

Growing Demand for Specialty Effect Pigments

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Like high-value organic pigments, specialty effect pigments find most applications in automotive coatings, although use of these high-value pigments is increasing in consumer goods and security applications. At the present, the market is growing at a healthy rate, but competition from offshore producers is expected to become an issue in the near future. Major suppliers of effect pigments are focusing on the development of novel technologies and products that differentiate themselves from the competition.

The global specialty effect pigment market is growing at approximately 7% per year and is estimated to be worth \$1.287 billion in 2004, up from \$1.065 billion in 2001, according to Mike Brown of the ChemQuest Group, Inc., a management consulting firm located in Cincinnati, OH. Mica pearlescent and aluminum flake pigments account for 94% of sales (50% and

44%, respectively). Mica pigments sales are growing at 8% per year and are estimated by ChemQuest to reach \$649 million in 2004. Aluminum-based pigments are pegged at \$562 million in 2004 with an annual growth rate of 4%. The remaining 6% of sales are attributed to other specialty effect pigments, particularly color shift pigments. Sales for this category are estimated to top \$76 million in 2004 and are growing at a rapid 15% annually.

According to Robert Daily, color marketing manager with DuPont Performance Products, specialty effect pigments are very popular in the North American automotive market, but are less so in Europe and Asia. Currently there is a lot of interest by automakers in color shifting pigments, but the costs are still too high. "Automakers will only increase spending on a component such as a high end coating if

The above photos are courtesy of (from left): Flex Products; Eckart America L.P.; and Engelhard Corporation.

the extra dollars will bring some dramatically new and different to the product. Color shifting pigments are very expensive, so while the interest level is high, there will only be a few vehicles with coatings containing this new type of effect pigment. Generally you will find these pigments used in niche markets like high end sports cars," Mr. Daily explains. Specialty effect pigments also find use in cosmetics, and often trends in color and style originate in this market and are then transferred to automotive applications, according to Mr. Brown.

As offshore competition slowly heats up, the leading specialty effect pigment producers also face the challenge of demonstrating that the value their products provide makes up for their higher cost. Major players are focusing on development of new technologies and increasing the performance of their product offerings. "Due to our current economic and world conditions, the demand and use of specialty pigments have not proliferated as much as we would like," says a spokesperson from Flex Products, Inc., a JDS Uniphase Company. "Manufacturers and ultimately customers are not as willing to pay the incremental cost to obtain a unique or highly differentiated product or solution."

"Trends focus on added value products which combine novelty with performance attributes towards specific application requirements such as solvent-based, water-based, or powder coatings," says Stephane Rochard, global marketing manager, automotive and industrial markets for Engelhard Corporation's special effect pigments. Engelhard is responding by expanding its range of effect materials and by offering new and innovative solutions to the industry as well as raising quality standards and services.

"In addition, we need to proactively take measures to maintain existing business in the face of the threat from both traditional and offshore competition, which includes maintaining a consistent cycle of new product introductions," says Bill Floyd, market manager, industrial coatings for Silberline. Innovation and providing solutions to regulatory issues are keys to success. Silberline has worked to reduce waste and improve efficiencies, and in particular, to significantly reduce the time cycle of "concept to commercialization" to develop new products, ideas, and services, according to Mr. Floyd.

Technical challenges include meeting regulatory requirements for lower VOCs in coatings, improving overall performance, durability, ease of application, and consistency of product and appearance from lot to lot. Performance requirements especially in high performance coatings such as those for automotive applications are increasing as basecoat and clearcoat film thicknesses are decreasing, says Paul Nowak, marketing manager for advanced materials with Wacker Chemical

Corporation. "The three most important issues are long-term UV stability, impact resistance especially over flexible substrates, and humidity resistance," he notes. "In addition efforts are being made through the modification of and treatment of the surfaces of these materials to incorporate more functionality in order to try and solve some of these issues," Mr. Nowak adds.

As technology advances and more products are being developed, special effect pigments are making their way into segments other than the automotive market. "Effect pigments are used as a tool to differentiate our customers' products from the competition," says Werner H. Peter, of BASF. He adds that effect pigments are also being utilized as pigments that offer true infrared (IR) reflection as compared to IR transparency. "New technology platforms have been introduced to broaden the spectrum of special effects and styling options," notes Engelhard's Mr. Rochard, "and each technology platform responds to specific market needs for product differentiation."

Silberline has found that the market desires finer, brighter, and smoother aluminum pigments that provide formulators the opportunity to achieve a "liquid metal" effect for consumer electronic goods and automotive auxiliary and interior applications, according to Mr. Floyd. "The most recent changes in special effect pigments center on unique color travel and color shifts, such as new holographic metallic pigments," says Martha Davies, technical director for paints, coatings

Major Suppliers of Specialty Effect Pigments

BASF
EMD Chemicals
Eckart
Engelhard
Flex Products
Shephard Chemicals
Silberline
Wacker Silicone

Global End Use Market for Specialty Effect Pigments in Paints and Coatings

Pigment Type	2001 (\$MM)	2004 (\$MM)	CAGR
Aluminum Flake	500	562	4%
Mica Pearlescent	515	649	8%
Other (includes color shift)	50	76	15%
Total	1065	1287	7%

Source: The ChemQuest Group

and plastics with Eckart. She adds that customer handling and end use application issues have also been a focus of development efforts. Finer, brighter nondegrading pigments, powder coating pigments for extrusion applications, improved chemical resistance, and the goal of developing a cost-effective pigment that provides a chrome-like appearance are also recent advances," Ms. Davies notes. Several other companies noted that pigments providing a sparkle effect are also very hot today.

Wacker has observed an increased demand for additional functionality and performance in specialty effect pigments along with the need for increased performance in emerging coatings technologies such as UV curable and powder, according to Mr. Nowak. "There is also an underlying trend in developing special effect pigments using recycled materials such as silver coated glass flakes, clear and colored glass flakes or chips, and various geometries such as spheres," he adds. "The latter are typically used as extenders for the more expensive effect materials and to impart a textural or lofted appearance to the coatings containing flake pigments." Finally, Mr. Nowak notes that the "holy grail" with respect to effect materials is to create a true "chrome finish," but to date efforts in this area have been extremely limited.

Flex Products, a JDS Uniphase Company, develops, manufactures, and distributes color shifting pigments and has recently found significant opportunities in security applications. According to the company spokesperson, premium product brands manufacturers are now taking extra steps to help detect and deter counterfeiting by employing special security technologies in their labeling or even within their products, and pharmaceutical companies are also utilizing brand protection in their packaging, labeling, and sealing materials. Flex Products has also sold its color shifting pigments for use in security features that protect world currencies, and over 90 countries in the world now incorporate its color-shifting technology, called Optically Variable Pigment (OVP®) in their currencies.

Recent product offerings from Flex Products include SpectraFlair® light diffractive pigments and SecureShift® light interference technology. SpectraFlair pigments are light diffractive colorants that generate the appearance of multiple, bright rainbows producing prisms moving over a liquid silver color. The combination of rainbow-like color, aluminum core, and fine particle size create the appealing, iridescent, liquid silver metallic appearance. SpectraFlair pigments change from a typical metallic paint appearance in low illumination, to vivid, multi-rainbow paints in direct bright light.

SecureShift light interference technology combines secure authentication, flexible aesthetics, and ease of application in creating a unique and effective product

security program. Each pigment flake is capable of exhibiting a wide range of hues depending upon the angle at which it is viewed and the angle of incidence of light, proving a dramatic color shift that is even achievable in low-light environments.

In 2003, JDS Uniphase acquired LA Label Corp. to expand its product security and authentication solutions. This acquisition also gave the company the ability to provide in many cases, end-to-end customer solutions (i.e., from inquiry to design and prototype, through manufacturing, and product delivery).

Delta Colours has introduced two new effect pigments that also have security applications. Long Life After Glow is a phosphorescent pigment that takes very little time to charge up and possesses a long after life. "This pigment is so bright, that once it is on, it is hard to turn off," says Bill Bunker, technical sales, coatings with Delta. The pigment used for lighting exit routes, marking shelter locations, and for other security and safety applications, has found wide acceptance in the U.S. Delta also offers fluorescent pigments that show up under black lights that are used to identify stolen goods, uncover product tampering, and for protection against counterfeiting.

BASF's portfolio of 11 effect pigments includes iron oxide coated aluminum, platelike iron oxide, coated mica, and multi-layered interference products. The company's new Variocrom® pigments find use in security applications, as well as in the automotive, industrial, and architectural sectors. "For small surfaces, an extreme color travel is often needed. However, on large surfaces, the travel needs to be more subtle. The complete line of Variocrom pigments contains four products to achieve the desired transition," says Mr. Peter.

In 2004, BASF will also launch a new red effect pigment within its Paliocrom® product line. This effect pigment will open new color space possibilities with respect to red metallics for automotive and industrial segments. The advantages offered will include super brilliant red metallics in combination with perylene, plus excellent hiding and gloss. The new Paliocrom Red





Photo courtesy of Silberline.

will be added to the existing Pallocrom Gold and Pallocrom Orange products currently on the market.

EMD Chemicals has over the past few years developed novel alumina and silica technologies to expand on its traditional pearlescent pigments based on mica platelets, according to Elisabeth Hoener, technical marketing manager, coatings. Its Xirallic® product line is formed via a crystallization process that results in platelets of

aluminum oxide that are coated with titanium dioxide (TiO_2). The coating is designed to give the desired color. Originally EMD introduced silver, yellow, copper, and red pigments and since has added green and blue. The latest product—Cosmic Turquoise—will be launched in early summer 2004. "Our Xirallic pigments provide interference, gloss, a coarse look, and high sparkle in bright light," says Ms. Hoener. "Most importantly, in dull light the coating still retains an elegant look, which is not the case with many larger-size pigments," she adds. EMD has had great success in introducing this product line to the automotive market, with wide acceptance in the U.S. and Japan and growing interest in Europe.

Colorstream® is the second new product line from EMD and it is based on artificially produced amorphous platelets of silicon dioxide that are then coated with titanium dioxide. The thickness of the flake is controlled during the production process and, in Colorstream products, the flakes also contribute to the color. After addressing some early technical problems, EMD fully launched the Colorstream product in late 2002/2003 with Autumn Mystery WNT and Viola Fantasy WNT. In early summer 2004 the company will introduce the new color Arctic Fire WNT with a color range from turquoise to red.

In comparison to the inorganic-based color shifting pigments, Wacker Chemie offers polymeric liquid crystal based effect materials under the Helicone HC® name. With their ability to transmit light even from the edges of the particle, these polymeric pigments allow for extremely clean and rich colors to be developed, especially at the diffuse angle. "They only reflect and transmit light so the color developed is totally depend-

ent on what they are used with, providing nearly infinite color formulation latitude," says Mr. Nowak. In addition, their polymeric nature results in less of an effect on the physical properties of the coatings in which they are used.

Wacker Chemical is continuing to evaluate its materials in combinations with more standard organic and effect materials to create unique shades that can impart brand recognition, awareness, and security, says Mr. Nowak. Modifications of the technology in terms of thickness and particle size and investigation of new UV absorber technologies to increase the long-term durability requirements in high performance applications are also a key focus, he notes. In addition, new colors are being developed which cover more of the visible color spectrum as well as creating high tech functionality for military, aerospace, and security applications. Wacker has also formed several active partnerships both from a pigment supplier standpoint and end user standpoint to bring these materials forward.

Silberline recently introduced Sparkle Silver Ultra™ aluminum pigments, which are the next generation of "Silver Dollar" pigments, according to Mr. Floyd. "They are very bright, lenticular aluminum pigments that offer a very smooth patina and narrow particle distribution, allowing the formulator to create very smooth masstone silver and/or clean vibrant metallic tints," he explains. Aquaver®, an essentially VOC-free inhibited aluminum pigment pellet for aqueous inks and aqueous industrial coatings was also recently introduced by Silberline.

Silbercote™ technology involves organically treated aluminum flakes that provide a wide range of metallic effects that have improved adhesion, chemical and environmental resistance, and electrical charge resistance in solvent-based coatings applied to plastic substrates. For water-based coatings on plastics, Silberline now provides the "4-All" technology, which is an inorganically treated aluminum flake that imparts excellent adhesion and chemical resistance in the finished coating. Variations of these two treatments are also available in a dry pigment form for powder coatings applications and are promoted as the SilBerCote™ PC "X" and SilBerCote™ PC "Z" product lines.

Engelhard has recently introduced new special effect pigments for paints and coatings including its Lumina® colors, which are mica based pigments based on technology that combines Engelhard's expertise in particle size control and coating of micron

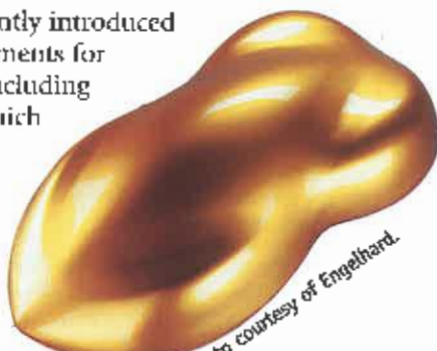


Photo courtesy of Engelhard.



Photo courtesy of Flex Products.

size lamellar particles to achieve chromatic colors and strong interference effects. New effect materials include Lumina Turquoise, a novel interference color which provides unique styling options; and Lumina Brass, a new metallic gold effect pigment with exceptional chroma and brightness. Additional technology platforms have been developed to expand the range of effects beyond pearlescence: Firemist® Super pigments; borosilicate based effect materials for high intensity and sparkle interference effects; and Mearlite® SSQ, a liquid metal effect material based on crystals of bismuth oxychloride.

Engelhard has also introduced CFS™, a new nonchrome, exterior surface treatment for outdoor applications, particularly automotive coatings. This new surface treatment adds performance attributes in terms of durability in both solvent- and water-based coatings. The company also launched Cyclo™ Luster pigments, which are surface treated mica based effect pigments for improved performance in powder coating applications. Engelhard has also formed an alliance with Prizmalite Industries in order to market and develop new effect and functional materials based on ultrafine solid glass microspheres.

Eckart has recently introduced several new special effect pigments for the paint and coatings marketplace. The PCS product line is a range of metallic pigments designed for use in powder coatings that provide improved chemical and weather resistance. Eckart's PowderSafe metallic pigments, also designed for powder coatings, provide the ability to extrude the pigments while retaining the desired metallic effect. The company also offers new water stable photo vapor deposition (PVD) pigments for paint and coatings applications under the Hydroshine name. "Eckart continues to make additions to the metallic effect product line on a regular basis in order to address specific customer needs for shear stability, appearance, and handling," says Ms. Davies. "We are committed to the NAFTA market and are continuing our expansion to support current and future customers' needs for product development, production and services," she adds. 