produced with a base formulation which contains a binder produced using CDP™. The comparable base formulation contains a binder produced using suspension polymerization, is shown on the right. This shows that pigment stabilization is substantially improved in the formulation made with the continuously produced binder.

Metal adhesion

An improvement in metal adhesion could also be achieved. If we compare the cross cuts of pigmented films (production and application like the above-mentioned base formulation, but without Bayferrox 110) on an iron surface (Q-panel, Figure 3 a), it can be seen that the formulation with the continuously produced product (left) has less chipping in its film than the formulation made with the suspension polymer (right). The effect can be seen even more clearly on a zinc surface (Figure 3 b).

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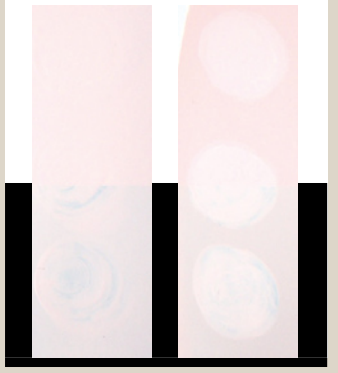

Figure 2: Rub-out test; Base formulations identical to figure 1; left: Base formulation 1 with continuously produced binder; right: Base formulation 2 with suspension plymer

DEGALAN®
Currently available polymers produced by the new process

Produkt	Characteristics	Applications
DEGALAN® PQ 611 N	• Soft, flexible • Soluble in low-odor, pure aliphatic solvents • Outstanding pigment wetting and dispersing properties • Good compatibility with other coating raw materials	• Spray can applications • Correction fluids • Interior wall paints • Additive for UV-curing coating systems
DEGALAN® P 28 N	• Excellent pigment wetting properties • Outstanding compatibility with other coating raw materials • Clear, transparent films, soluble in alcohols	• Printing Inks (flexographic printing inks) • Correction fluids • Drying accelerator for alkyd resins • Spray can applications
DEGALAN® 64/12 N	• Good pigment wetting properties • Films with good weathering and light stability, especially on tropical climate zones • Chemical resistant coating films	• Ship and container coatings • Road marking paints and all-purpose paints
DEGALAN® PM 381 N	• Very good pigment wetting properties • Clear, transparent films • Films with good weathering, light, and chemical resistance	• Concrete paints with good carbonation barrier properties • Architectural paints, printing inks, plastics coatings • Spray can applications

VESTASOL® strengthens the VESTA brand family

The introduction of VESTASOL®, the new brand name for specialty solvents, rounds out Evonik's range of VESTA brands. The following solvents will be marketed under the new brand name: isophorone, trimethylcyclohexanone (TMC-one), tetrahydronaphthalene (THN) and decahydronaphthalene (DHN). Thanks to their high boiling point and excellent properties like strong dissolving power these solvents are mainly used in the coatings and printing inks industry.

VESTASOL® solvents improve the gloss of coatings and lacquers, allowing the production of brilliant shades. VESTASOL® stands for high product quality and the excellent advisory and problem-solving competence of our technical service staff. The solvents are suitable for use with a wide range of different binder classes.

Evonik's VESTA brand family comprises high-quality products and solutions for the coatings and adhesives sectors. Alongside VESTASOL®, the VESTA brand family comprises VESTAMIN®, VESTANAT® and VESTAGON®.

vestasol

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Pigment Concentrates with Extremely low Viscosity[1)]

1) Extract of a paper in Farbe und Lack, February 2010

Introduction

The necessity to reduce VOC content poses a particular challenge to formulators of coatings. The coatings must satisfy environmental guidelines but also meet performance criteria.

Besides waterborne formulations, high-solids systems are an important alternative to conventional solventborne coatings. In such systems, the low organic solvent content is achieved with binders of low molecular weight and thus low viscosity. But how can the VOC content of solventborne coatings be lowered further?

This article shows possibilities using modern wetting and dispersing additives with outstanding viscosity-lowering characteristics and compares binder-containing with binder-free pigment concentrates.

Pigment concentrates for solventborne coatings

Large volume products are usually manufactured by direct grind in which various pigments are dispersed in one step in a main binder. In the case of small batches, pigment concentrates permit cost-effective, flexible production. The base paints are colored by mixing.

Traditionally, pigment concentrates containing binders are used in solventborne industrial coatings. Grinding resins such as ketone or urea-aldehyde resins ensure a relatively broad, though limited compatibility of the concentrates. The lowest possible amount of dispersing additive is used to lower viscosity and increase color intensity.

Because of more stringent environmental legislation, the VOC content of pigment concentrates must be reduced. Since the ketone or urea-aldehyde resins used are already of low molecular weight, it is almost impossible to lower the viscosity of the solution by further decreasing the molecular weight of such resins. Dispersing additives with extreme viscosity-lowering action are thus becoming increasingly important.

Novel additives reduce viscosity

Researchers at Evonik Tego Chemie GmbH have developed particularly powerful wetting and dispersing additives with a star-shaped structure. Many functional groups with affinity for pigments are concentrated at the center. Precise modification with stabilizing side chains is easy to achieve. The compact polymers effectively reduce interactions between the pigments.

Binder-free: an alternative?

Binder-containing and binder-free pigment concentrates based on a new, star-shaped wetting and dispersing additive, TEGO® Dispers 670, were produced and investigated. Priority was given to optimizing the VOC content. By definition, binder-free formulations do not contain any grinding resin. In the following discussion, pigment concentrates based on iron oxide red (PR 101) and titanium dioxide (PW 6) are used as examples (Table 1). A urea-aldehyde resin was used as the grinding resin. The dispersing additive TEGO® Dispers 670 was compared with commercial benchmarks with known viscosity-lowering characteristics. According to the manufacturers, the statistically branched polyurethane is recommended for binder-containing systems, the block polymer polyacrylate particularly for binder-free systems. The additives chosen for comparison represent the established chemical classes.

Fundamentally, the binder-containing concentrates contain less pigment than the binder-free variants.

Rheological properties

A high pigment loading is desirable on economic grounds in order to disperse as much pigment as possible in a single grinding operation. The more pronounced the lowering of viscosity by a dispersing additive, the higher the pigment loading can be and the less organic solvent is required.

Table 1
Formulations of binder-containing and binder-free pigment concentrates

	Iron oxide red (PR 101)		Titanium dioxide (PW 6)	
Raw materials	BF*	BC*	BF*	BC*
Grinding resin (60 % in MPA)	–	19.0	–	20.6
Methoxypropylacetate (MPA)	9	7.8	7.7	11.1
Bentone paste	–	–	0.3	–
Dispersing additive	21	8.2	12.0	3.3
Pigment	70.0	65.0	80.0	65.0
Total	**100.0**	**100.0**	**100.0**	**100.0**
Dispersing additive relative to pigment [%w/w]	12	5	6	2
Grinding resin relative to pigment [%w/w]	–	17.5	–	19
Density [kg/L]	2.6	2.4	2.5	2.0
VOC content [g/L] when using TEGO® Dispers 670	398	430	283	407
Non-volatiles [%]	84.7	82.1	88.5	79.7

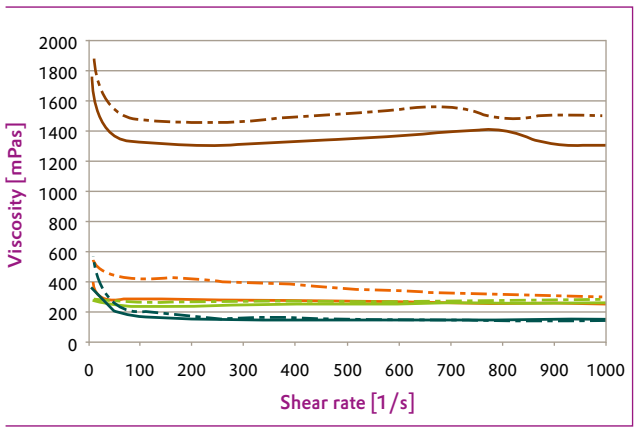
*) BC: binder-containing, BF: binder-free

It is clear from Figure 1, in which PR 101 is used as an example, that the comparison additives do not lead to extremely low viscosities. In contrast, both the binder-containing and the binder-free concentrates with TEGO® Dispers 670 have a low viscosity.

In all cases, stability is sufficient although the stability of the formulations based on the comparison additives is borderline.

With inorganic pigments, the binder-free technology leads to lower viscosities despite unusually high pigment loadings. In the case of PW 6, the formulation of a free-flowing, binder-free concentrate containing 80 % pigment was only possible using TEGO® Dispers 670. The comparison additives resulted in paste-like products.

Figure 1
Comparison of the viscosities of the PR 101 concentrates before and after storage



BC: binder-containing, BF: binder-free

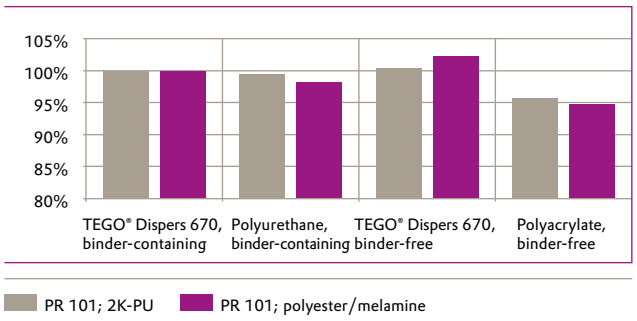
- TEGO® Dispers 670 BF, initially
- TEGO® Dispers 670 BF, 7d@50 °C
- TEGO® Dispers 670 BC, initially
- TEGO® Dispers 670 BC, 7d@50 °C
- Acrylate BF, initially
- Acrylate BF, 7d@50 °C
- Polyurethane BC, initially
- Polyurethane BC, 7d@50 °C

Color intensity

For better comparison, the unpigmented test coatings were treated with the same amount of PR 101, so that the amount each concentrate used in the coating varied. Figure 2 shows the color intensity of the concentrates in the various paints relative to the color intensity of the binder-containing concentrates with TEGO® Dispers 670. TEGO® Dispers 670 increases the color strength compared to the benchmarks.

The color intensity of the binder-free concentrate with TEGO® Dispers 670 is slightly (about 2 %) greater than that of the binder-containing variant. The pigment loading is also higher so that the same color intensity can be achieved using 10 % less pigment concentrate.

Figure 2
Relative color intensity of the PR 101 concentrates after let-down (TEGO® Dispers 670, binder-containing = 100 %)



VOC content

Despite the inorganic pigments' high density, the VOC content of the binder-free pigment dispersions based on TEGO® Dispers 670 is significantly lower than that of the binder-containing variants because of the greater pigment concentration (Table 1). The formulation of binder-free pigment concentrates with a VOC content below the limiting value of 400 g/L was therefore successful.

Cost calculation

In the case of PW 6, the raw material costs of the binder-containing and binder-free variants were comparable. Taking into account the production costs (time/kg of dispersed pigment), the binder-free technology has advantages because of the higher pigment loading.

With PR 101, the raw material costs of the binder-free concentrate are greater than those of the binder-containing variant. However, the emphasis during development of the concentrates was on achieving the lowest possible VOC content.

Binder-free PR 101 concentrates with raw materials costs considerably lower than those of the binder-containing variants can be easily formulated with TEGO® Dispers 670. The pigment concentration is then at 75 % w/w. However, because of the high density of PR 101, the VOC content is above 400 g/L.

Summary

The viscosity-lowering effect of TEGO® Dispers 670 enables the VOC content of pigment concentrates, mixing systems and direct grinds to be reduced. The use of TEGO® Dispers 670 enables binder-free pigment dispersions, particularly of inorganic pigments, to be formulated with lower VOC content than that of their binder-containing counterparts.

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American Coatings Show 2010

A fixed trade fair date for Evonik Industries

At the American Coatings Show in Charlotte, NC, USA, Evonik will present innovative and future-oriented products and system solutions for the paints and coatings markets.

Evonik will attend this year's American Coatings Show from April 13 to 15, 2010 with a broad range of products. The products will be presented on a 1200 square feet (111 m²) "Smart Formulating" booth in Hall A/Booth 1244. Smart Formulating has been the Group's guiding principle in the paints and coatings markets for many years now and it represents our promise to work as partners with our customers and to develop innovative, effective, and individual solutions for modern paint and coating systems. The presentation within the scope of the Smart Formulating concept is based on six "components", each of which is allocated a reference color for coding:

Component	Reference color
Additives	Red
Coloring	Orange
Matting	Light green
Resins	Green
Crosslinkers	Turquoise
Resin Components	Blue

The booth and the communication media are structured according to these components and their colors. Based on the draft drawings for the booth and the list of our product brands according to components, we offer you the option of obtaining advance information about where to find the right person who can help you without having to ask at the information booth.

Product brand list by component

Product Name	Product Description
Additives	
TEGO® Airex	Deaerators
TEGO® Dispers	Wetting and dispersing additives
TEGO® Foamex	Defoamers
TEGO® Glide&Flow	Surface control additives
TEGO® Hammer	hammer finish additive for solventborne formulations
TEGO® Rad	Surface control additives, radiation-curing
TEGO® Wet	Substrate wetting additives
TEGO® Phobe	Hydrophobing agents
TEGO® ViscoPlus	Rheology additives
TEGO® Twin	Defoaming substrate wetting additives
VESTOWAX®	Collective designation for a multitude of natural and synthetic materials
AEROSIL®	Silicon dioxide, hydrophilic Silicon dioxide, hydrophobic
AEROXIDE® Alu	Aluminium oxide, hydrophilic
AERODISP®	Dispersions based on fumed oxides
Dynasylan®	Organofunctional silanes
Dynasylan® HYDROSIL	Water-borne silanes
Dynasylan® SIVO	Multifunctional Silane Systems™
Protectsil®	Functional silanes, Silane emulsions, Solid silanes
Coloring	
NEROX®, Color Black, Special Black	Carbon Black Pigment, oxidized
PRINTEX®, Color Black	Carbon Black Pigment, non-oxidized
NIPex®	Carbon Black Pigment
Aniline Black BS 890	Pigment Black
SIPERNAT® 820 A	Aluminum-silicate
INXEL™	Pigment Preparations
COLORTREND® 808 COLORTREND® 888 COLORTREND® 896 COLORTREND® 844 CHROMA-CHEM® 846	Colorants
IDIS®	Water and solvent based Dispersions
DERUSSOL®	Pigment Black Dispersions

Product Name	Product Description
Crosslinkers	
Dynasylan®	Functional silanes, silicic acid esters
VESTAGON® B, VESTAMIN® BF	Blocked polyisocyanates, internally blocked polyisocyanates
VESTAGON® HA	Hydroxyalkylamide hardeners
VESTAMIN®	Aliphatic and cycloaliphatic diamine
VESTANAT® T, -HT, -HB	Aliphatic polyisocyanates
Matting	
ACEMATT®	Matting Agent
VESTAGON® EP-R 4030	Crystalline, hydroxyl functional super durable polyester
Resin Components	
VISIOMER®	Methacrylic Monomers
VESTAMIN®	Aliphatic Diamines
VESTANAT®	Aliphatic Diisocyanate Monomers
VESTANAT® T, -HT	Aliphatic Polyisocyanates
Dynasylan®	Functional Silanes, silicic acid esters
Polyoil	Polybutadiene oils
Resins	
Tegomer®	Functional Polydimethylsiloxanes (PDMS)
DEGALAN®	Bead polymers
VESTICOAT® UB, DYNAPOL®, DYNAPOL® S, DYNACOLL®	Saturated Polyesters, Blocked PUR Systems, etc
SILIKOPHEN®, SILIKOPON®, SILIKOFTAL®, SILIKOPUR®, TEGO® Protect	Silicone-based Resins
TEGO® AddBond	Adhesion Resins
TEGO® VariPlus	Special Cobinders
Polyoil/POLYVEST®	Liquid Polybutadiene, Resins and MSA-adducts
VESTOPLAST®	Amorphous Poly-alpha-olefins

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New Food contact approval

expands the use of DYNAPOL® L 912

The number of specialty products of Evonik Coatings & Additives approved for direct food contact has been increased. Additionally to the already existing European approval according to the directive 2002/72/EC, the U.S. Food and Drug Administration (FDA) granted recently a "Food Contact Substance Notification (FCN)". It allows the use of DYNAPOL® L 912 in applications with food contact according to § 175.300 (lacquers), § 175.105 (adhesives) and § 175.125 (pressure sensitive adhesives).

By giving interior can coatings excellent metal adhesion and resistance towards sterilization, DYNAPOL® L 912 helps to meet highest demands towards the protection of the filling goods – even aggressive food.

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Dates

Smart Formulating
Trade Fair Appearances 2010

13.–15. April 2010
ACS (American Coatings Show)
USA, Charlotte
9.–11. November 2010
Eurocoat
Italy, Genoa
1.–3. December 2010
Chinacoat
China, Guangzhou
1.–3. December 2010
China Adhesives
China, Shanghai

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