ADDITIVES UPDATE: Market Remains Attractive Despite Challenges

Brown, vice president of The ChemQuest Group. The overall global growth rate for additives in paints and coatings is estimated to be 5% per year. According to ChemQuest, the market is nearly evenly divided between the five major categories of coatings additives: rheology control agents, surfactants (largely for wetting surfaces and pigments), specialties (antioxidants, co-catalysts, photoinitiators, and light stabilizers), biocides, and others (corrosion additives in particular).

Steven Nerlfi, with market research firm Kusumgar, Nerlfi & Growney, places the value of the North American market a bit higher at \$1.5 billion, based on a volume of 560 million pounds. He estimates the overall growth rate to be only 1% per year. The growth rate for leading additives, including rheology modifiers, dispersants, and biocides, is 1–2% per year, according to Mr. Nerlfi. Silane adhesion promoters are the fastest growing segment but are still very small in volume, he states.

A consumer-driven trend impacting additives suppliers is the increasing role of fashion, particularly for interior paint. "There is a trend towards deeper colors for use in interior decorating. In these paint formulations, color uniformity and rheology control along with scrub and stain performance become increasingly important," says Sandeep Goel, additives market manager with Rohm and Haas Company.

Various market conditions are creating both opportunities and challenges for suppliers of additives to the paint and coatings industry. "A significant level of merger and acquisition activity has occurred in recent years in the additives space," notes Mr. Nerlfi. Consolidation has enabled producers to respond more effectively to the globalization that has

Additives for paints and coatings remains an attractive market despite rising raw material and energy costs. These materials serve a critical function in paints and coatings, enabling formulators to meet the ever higher performance demands of customers and increasingly stringent requirements of environmental regulators. The global coatings additives market continues to grow at a healthy rate. Offshore competition has become an issue for North American producers in some segments of the market. Development of strong customer relationships, focus on service, and investment in innovation will drive the market in the future.

The global coatings additives market in 2004 was valued at \$2.7 billion, with North America accounting for 40% or \$1.1 billion, according to Michael D.

by Cynthia Challener, JCT COATINGSTECH Contributing Writer

occurred in its customer base. "Consolidation of the customer base, whether in the form of smaller companies allied as purchasing blocks, or as larger scale mergers and acquisitions, will continue to concentrate buying decisions. Fewer companies will be purchasing higher volumes and expecting better value," notes Robert Miller, product manager for Troy Corporation's Troy Performance Additives business.

The shifting of manufacturing to offshore locations-China and India, in particular, and especially for OEM production-has led coatings formulators to set up operations near their customers. "Coatings producers are expecting additives suppliers to provide the same level of service in these locations as in their North American plants," says Mr. Brown. "This burgeoning market demands a wide range of paints and coatings that are very different than those required for traditional markets like Europe and North America," notes Caio Sedeno, marketing executive for surfactants with Dow, "Additive suppliers must also be aware of supply chain logistics." Intellectual property concerns and the different technical requirements of formulas marketed to these offshore locations must be considered as well.

Stricter VOC regulations in many regions of the world have led to the increasing effectiveness and concentration of the active ingredients. "Suppliers have worked to reduce the level of inactive ingredients, particularly those that contribute to VOCs and HAPs. The goal is to sell additives in as pure a form as possible. Coatings formulators therefore require less material to achieve the same level of performance. Typically they don't need to reformulate with these more active additives, either," explains Mr. Nerlfi. In addition to VOC compliance, there is an increasing need for improved performance of coatings over low energy substrates, according to Mr. Miller.

Innovation is a key characteristic of the additives market. "There is significant investment in new product development," says Mr. Nerlfi. "New products are launched frequently, as additive suppliers develop new compounds that perform more effectively in different environments and applications." Mr. Brown adds that the additive market remains an attractive space, with producers able to get close to value use in their product pricing. "Investment in innovation of new technologies and products is common in this market, as compared to focusing on improvement of manufacturing processes, which tends to be the case with commodity ingredients," Mr. Brown adds.

There is much interest in performance-enhancing additives and multifunctional additives for paints and coatings. "Some of the new UV screeners and photoinitiators fall into this category," notes Mr. Brown. "These products are glamorous and are receiving quite a bit of attention. However, additives that optimize performance are also very important today," he states. Opacifiers, rheology modifiers, and specialty solvents are enabling coatings formulators to develop cost effective, high performing formulations that meet VOC requirements. Opacifiers, which scatter light, can reduce the amount of titanium dioxide (TiO₂) necessary in a formulation. As the prices for TiO₂ and acrylic acid based compounds continue to climb dramatically, substitutes for these materials are currently very attractive.

The multi-functionality of active ingredients, com-

Leaders and Innovators in Additives for Paint and Coatings

Air Products Arch Chemicals **BYK-Chemie Ciba Specialty Chemicals** Cognis Degussa **Dow Chemical Dow Corning** Elementis **GE** Advanced Materials Hercules Incorporated ICI (Alco and Unigema) OM Group Rhodia Rockwood/Southern Clay Rohm and Haas Troy Corporation WR Grace Source: Kusumgar, Nerlfi & Growney bined with the increasing complexity of formulations, has led to increased interactions between additives in coatings formulations. "Formulators would like to be able to use new additives in existing formulas without any adjustments, but it is becoming increasingly difficult to do so," says Mr. Brown. "The perfect additive is one that can be dropped into a formula and provide enhanced coatings performance without affecting the rest of the ingredients. The industry is reaching a point of diminishing returns with respect to additives, as formulators' willingness to adjust existing formulas decreases, while the demand for high performance increases."

Customer support has always been an important part of the relationship between additive suppliers and paint and coatings manufacturers, but will be even more so as the complexity level rises. "There has always been a need for a high level of interaction between additives suppliers and coatings formulators, be-

Leading Categories of Additives for Paint and Coatings

Rheology modifiers Light stabilizers Dispersants Wetting agents **Biocides** Plasticizers **Corrosion** inhibitors Foam control agents Drying agents Slip/rub agents Flatting agents Fire retardants **Opaque** polymers Hollow/solid spheres Others: adhesion promoters, antioxidants, antiskin agents, heat stabilizers

Source: Kusumgar, Nerlfi & Growney

cause suppliers need to convince coatings producers to change their formulations. This question must be answered before the issue of price is addressed," Mr. Nerlfi notes. "Additives suppliers have to prove that formulators will be able to use a new additive to differentiate their products from those of other competitors, and that requires a lot of service and interaction."

With increasingly complex formulas, there are increasing expectations on the part of coatings manufacturers to get technical support from additives suppliers. Coatings producers are looking for assistance with reformulation work and qualification testing. "As coatings manufacturers increase demands for technical support, additives suppliers are saddled with higher costs for these services," says Mr. Brown. He expects that those companies lacking an understanding of the importance of providing a high level of technical support and/or the capability to do so will be placed at a significant disadvantage.

RHEOLOGY MODIFIERS

In the U.S., rheology modifiers account for 100–105 million pounds, valued at \$235 million, according to Kusumgar, Nerlfi & Growney. There are commodity and specialty rheology modifiers. Cognis, BYK-Chemie, and Tego dominate the North American market for spe-

cialty rheology modifiers, while Hercules, Dow, Akzo, Clariant, and Rohm and Haas are major suppliers of the more commodity-like associative thickeners, according to Mr. Brown of ChemQuest. In the specialty segment, products for high-solids coatings and other new technology platforms are the primary focus of R&D efforts, according to Mr. Brown. Michael Brown, sales and marketing manager for the U.S. paint industry with the Aqualon business of Hercules Incorporated, notes that paint companies supplying large Do-It-Yourself outlets are under increasing cost pressure, so there is reduced emphasis on raw material innovation.

Hercules' Aqualon business is the world's leading manufacturer of cellulosic derivatives used in latex paint as rheology modifiers and thickeners. The company recently introduced Natrosol® HE 10K, an extremely efficient cellulosic thickener. In the past year, 10,000 metric tons of new Natrosol capacity has been installed at Aqualon's three global HEC plants. In the near future, the company will be launching, under the umbrella of its Aquaflow® line, a new product that reduces post-tint viscosity loss in deep and accent bases, according to Mr. Brown of Aqualon.

Rohm and Haas is a leading global supplier of synthetic rheology modifiers, opaque polymers, dispersants, and biocide additives. The company offers an Acrysol[™] line of solvent-free, HEUR and HASE thickener products with superior performance for various paint grades and applications. A Design Rheology[™] series is also offered that matches the in-can feel of cellulosics as an improved replacement. Most recently, the company introduced RM-5000, RM-6000, and RM-7, all solvent-free thickeners that demonstrate improved viscosity efficiency and performance over a broad range of formulations.

Tego Coating & Ink Additives offers additives that address interface phenomena including defoamers, deaerators, pigment wetting and dispersing additives, flow and glide agents, substrate wetting additives, radiation-curing additives, rheological additives, and hydrophobing agents. The technology is based on silicone chemistry, block copolymers, polyethers, and siliconefree specialty surfactants. The company recently launched a new line of rheology modifiers–TEGO® ViscoPlus—to address the drag resistance, hiding power, gloss development leveling, and high spatter resistance of waterborne paints and coatings. These polyurethanebased associative thickeners are designed for architectural, wood and furniture, and industrial coatings.

BYK-Chemie offers wetting and dispersing agents, defoamers, and air-release additives to the paint and coatings market. In 2004, the company invested more than Euro 65 million to expand production of additives from around 50,000 to roughly 90,000 tons per year at its facility in Wesel, Germany. The company also opened new technical service laboratories in Shanghai and Guangzhou, China and São Paulo, Brazil. Further laboratories are to be built in northern China and India in the foreseeable future. BYK-Chemie recently introduced the liquid rheology additive, BYK®-425, which creates a pseudoplastic flow behavior and improves sag resistance and anti-sedimentation. It is a VOC-and alkylphenol ethoxylates (APE)-free rheology modifier that is suitable for aqueous and water-reducible systems and shows a broad compatibility with many aqueous binder systems.

Elementis Specialties manufactures and markets a variety of specialty products for both waterborne and solvent systems including rheological additives, surface conditioners, dispersing agents, waxes, defoamers, interfacial tension modifiers, and other performance enhancing additives. In 2004, Elementis acquired Sasol Servo B.V. The company's newest product is Bentone® DE, a new hyper-dispersible hectorite based rheological additive for water-based architectural coatings formulations. Due to its ultra-fine particle size and the special beneficiation process, the product can be easily dispersed and activated without the need for high shear forces. Rheolate® 125 is a solvent and APE-free acrylic rheology modifier with improved efficiency designed for waterborne paint systems. It is highly shear thinning and provides effective atomization, exceptional impact resistance, and improved moisture resistance in most water-based industrial and wood coatings, according to the company.

Eastman Chemical Company offers a broad line of mixed esters of cellulose, both cellulose acetate butyrate (CAB) and cellulose acetate propionate (CAP), useful as additives for solventborne and some UV-curable applications. Cellulose esters provide performance benefits including improved flow and leveling, reduced cratering, faster dry time, sag resistance, viscosity control, intercoat adhesion, color uniformity, and metallic flake orientation. These materials may also be useful as pigment dispersion media or as primary film formers. Carboxymethyl cellulose acetate butyrate (CMCAB) has recently been introduced to provide many of these same benefits in waterborne industrial coatings.

LIGHT STABILIZERS AND PHOTOINITIATORS

North American manufacturers of UV screeners (light stabilizers) and photocatalysts (photoinitiators) have faced growing fierce competition from offshore producers, who export products to the U.S. at significantly depressed prices. While these are high priced additives, they have experienced significant price erosion from this competition. No significant new technology developments have been introduced to the market recently. Major players include Ciba, Clariant, and Cytec. Ciba Specialty Chemicals produces light stabilizers, photoinitiators, antioxidants, dispersants, algicides, rheology modifiers, optical brighteners, and metal deactivators for paint and coatings applications. The company recently opened an R&D center in Shanghai, China. The center's mission is to combine expertise in organic synthesis, physical chemistry, polymer chemistry, photochemistry, and analytical chemistry with application and formulation sciences to create new products and solutions for its customer industries—in particular in Asia, but also globally, according to the company.

Ciba recently introduced Ciba[®] Irgacure[®] 2022, an easy-to-use photoinitiator for opaque formulations and UV-stabilized/UV-cured systems. The company has also developed new photolatent bases that allow for "on-demand," light-induced curing of paints while achieving a balance between pot life and reactivity, enabling a new generation of UV-A-curable clearcoats for car refinish applications. Ciba also launched its new UV plasma curing technology for coatings on three-dimensional substrates. The technology ensures the excellent properties of UV-curable acrylate-based coatings and allows curing of "shadow areas," thereby enabling scratch-resistant UV-curable coatings for the automotive industry, according to the company.

New UV absorbers from Ciba Specialty Chemicals include its Tinuvin[®] line of products. Tinuvin 479 is designed for clearcoats and for thin film applications such as automotive window glazing and sunroofs. Tinuvin 477 DW protects UV-A radiation-sensitive materials in waterborne adhesives and coatings on substrates such as wood, plastics, and glass. Tinuvin 152 is a nonmigrating radical scavenger specifically designed for automotive coatings. Tinuvin 5236 is a liquid UV absorber for solventborne and UV-curable industrial and decorative coatings.

SURFACTANTS (DISPERSANTS, WETTING AGENTS, DEFOAMERS, ETC.)

Dispersants, wetting agents, defoamers, and other additives with surfactant properties have witnessed incremental product development efforts. "Companies are focusing on improving technical service and support, particularly in formulations development," says ChemQuest's Mr. Brown. In North America, the market for these types of additives is quite fragmented. Leading players include BYK-Chemie, Cognis, and Tego.

In the surfactant area, one of the most important trends that Dow sees is the movement away from formulations that contain APE, in response to regional regulatory and environmental concerns. "Replacing APE's requires meeting both performance expectations and a price point that is competitive to the consumer and the formulator. As formulators are moving away from APE and other additives, they are looking to suppliers like Dow to assist them as they completely re-adjust and optimize their formulations, which is usually time-consuming and costly," says Kara Weber, technical service specialist with Dow Chemical. The company currently offers its Tergitol[®] 15-S series APE-free secondary alcohol ethoxylates and is actively researching new technologies and chemistries that will be designed to offer superior performance to the solutions currently available.

In addition, Dow is looking to assist customers in simplifying their formulations by using one additive that offers both solvent and surfactant benefits. The Dow Surfactants business is working with the Dow UCAR latex division in developing formulations that rely on a single additive to provide the wetting features of a surfactant and the dissolving features of a solvent. "This process of reducing the additives, modifying the surfactants, and developing simpler formulations will reduce overall expenses for the formulator," notes Ms. Weber. "Our focus on developing new surfactants is on differentiation," states Mr. Sedeno. "We will continue to grow our portfolio of specialty surfactants to better meet the needs of our customers in the paints and coatings industry." Degussa's Aerosil & Silanes business unit has introduced a new line of water-based dispersions with solid content ranging from 12% to 50%. The company began producing Aerosil® fumed silica dispersions domestically in May 2005 at its new plant in Mobile, AL. The new facility more than doubles Degussa's production capacity for these Aerodisp® products, which are also produced in Rheinfelden, Germany. The new dispersion plant will initially focus on water-based dispersions of fumed silica, but will eventually produce dispersions of fumed alumina, fumed titanium dioxide, and fumed mixed oxide, according to Carlos Gonzalez, marketing manager, Aerosil Products, Paints and Coatings with Degussa.

BYK-Chemie recently introduced the silicone-free defoamer BYK®-1790 for use in solvent-free radiation curable systems. It is compatible with a number of other additives and meets all requirements for food contact materials in the European Disperbyk®-145 is a new high molecular weight wetting and dispersing additive for nonpolar solvent-based systems that deflocculates pigments and provides steric stabilization, providing higher gloss and color strength and reduced viscosity. It is recommended for use in architectural, industrial, wood and furniture coatings, and pigment concentrates. Disperbyk³-194 is designed to avoid flooding and floating, particularly for the production of pigment grinds for aqueous systems as well as for pigment grinding in aqueous coatings and printing inks. It reduces viscosity and increases gloss as well as transparency in aqueous coatings, printing inks, and pigment concentrates.

Cognis offers defoamers, emulsifiers, corrosion inhibitors, rheology modifiers and thickeners, wetting agents and dispersants, and leveling agents for waterbased, solvent-based, and powder formulations for architectural, automotive, industrial, and wood coating applications. The company recently introduced its Starfactant[®] product, which offers unique substrate wetting with defoaming. Starfactant is effective at lowering static and dynamic surface tension while reducing foam in waterborne polyurethane, epoxy, and acrylic systems, and 100% UV formulations. Edenol® EFC-100 is an emission-free, nonyellowing, low-odor coalescing agent for use in all decorative paints. It is produced from renewable fatty acids and is cost-effective, easy to incorporate, improves the efficiency of rheology modifiers, and offers higher gloss and improved scrub resistance. Disponil® AFX is an APE-free high-performance. non-ionic surfactant series suitable for a wide range of

emulsion polymerization applications and polymer dispersions. "We provide specific, integrated solutions that aim to deliver environmental sustainability, reliability, consumer safety, and superior performance," says Patrice Pinsard, vice president of Cognis' Polymers, Coatings & Inks business.

Troy Corporation provides a complete line of preservatives and additives that are used for dry film preservation, in-can protection, surface wetting, defoaming, dispersing pigments, rheology modification, and surface drying. The company has recently introduced several new products, including Troysperse²⁹ 90W, a dispersant for universal tinting systems for alkyd and latex coatings with organic or carbon black pigments. Troy also launched a zero-VOC wetting additive based on Troysol²⁹ LAC technology that is very effective in improving the performance of low-VOC coatings and the wetting of difficult substrates such as plastics.

"Iroy will continue to develop products that have reduced VOC content, maintain end-use performance, are cost-competitive, and are safer to use both in the plant and when ultimately applied." says Mr. Miller. The company continues to expand operations in the Asia/Pacific region and other emerging countries. It is increasing production capacity of both additives and biocides at its Troy Siam facility and expanded its technical capabilities in the region with a new technical center in Thailand.

BIOCIDES

The value of the biocides market in North America is estimated to be \$105 million, based on a volume of 30 million pounds, according to Kusumgar, Nerlfi & Growney, It is a highly regulated market. "There is a massive barrier to entry into the blocides market because of the restrictive regulations and extensive requirements for product testing," Mr. Nerlfi comments. "With the introduction of the Biocidal Products Directive in Europe and increasing regulatory requirements on a global basis, significant extra cost is being asked of biocide suppliers to support continued participation in the market going forward," adds Mark Saurin, global marketing manager for paints and coatings with Dow Biocides and ANGUS Chemical Company, "Not only is this challenging the economics of the existing business, it is inhibiting the development of new biocide products to continue to improve and develop performance capabilities. This poses a dilemma to the market as paints and coatings customers continue to strive for improved cost effectiveness and technical performance," he continues.

Merger and acquisition activity has been significantin this segment of the additives market, with the acquisition of Avecia's biocides business by Arch Chemicals and the purchase of Biochema Schwaben and Degussa's biocide business by International Specialty Products (ISP) being the most recent.

Biocides in coatings serve to both preserve the formulation while it is in the container and to inhibit the growth of organisms in the applied film. Smaller companies offering in-film preservation include AgION Technologies, Microban, and Clean Seas Company. AgION's antimicrobial additives, Silver/Zinc or Silver/Copper with zeolite carriers, provide a continuous controlled release of the metal ion over a long period of time and are ideally suited for use in coatings. Microban's broad range of biocides and fungicides are engineered into the coating during the manufacturing. process and are resistant to leaching, so they provide durable protection throughout the useful life of the coating. Clean Seas Company focuses on the marine coatings market and offers its Microbiological Enzyme Technology (MET^{ag}) as an alternative to copper-based biocides.

Dow Biocides is responding to the challenging market environment for biocides by offering a very broad range of products, demonstrating the increased effectiveness of a combination of biocides, developing propriety evaluation technology, and providing regulatory assistance. "In the future, there will be fewer choices of actives. Customets will be challenged on what to use

from the more limited selection and how to maximize their uses,^{*} says Mr. Saurin.

Dow recently introduced benzisothiazolinone (BIT) to its portfolio under the Canguard tradename, a product that complements Dow's current line of formaldehyde. and nonformalde. hyde based offerings for the paints. and coatings industry. The company also launched its Taunovate High Throughput microbiological testing capabilities, screen-



ing techniques for enabling the quick, accurate, and cost-effective analysis of formulation challenges to ensure optimal preservation solutions. Dow's initial focus is delivering against customer needs in industrial by giene and in-can preservation. The next challenge will be to address the market need for a better answer to dry film preservation, according to Mr. Saurin.

The protection of coatings applied to inorganic substrates such as stucco and Hardy board from algae formation is an issue for biocide suppliers. "Specific algaecidal ingredients need to be added to a mildewcide in order to achieve the full spectrum of protection required," explains David Sutton, North American marketing manager for Rohm and Haas Company's Coatings and Latex Biorides business. Separately, a growing number of paint customers are concerned about the use of formaldehyde releasers as in-can preservatives, because formaldehyde has been classified as a human carcinogen by the World Health Organizations' International Agency for research on Cancer (IARC). "Rohm and Haas is responding to these. trends by developing a comprehensive line of biocides that meet reduced VOC requirements and offer alternatives for both in-can and dry film preservation," says Mr. Sutton.

The latest products from Rohm and Haas are Rocima^{ra} 200, a patented low-VOC formulation of 4,5-dichloro-2n-octyl-4-isothiazolin-3-one (DCOIT) and Rocima^{za} BT 1s and 2S (10% and 20% formulations of BIT). The company is also in the process of introducing Rocima^{**} 355, a patented, two-to-one synergistic blend of DCOII^{**}



and iodopropynylbutylcarbamate (IPBC) in an ultralow VOC formulation.

Troy Corporation has introduced Polyphase® 662, 663, and 678, zero-VOC dry film preservatives created to be effective. against a broad spectrum of microorganisms, and to be safer to handle because of better toxicology profiles than generic products. Test fence exposures conducted in multiple sites in Asia, Europe, and North

America have shown that these products outperform older, generic dry film preservatives, according to Mr. Miller. Polyphase[®] 678 protects both exterior and interior coatings against a broad scope of fungi, while Polyphase[®] 662 and 663 protect exterior coatings against both fungi and algae.

NANOTECHNOLOGY

The advent of advanced nanotechnology-based capabilities will enable additive suppliers to develop novel products that do not fit into traditional categories, according to Mr. Brown of ChemQuest. Several examples have already been commercialized. PPC's CeramiClear clearcoat product is a hybrid of organic and inorganic technologies and contains nanoceramic particles for improved scratch and mar resistance during everyday use. PPG has also introduced SunClean self-cleaning glass, which is a coated glass product containing micronized titanium dioxide particles that act as photocatalysts to help break down and loosen organic dirt. A hydrophilic portion of the coating causes water to sheet evenly over the glass surface and flush away the loosened dirt.

Degussa's Applied Technology Group within the Aerosil & Silanes business unit has focused its product development efforts on nanostructure fumed metallic oxides to improve many characteristics of paints and coatings, including rheology, water repellancy and anticorrosion properties, scratch-resistance, self-cleaning capabilities, and transparent UV and IR absorption. according to Mr. Gonzalez. The company recently introduced its Lotus Effect® grades of fumed silicas, which impart self-cleaning characteristics to coatings. Aerosil® R9200 is Degussa's latest structure-modified, fumed silica-grade DDS-treated product. It imparts improved scratch and chemical resistance in conventional, high-solids, and 2K coatings systems, and can be used at higher loading levels without significant increases in viscosity, Mr. Gonzalez says.

Degussa's newest AdNano[®] fumed zinc oxide product, available in both hydrophilic and hydrophobic grades, acts as a UV-A filter, providing greater clarity in wood coatings. It also provides hardening of the coating surface, providing effective stability at high tempetatures and long-life protection. The company is currently introducing the product to the outdoor plastics, lacquers, and other decorative coatings markets. Another recent product introduction from the company is Aeroxide[®] C805, a hydrophobic aluminum oxide for powder coatings that is designed to stabilize chargeability.

BYK-Chemie has introduced several nanotechnologybased additives that have been jointly developed with Nanophase Technology Corporation (NTC) for the paint and coatings marketplace. Nanobyk-3600 and Nanobyk-3601 have been developed to improve scratch and wear resistance of UV-coatings that can also be applied to plastics (e.g., as a topcoat for vinyl floorings).

The newest offerings from BYK-Chemie include Nanobyk -3602, which is based on alumina nanoparticles in hexandiol diacrylate (HDDA): Nanobyk-3610, which contains surface-modified alumina nanoparticles in methoxypropylacetate (PMA); and Nanobyk-3650, which is composed of surface-modified silica nanoparticles in PMA. The Nanobyk-3602 and 3610 additives are also designed for UV systems and provide improved scratch resistance, coating flexibility, and maintenance of gloss, color, and transparency. Nanobyk-3650 is the first of this series of products designed for solventbased polyurethane coatings and melamine-cured coatings. It offers the same advantages as the other Nanobyk additives.

MISCELLANEOUS ADDITIVES

A whole host of additives are available for special applications. Akzo Nobel Polymer Chemicals BV offers Ketjenblack EC 600JD superconductive carbon black for use in making plastic car parts conductive so that they can be electrostatically sprayed with paint. This product, along with Ketjenblack EC 300J, is also used to make conductive primer paints for plastic parts. Research efforts at the company focus on developing ways to reduce the required amount of carbon black, according to Heleen van de Lustgraaf, group communication manager chemicals. Akzo Nobel n.v.

Opaque polymers enhance the utility of titanium dioxide and provide excellent hiding performance through a lower density material. They also help to reduce the need for binders and other extenders. Ropaque Ultra^{re} from Rohm and Haas offers several benefits, including improved that retention, reduced dirt pickup, enhanced scrub resistance, reduced cracking, brighter colors, and similar color change during drying. Economically, the use of Ropaque Ultra results in lower paint manufacturing costs while achieving equal, and sometimes higher, levels of performance.

Cytec Surface Specialties, which recently acquired the Surface Specialties business of UCB, provides a broad and deep portfolio of additives: pigment wetting and dispersing agents, flow and leveling agents, defoamers, adhesion promoters, catalysts, UV light stabilizers, preservation and curing additives, theology modifiers, driers, antiskinning agents, antistatic agents, and antioxidants. "We continue to be innovative in those areas that help customers solve problems in performance, application, and production," says Terry Scoville, market manager, Liquid Coating Resins & Additives-Americas with Cytec Surface Specialties. The company is proactively moving to eliminate or greatly reduce materials that may be banned or limited in the future.

The most recent product introduction from Cytec is the flow modifier Modallow[®] 9200. This crosslinkable, acrylic flow/leveling agent is especially designed for solventborne clearcoats such as automotive topcoats. Modaflow 9200 helps improve the gloss and leveling characteristics of a coating without any negative influence on re-coatability, adhesion, and the darity in both the dry film or the wet coating solution, according to Ming Tsang, technical applications specialist, Liquid Coating Resins & Additives–Americas with Cytec Surface Specialties.

ANGUS Chemical Company provides neutralizing and dispersing additives, moisture scavengers, resin crosslinkers, and performance solvents for the paints market. Many of the products are aminoalcohol-based and rely on the company's expertise in nitroparaffin chemistry. "Our AMP' additive is recognized and growing on a worldwide basis due its multifunctional nature to achieve many paint formulation goals," says Mr. Saurin. "The multi-functionality of the products, when fully utilized, can allow customers to comply with tightening VOG requirements, reduce cost, and improve key performance criteria in waterborne decorative paints, other water based industrial coatings, and even traditional solvent-based decorative formulations," he continues. ANGUS bas made significant investments to its facilities at Ibbenburen, Germany and Sterlington, LA to improve reliability, increase capacity for a number of key products including AMP-95^{ra}, and to upgrade regulatory projects critical to business sustainability.

Tego Coating & Ink Additives' new Tego® Aires 907 W. a silicone-free deaerator for water-based coatings used in automotive and industrial applications, prevents the formation of pinholes and blisters during spraying. Tego® Aires 945, 950, and 955 are new deaerators for solvent based high-solids systems.

In the past year, Eastman introduced Eastman Coatings Film Technologies, a product portfolio for the architectural coatings market aimed at helping formulators to continue to develop high-performing paints in a tightening and varied regulatory environment, according to Richard Krawiec, product manager for Eastman's Additives business. The portfolio brings together several coalescents, including *Texanol* ester alcohol, *Eastman* EEH solvent, and the new *Optfilm* Enhancer 400, a low-odor and extremely low-VOC coalescent. Used individually or in combination, they provide formulators in the U.S. with a number of options to help enhance film integrity, color formation, scrub resistance and gloss on wide range of interior and exterior applications, while meeting VOC regulations.

The portfolio has also been commercialized in Europe, where it is tailored to meet the unique needs of formulators and paint companies there. The European portfolio also includes *Texanol* ester alcohol, which is not considered a VOC under the European Decopaint Directive, the highly efficient EEH Solvent, and *Optifilm* Enhancer 300, a low-odor, non-VOC coalescent. In the fall, Eastman will launch this portfolio in Asla, an important market and growth area for the company.

Eastman also offers numerous adhesion promoting additives for coatings. Based on chlorinated or nonchlorinated polyolefin technology, these materials can improve the adhesion of coatings and inks to a variety of substrates, especially to olefinic materials such as polyethylene, polypropylene, and TPO.

CONCLUSION

Whether additives suppliers to the paint and coatings industry produce one or several different categories of materials, each faces the same issues of rising raw material prices, growing offshore competition, stricter environmental regulations, and increasing demands for more extensive technical service. "Success will depend on our ability to provide innovative, environmentally compliant, technical solutions that leverage the interoperability between products," says Rohm and Haas' Sandeep Goel.