From nanotechnology to stir-in pigments

Raw material developments driven by environmental requirements.

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Increasingly rigorous legislation is the primary force compelling suppliers of coating raw materials to come up with new developments. These are mostly occurring in the fields of water-thinnable powder and UV coatings. VOC-reduced products and reduced-toxicity products both featured in Nuremberg. Interesting new process ideas also contributed to their development. Some of the raw material highlights of the show are discussed below.

BASF AG presented a range of organic and inorganic pigments for aqueous binder systems under the name "XStab". These pigments are readily dispersed in a water-based medium. Another new development introduced and demonstrated on the BASF stand goes by the name of "Larolux". This patented process for UV curing acrylic paints utilises affordable, ozone-free UV lamps. Up to now, the coating surface had to be protected with an inert gas (e.g. nitrogen) in closed equipment to keep away atmospheric oxygen, which has an inhibiting effect. The new process employs carbon dioxide, which is heavier than air. A "lake of inert gas" forms in the container; the latter can therefore have a simple design and can be kept open. Lining the container with aluminium causes the UV light to be reflected and creates perfect illumination of 3D substrates. The equipment is highly affordable and is thus suitable for small paint shops.

Processing UV coatings without inert gas

Eastman offers an alternative to inert-gas-free processing of UV coatings with its "Lumicure 323" series. These products are based on polyester/vinyl ether and feature low skin irritation and high reactivity. They are intended for industrial processing - e.g. spraying - on wood and have a high chemical resistance. Eastman is working intensively in the powder coating sector on a method for coating coils. The high line speeds found there necessitate extremely reactive resins. One such resin, based on a polyester with terminal carboxy and hydroxy groups and curing at temperatures around 120°C, is about to be released. At the moment, it is undergoing practical tests. A new coating method is also being tested. It consists by a combination of stirring and agitation; there is no need for conventional grinding. They are powder preparations consisting of 80% pigment and 20% APEO-free polymer. Because they consist of free-flowing, dust-free granules, they can be taken from containers cleanly without any wastage. Dispersion is particularly rapid because the pigments are in the form of hollow spheres with a mean diameter of 100 µm that the solvent can penetrate quickly. Accordingly, the final colour strength develops very rapidly.

Dispersions for low-VOC wood finishes

Johnson Polymer launched acrylic dispersions for the wood finishes sector that are made in a new RC ( rheology controlled) process. A low-molecular, acid-functional resin serves as stabiliser. These dispersions are notable for enhanced stability (both steric and ionic) and almost Newtonian flow characteristics. The stabiliser supports film-formation and so slashes the requirement for film-forming aids. This in turn conduces to a lower VOC content in the coating. The two new dispersions "Joncryl SCX 8330" and "Joncryl SCX 8383" are self-crosslinking acrylic dispersions offering fast drying, chemical resistance, mar resistance, abrasion resistance and good warm appearance on wood.

"Joncryl HPE 2157" is a new product aimed at the printing inks sector. A new polymerisation process has been used for this styrene/acrylic dispersion. The dispersion is noted for very rapid drying and so can replace toluene printing inks with an aqueous system. Another advantage is the low depth of penetration into paper, a fact which leads to a more brilliant colour strength.

Suitable for direct contact with foods

A new series of DFC (Direct Food Contact) products is available for the food-packaging sector. It was developed to meet the demand for printing cooking instructions or direct advertising on the trays of, e.g., frozen convenience meals. As a result, the inks come into direct contact with the food. The inks must additionally be resistant to elevated temperatures, e.g. in microwave ovens. These requirements are met by the aqueous acrylic dispersions and solutions from the "Joncryl DFC 3000" series.

Nanoparticles in reaction resins

Hanse Chemie offers two series of monodisperse silica nanoparticles in liquid reaction resins under the name "Nanocryl" and "Nanopox". Up to now, additives based on, e.g. fumed silica, have been used for increasing the mar resistance of coatings. In clear coatings, however, these products cause haziness and generally lead to viscosity increases and settling due to large particle sizes. This
restricts their application areas. The new technology converts an aqueous sodium silicate into an amorphous silica that consists of spherical SiO2 nanoparticles with diameters of approx. 20 nm and an extremely narrow particle size distribution. These particles are incorporated into polymers or monomers, and even SiO2 contents of up to 50% will retain their transparency and low viscosity. The products can be used as fillers or additives for increasing surface hardness and mar and abrasion resistance. Further advantages are enhanced mechanical properties, such as impact strength and toughness, with no impairment of chemical resistance, weatherability, ease of processing and curing rate in the cured base resin.

The "Nanocryst" series consists of various acrylic monomers with SiO2 contents between 40 and 60%. These are clear solutions whose viscosities largely correspond to those of the pure monomers. The "Nanopox" brands are added to UV and peroxide-curing acrylic coatings. "Nanopox" brands are epoxy resins that also have SiO2 contents between 40 and 60%. They can be used alone or in combination with other epoxy resins, e.g. in paints, adhesives or glassfibre-reinforced composites.

Fine-particle matting agent for UV systems

Grave Davison showcased silicon compounds of another type. "Syl OID RD 2105" is a new fine-particle matting agent for radiation-curing coatings. It consists of a silica gel whose surface has been given organic treatment. It offers distinctive advantages in UV-curing systems: high matting efficiency, little effect on viscosity, and low gloss differences at different coating thicknesses. The product is easy to incorporate, exhibits high film clarity and does not tend to settle. "Syl Oid C 803" is a very finely divided matting agent with a mean particle size of 3.7 µm and can be very readily incorporated into coatings. It is suitable for use in thin-film coatings, printing inks and industrial wood topcoats.

"Syl owhite SM 405" is a filler that serves as a partial replacement for titanium dioxide and therefore offers a cost advantage. This precipitated, amorphous sodium aluminium silicate is highly purified and supports the brilliance of the paint by virtue of its high whiteness. It can be incorporated easily and stabilizes the viscosity of paints in storage thanks to its low settling tendency.

Additives for cutting VOC

Additive suppliers were very well represented at this year's ECS, almost outnumbering coating raw material companies. Additives are also playing their part in VOC reduction and compliance with other environmental regulations. This is being achieved through the use of, e.g., crosslinkable additives and highly effective products that minimise additions.

"TEGO Rad 2300" from Degussa Tego Coating & Ink Additives is a crosslinkable additive for radiation-curing coatings. It effects good substrate wetting by lowering surface tension. Mar and blocking resistance are enhanced. Another advantage is low foam formation. Because it can crosslink via free-radicals, the product does not migrate into continuously hardened films and thus is not extracted from the film in extraction tests.

"TEGO Dispers 680 UV" and "681 UV" are aminofunctional polyesters with a wax-like consistency. These solventless, pigment-wetting agents were developed especially for use in highly pigmented, radiation-curing printing inks. The products provide excellent colour strength, low viscosity and good flow.

Custom dispersing agents through controlled free-radical polymerisation

Efka Additives presented two new dispersing agents based on acrylic block copolymers. These products are made by a new polymerisation process called controlled free-radi cal polymerisation or CFRP. The properties expected of dispersing agents, namely affinity for the binder and affinity for the pigment, are achieved in conventional products by copolymerising suitable components. However, this proceeds in an uncontrolled fashion, and leads to totally random distribution of the components in the product and sub-optimal effectiveness. The new process, for which a special catal yst was developed in close collaboration with Ciba Specialty Chemicals, yields custom-made products. It enables the individual components to be selectively positioned in the copolymer such that those with an affinity for the binder are concentrated at one end of the molecular chain and those with an affinity for the pigment are at the other. This greatly enhances product effectiveness. Another advantage is a very narrow molecular weight distribution. The first products to be based on this new process are "E FKA - 4300" and "E FKA - 4330". The particular advantages are a major lowering of viscosity, increased pigment absorption, greater stability and universal compatibility with binders. "E FKA - 4300" is used in solvent-based, high-quality coatings, such as automotive finishes, coil coatings and two-pack paints. "E FKA - 4330" prevents pigment flocculation, especially in systems with a low pigment content.

Molecular defoamer based on the Gemini process

Air Products launched a new molecular defoamer. "Surlynol MD - 20" is based on the Gemini process, which substantially increases effectiveness through a bimolecular structure. Molecular defoamers destroy foam not through incompatibility but rather through degradation brought by ionic forces, hydrogen bonds and van der Waals forces. "Surlynol MD - 20" contains neither solvent nor silicone. It also works as a strong wetting agent. Its high effectiveness enables addition levels to be slashed.

BYK Chemie presented a new liquid rheological additive called "BYK - 420". The product is based on polyurea and is used for aqueous industrial coatings and pigment pastes. Its thixotropic character provides control over paint sagging. It also prevents settling in pigment pastes, extenders and matting-agent concentrates.

Texturing agent for powder coatings

Clariant has brought out a new texturing agent for powder coatings called "Licomont AR 504". This modified polypropylene wax produces a soft, wavy texture on the paint surface. The degree of texturing can be varied over a wide range via the amount of wax added. This varies from 1% to a maximum of 6%, which provides the strongest effect. This new wax comes in the form of granules or fine particles.

"TP Ceridust 6073", "6074" and "6075" are new texturing agents from Clariant's micronised "Ceridust" range. These three polypropylene-based wax grades are primarily recommended for air-drying, solventborne coating systems, e.g. wood and furniture finishes. Clariant has also launched "TP Ceridust 3921 P", a wax blend that contains PTFE and is based on a novel polyolefin. This micronised wax grade is notable for a number of advantages that vary according to application area. For example, in coatings, it improves such properties as mar resistance, slip, antiblocking and matting. In printed materials, by contrast, it substantially raises abrasion resistance. The additive is suitable for wood and powder coatings as well as coil coatings and printing inks. The extremely fine particle size (d50 = 6 micrometers) additionally renders it appropriate for thin-film applications.
such as can coatings.

LIFELINE

→ Ralph Stange was born in Shanghai and grew up in the Netherlands. After studying engineering in Krefeld he joined BASF AG Ludwigshafen in 1961 where he worked as an applications consultant in the marketing department specialising in amino resins for automotive finishing, advising customers in Germany and all over the world. From 1993 to 1996 he was based in the USA helping to develop BASF's coatings raw materials business in the NAFTA area. He retired in 2000 and has since worked inter alia as a correspondent for European Coatings Journal.