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 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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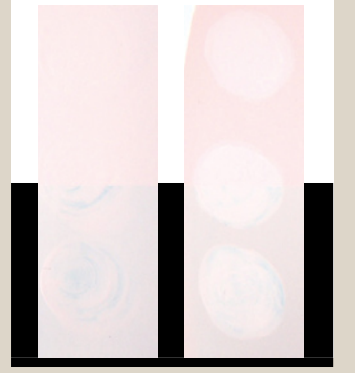

Figure 2: Rub-out test; Base formulations identical to figure 1; left: Base formulation 1 with continuously produced binder; right: Base formulation 2 with suspension plymer

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

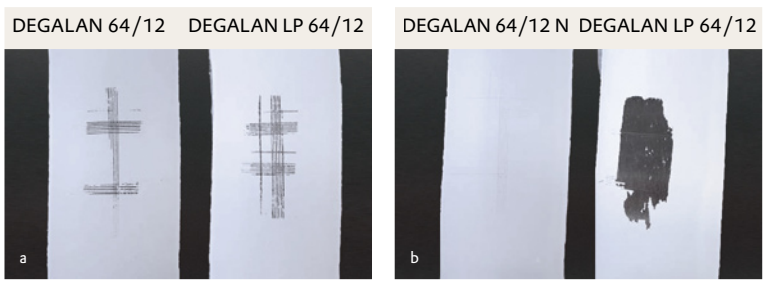

Figure 3: Metal adhesion after cross-cut; a) adhesion on iron (Q-panel); b) adhesion on zinc-coated surface; Left side of each: formulation with continuously produced binder (without Bayferrox 110 pigment); right side of each: formulation with suspension polymer