By Cynthia Challener, CoatingsTech Contributing Writer

Powder coating technology is viewed as a sustainable option in many industrial coating applications. It is most widely used to coat metal substrates, but efforts have focused on developing curing solutions that enable the application of powder coatings to temperature-sensitive materials such as wood and plastics. Growth in manufacturing and construction markets combined with growing demand for more sustainable solutions is creating new opportunities for powder coatings. Raw material suppliers and coating formulators are responding with the development of new powder coating technologies that can be produced and applied more efficiently, exhibit improved performance attributes, and have a greater range of potential end uses.

CoatingsTech surveyed resin, pigment, and additives suppliers and coating manufacturers regarding the current drivers of powder coating technology, recent developments, and what might be expected in the future. Their insights are presented below.

Participants in the discussion included:

Daniela Vlad—managing director, AkzoNobel Powder Coatings;

Robert Watson—research and development manager, allnex;

Cindy Fruth—sales and market development manager for Powder Coatings, Arkema Coating Resins;

Josh Gingras—North American Coatings business manager for Technical Polymers, Arkema Inc.;

Thomas Czeczatka—global end use manager for Powder Coatings, BYK;

Robert K. Roop—vice president of Global Refinish and Industrial Technology, Axalta Coating Systems;

Romesh Kumar—senior technical sales manager for North America, Clariant Plastics & Coatings USA Inc.;

Marten Houweling—global metal program director and product manager for Powder Coating Resins, DSM;

Brian Coutts—president, Erie Powder Coatings Inc./EPC Powder Mfg.;

Beth Ann Pearson—director of Marketing and Business Development, Estron Chemical; and

Kevin Biller—president, Powder Coating Research Group.

Q. What are the major drivers of new technology development for powder coatings? How have these drivers changed in the last 5–10 years? Do you anticipate any major shifts going forward?
Biller, The Powder Coating Research Group: Powder coatings' pillars of efficiency, economy, excellent performance, and environmental compliance have compelled finishers to consider it as an alternative to solventborne coatings for decades. Interest continues for non-traditional substrates such as engineered boards, plastics, and composites. There have always been barriers to entry, with most centered around

fear of radical change and the potential for failure. In the last 5–10 years, there has been a resurgence of interest in powder for novel applications as part of a rebound from the inertia experienced as the result of the economic downturn and industry's subsequent reluctance to invest in capital equipment. My hope is for a major shift in powder displacing VOC-emitting liquid paint technology, but realistically the changes will be slow, deliberate, and incremental.

Pearson, Estron Chemical: For the past several years, the powder coatings market has been, and continues to be, in a mode of growth and innovation throughout multiple market spaces. The emergence of technologies that meet the ever-present challenges for cost and manufacturing efficiencies drive these needs. One example is the growth and expansion of compact process systems. Compact systems, known as short systems in the EU, are systems in which there is a chance to lower the overall processing costs; for instance, lower cure technologies for metal and plastic, faster curing times, coatings with dual-layer functionality, and dry-on-dry cure. The industry has also developed advanced technologies enabling the use of powder on wood and medium density fiberboard (MDF) substrates and offering enhanced corrosion protection on metal.

Watson, allnex: In comparison with some years ago, today there is a dual approach to new technology development. One aspect involves improvement of numerous coating performance targets, such as flow, edge coverage, and corrosion resistance, to achieve performance properties better aligned with those of liquid technologies. Improvement of the mechanical properties of durable and superdurable coatings is also important. The second approach relates to the need for affordable and reliable products without sacrificing overall technical performance.

Vlad, AkzoNobel Powder Coatings: The main drivers for technology development are the increasing demand for sustainable solutions and meeting customer demands for enhanced performance. With an ambition to reduce environmental impact, customers continuously aim to improve process efficiencies, such as removing coatings steps or better utilizing coating materials. A reduction in baking temperatures means powders can be applied on more and more substrates, resulting in lower energy consumption, no VOCs, and therefore a more sustainable alternative to liquid coatings and anodizing.

Recent powder coating technology developments include creating a chrome look, hammered effects, textures, ultra matt, etc. There are also strong needs around durability, corrosion-protection, and lifelong aesthetics of coated products. We also expect the demand to increase for less uniform finishes so that they look more natural, such as stone or wood effect. In addition, wider color options will reinforce powder as a strong substitute for liquid coatings. Our ambition is to make powder coatings available to as many markets as possible, as it is a very sustainable technology.

Roop, Axalta Coating Systems: In the last 5–10 years, the focus has been on two-layer systems with the primer being formulated for corrosion, chemical, and edge coverage, and the topcoat formulated for weatherability and aesthetic appeal (e.g., metallics that resemble automotive finishes). A few current drivers for new technology development in the industry are high-performance direct-to-metal weatherable topcoats that do not require a primer, and enhanced corrosion resistance, edge coverage performance, and superior performance for heavy-duty industrial applications. Other notable drivers include self-cleaning technology, improved mar resistance, and low gloss finishes. In addition, environmental regulations will continue to make an impact (e.g., REACH).

Fruth, Arkema Coating Resins: Currently, Arkema sees three primary drivers in powder coating product development—improved durability, better cost in use, and the development of more products for use

on non-metal surfaces. Durability has always been important, but as powder coatings gain new market share in areas like North American architectural coatings, they will need to consistently meet AAMA (American Architectural Manufacturers Association) 2604 and AAMA 2605 specifications. In addition, we have seen more requests for superdurable products for all markets for low temperature cure and improved corrosion resistant coatings. The shift to superdurable products versus standard solutions is going to continue for the foreseeable future. Superdurability will become the baseline in the industry.

Kumar, Clariant Plastics & Coatings USA: Drivers are higher durability (color and structural improvement) and bright hues (opaque yellow, red, and orange shades). Development of new and improved (more weatherfast) resins that require higher performance and expectations for non-lead pigments are ongoing trends. New applications include the use of powder coatings on wood (e.g., kitchen cabinets) and on metal substrates to offset coil coatings among others.

Coutts, Erie Powder Coatings: In the end, customers using powder coatings are the main drivers of technological development. Customers need something or need a powder to do something that they currently can't, and we, along with our suppliers, develop the answers. I don't think this has ever changed or will ever change.

Q. What do you identify as the most important recent advances in powder coating technology over the past few years?

Roop, Axalta Coating Systems: There are several important advances. Improved hardness and chemical resistance utilizing high crosslinked resin technology; polyester HAA and TGIC primer technology with anticorrosive additives, barrier extenders, and hydrophobic properties; dry-on-dry technology for improved productivity and reduced energy consumption; bonded metallic coatings that deliver a unique, quality appearance; sprayable thermoplastic coatings that enable the application of ultra-durable thermoplastic to a much wider audience of coaters; cool coatings that help lower energy consumption; and coatings designed to speed coating and curing for faster line speeds. These technologies are benefiting architectural, agriculture, construction, and earthmoving (ACE), heavy-duty truck, transportation, and spec-driven general industrial applications.

Czeczatka, BYK: Powder coatings have achieved more widespread access in new applications. It is, specifically, lower baking temperatures that have permitted access to new substrates like plastic, MDF, and wood. The technology is opening up new possibilities and new markets. This trend is highly supported by improvements in application equipment and process control, which offer a wider range of application fields like dry-on-dry systems.

Fruth, Arkema Coating Resins: The introduction of powder-on-powder application (applying primer and topcoat with one cure step) opened new application areas and potential for powder coatings. Being able to apply to non-metal surfaces has and will drive new powder coatings growth, as current markets have matured to near full potential. Short term, we see more potential in application to MDF, as there are still many obstacles to overcome in applying onto wood substrates. These products offer a wide range of attributes based on formulation, but the advantages most customers see include a reduced carbon footprint, reduced emissions, and improved operational efficiency.

Coutts, Erie Powder Coatings: For Erie, the most interesting advances by far are in corrosion control coatings. This has been an area where all the stars align; there is a huge customer need for better

corrosion control in the market place. It is also an area where great advances can still be made, and the suppliers of raw materials are interested in helping to develop new strategies and products. Corrosion is a huge market, costing customers and the economy in general billions of dollars. There have been some advances, such as our easy-to-coat primers that haven't been available on the market until now, but there are a number of new corrosion control advances that are just getting to the market or are still in testing.

Vlad, AkzoNobel Powder Coatings: The ability to make weather-resistant, ultra-matt powder coatings (gloss levels <10) is an important advance because these coatings can mimic the sort of anodizing finishes that are currently very popular on commercial buildings, while avoiding the problems that often come with anodizing. Powder coatings can be applied to more than just aluminum, have greater color consistency between parts, and can be repaired. Specifiers of architectural coatings now have access to more sustainable alternatives to liquid or anodized ultra-matt finishes, backed by long-term warranties and industry certification.

Powder coatings can also combine increased functionality, beyond the already appreciated aesthetic and substrate protection qualities, with attributes such as easy clean for outdoor furniture and high-temperature resistance coatings such as on vehicle exhaust systems.

Pearson, Estron Chemical: There have been significant advances in flow control agents (FCAs) for compatibility and functionality. The advancement of these FCAs offer multiple advantages to the powder coating manufacturer, as they are designed to reduce cycle time, increase scheduling flexibility, and decrease part rejection rate with multi-technology use. These agents are invaluable for designing more functionality into one solution that "protects" multi-variant systems—meaning that an intended modification for improvement will only affect that single variable rather than multiple variables.

Biller, The Powder Coating Research Group: Application equipment makers continue to optimize and refine powder delivery technology and color changing capability. Dense phase feed systems and quick color change modules are improving powder transfer efficiency and application system uptime. Fascinating bio-based resin technology is emerging that could alter the feedstock components of the supply chain. United Soybean Board funding of a Battelle Memorial Institute project has generated a low temperature cure resin system based on soybean oil that exhibits excellent UV durability and mechanical flexibility. The novel bio-based resin technology may offer an alternative to super- and hyper-durable powder technology that conforms to AAMA 2604 and 2605 architectural specifications.

Q. What advances have been made in the area of smart powder coatings?
Watson, allnex: The concept of smart coatings, which are intended as finishing materials that can dynamically adapt their properties to an external stimulus, has started to impact powder coatings as well all the other coating technologies. In summary, easy-to-clean, improved corrosion, and anti-microbial coatings are capturing interest in the market.

Vlad, AkzoNobel Powder Coatings: Smart coatings can be defined as those that respond in a controlled manner to a specific external stimulus, and are increasingly of interest. There have been several advances in powder coatings that add unique performance features, albeit in a passive form. Examples include: active corrosion protection primers where the coating interacts chemically to disrupt the

electrochemical corrosion mechanism, thereby reducing corrosion; anti-microbial coatings that protect against degradation of the coating by bacteria; and thermochromic coatings that change color on exposure to heat. Low solar absorption coatings contain a reflective pigment that deflects infrared light, and thus the sun's heat, from any substrate that it coats, helping to keep interior spaces cool and reduce energy consumption (air conditioning).

Houweling, DSM: Typically the definition of smart coatings is related to new functionalities outside the decorative and protective field. For powder coatings there are numerous examples where new functionalities are formulated into powder coatings: antibacterial, easy-clean, self-healing, anti-static, conductive, EMS shielding, electrochroming, and also sensory, soft feel, and isolation functionalities are possible.

Roop, Axalta Coating Systems: There have been many major breakthroughs in smart powder coatings recently. Most smart powder coatings are specifically formulated for the end use of the product and its functionality. For instance, anti-graffiti coatings feature easy-to-clean properties to protect surfaces, such as signs, lockers, indoor and outdoor recreation equipment, public areas, and transportation terminals, from the permanent effects of spray paint and markers. Another interesting advancement is a nanocomposite coating based on compounds specifically designed to only react to liquid hydrocarbons.

Pearson, Estron Chemical: Smart coatings are those that are perceived as being passive, but are actually active, and vary based on the trigger mechanism. A prime example is coatings with flow control agents that manipulate the surface tension of a coating to give a resultant smoother surface finish, making it multi-functional.

Biller, The Powder Coating Research Group: The smartest powder technology revolves around self-healing formulation schemes. Novel core-shell technology has been pioneered by Autonomic Materials Inc. that could be a game-changer. These materials repair breaches in the coating without the use of heavy metals or phosphates. Fun technologies such as mosquito-repellent powder coatings and pollution absorbing formulas have debuted. Market acceptance is still unknown as these niches are rather narrow. Anti-microbial technology has advanced beyond the common silver ion technique and is being evaluated for an array of microbe killing performance.

Czeczatka, BYK: In addition to involving further developments in technology, smart coatings are also a marketing trend to promote powder coatings in more specialized application fields and niche areas away from commodity applications. In addition, smart powder coating technology also demonstrates that powder coatings nowadays are used in more specialized areas than in the past.

Q. Have there been any notable developments in hyper-durable powder coatings?
Watson, allnex: The possibility of going beyond superdurable with respect to weathering resistance with powder coating is not so new. Let's consider for instance acrylic technology or fluoropolymer based chemistry, as both can be considered as hyper-durable technologies. The point is eventually to meet advanced weathering requirements without the limitations of those chemistries, including their intrinsically high cost and limited surface finishing effects.

Vlad, AkzoNobel Powder Coatings: Hyper-durable powder coatings are the most weather-resistant coatings available, using similar chemistry to liquid polyvinylidene difluoride (PVDF) coatings to give 10-

year outdoor performance in Florida weathering tests. They meet the most exacting standard for coatings—AAMA2605 in the United States and Qualicoat class 3 in the rest of the world. Hyper-durable powder coatings are increasingly recognized as a relevant alternative to liquid PVDF, as demonstrated by the recent specification on monumental buildings, for instance the Hudson Yards development in New York.

Houweling, DSM: The hyper-durable market is dominated by liquid systems but the powder coating market share is growing based on properties, economics, and carbon footprint.

Roop, Axalta Coating Systems: Fluoropolymer technology is mainly used in architectural applications to promote weatherability; however, more ACE OEMs are requiring extended weathering performance. This technology has the capability to add 6000 hours of weather resistance under accelerated test conditions.

Fruth, Arkema Coating Resins: New applications in the ACE markets are driving demand for improved durability on superdurable products. Our customers are experimenting with alternative chemistries looking for the right mix of improved durability and cost effectiveness.

Pearson, Estron Chemical: Hyper-durable powder coatings are desired in the market as they are lower cost, easier to process, and demonstrate high durability. These applications require an advanced understanding of resin design and extensive weathering testing. The current technologies have a fluorocarbon base, which, in combination with a stabilized pigment system, make them extremely stable against degradation (both of the polymer and due to visual color loss). However, there are trade-offs, as this higher degree of crosslink density also results in a system that is more brittle and thus not recommended for applications involving high mechanical stress. The choice of pigment is also limited due to the stringent weathering requirements.

Q. What are the latest advances in ultraviolet (UV) and near-infrared (NIR) curable powder coating technologies?

Coutts, Erie Powder Coatings: UV coatings showed so much promise, but appear to have gone nowhere except for some very specialty applications. This appears to be due to safety issues with the chemicals, pigments blocking the UV light, and a number of other reasons including simple market inertia.

Biller, The Powder Coating Research Group: UV-curable powder coatings are a conundrum. They are beyond a chicken or an egg proposition. Resin companies and formulators intensely pursued the development of this technology in the 1990s. A smattering of new applications arose, including fully assembled electric motors, MDF cabinetry, vinyl flooring, and automotive radiators. Most eventually fell by the wayside due to performance issues (mainly process related) and a lack of strong technical support. A few brave souls continued their quest in spite of economic uncertainty and a general disinterest in the industry. Recently, new opportunities have sprouted that are a good fit for UV-curable powder, including hardwood and composite applications. Technologists are seriously revisiting UV-curable approaches to meet these specifications. A big question remains if the major resin suppliers will be willing to support these new applications.

Pearson, Estron Chemical: Neither of these technologies have really gained a strong foothold, largely because of the modifications that would need to be made to coaters' lines, as well as recognized

challenges for use. In an ideal world, UV-cured powder coatings should offer advantages such as faster cure cycles with lower cure temperatures, and can be used for substrates that are both heat sensitive and metallic. There are limitations in that there may be issues with some colors that can be cured due to interference with pigment choices, and the cure may not be as efficient with parts having a complex shape. NIR curing allows for selective heating of a coating with extremely high cure rates.

Houweling, DSM: We see both UV and NIR as promising technologies that fit well with the high-growth trend to develop powder coatings for heat-sensitive substrates.

Czeczatka, BYK: These are systems for low bake applications such as powder coatings on wood. They require special binders and special application equipment—mainly different ovens. Further improvements in equipment along the complete processing line combined with further developments in raw materials and formulations will help these products enter new markets.

Watson, allnex: These are two competitive technologies that can be considered valid options for thermo-sensitive substrates. Recently, it seems that the market is more oriented to NIR in conjunction with thermosetting technology in competition with UV-curable systems.

Kumar, Clariant Plastics & Coatings USA: These powder coatings could be used for wood, glass, plastics (recycled), and other non-metal substrates—even automotive interiors to replace soft touch paints. When good resins (UV and NIR curable) are available, this technology will grow, but for now their poor gloss and orange peel performance remain a challenge.

[Note that Biller asserts that the gloss of UV/NIR coatings can in fact be very high and equal to that of liquids, while the orange peel is significantly less than conventional powder coatings.]

Q. Have any noteworthy developments in functional powder coatings been made recently?
Pearson, Estron Chemical: Functional powder coatings typically refer to those specifically made with fusion bonded epoxy (FBE) used to protect steel pipe, rebar, and metal wire from corrosion. Rapid or snap cure and excellent flow are commonly sought attributes. The powder must be able to deposit on a moving substrate with a resultant smooth and contiguous layer because of what is being protected. Targeted applications utilize these coatings because not only is the coating functional in nature, but the substrate or part being coated is also functional in its usage.

Kumar, Clariant Plastics & Coatings USA: These low-priced, high-volume coatings remain based on epoxy resins. Epoxy resin prices have been on the upswing, however, and there is an opportunity for other resins to take away some market share in this high-volume business. The growing infrastructure market is also having a positive impact on the demand for functional powder coatings.

Czeczatka, BYK: Functional powder coatings must fulfill high anti-corrosive requirements, be chip- and chemical-resistant, and flexible. When we consider all recent and ongoing changes in regulatory affairs, especially for solventborne coating systems, we can expect a further move to powder coating technology. Improved powder coating systems might even replace a certain part of the market share held by waterborne systems. This is a trend in all global regions and particularly strongly driven by China.

New opportunities have sprouted that are a good fit for UV-curable powder, including hardwood and composite applications.
Wooden texture used as background
Vlad, AkzoNobel Powder Coatings: In our business, the term “functional powder coatings” refers to the market segment in which we supply our Resicoat range of functional powder coatings, which are totally different than other powders as most are hot-applied and in higher thickness, up to 1000 µm (1 mm). They are used for heavy-duty corrosion protection of cast iron valves and fittings, pipelines, and rebar, as well as for insulation and corrosion protection on lamination stacks, bus bars, and electronic components. Advances include higher Tg-powders to extend in-service lifetimes and the ability to operate in more aggressive environments. Powder coatings with preheating temperatures approximately 50–60°C lower (from 230°C to 160–170°C) offer the applicator significant energy savings and improved productivity while also reducing both the carbon footprint and the manufacturing costs associated with the paint application process.

Roop, Axalta Coating Systems: Axalta recently developed a pipe-in-pipe product technology for the oil and gas industry that creates a durable internal vessel able to extend the usable life of damaged pipes. Functional powder coatings also protect valves and fittings for fluid and gas handling systems, fire hydrants, and even large storage tanks. The term can also include products for wire encapsulation and electrical insulation.

Gingras, Arkema Coating Resins: As functional powder coatings become more attractive vs solventborne liquids for corrosion protection applications, products made completely from renewable resources such as castor oil may attract more attention. These powders are used to protect metal in industries like automotive, oil and gas, medical, and more.

Q. What gaps remain to be addressed by advances in powder coating technology, and what actions are being taken to do so?
Vlad, AkzoNobel Powder Coatings: Everything we do is driven by market needs and providing more sustainable solutions for our customers around the world—whether that’s reducing baking temperatures, removing process steps through dry-on dry-application, improved material usage through lower applied film builds, improving the longevity of the coated article through improved UV durability/corrosion-protection performance, or adding more functionality to the coatings. Providing the ultimate powder solutions and helping our customers to reach their sustainability goals are at the core of our work. For example, AkzoNobel recognized the desire for a low gloss finish several years ago, when matt and textured surfaces started to become more popular, and were the first to bring to market a range of ultra matt coatings with high scratch resistance.

Fruth, Arkema Coating Resins: There is still some uncertainty around the future of triglycidyl isocyanurate (TGIC) crosslinker technology outside of Europe, where it has already been regulated out. Enhancing the performance of hydroxyalkyl amide (HAA) crosslinkers remains a topic of interest for global paint companies. Our customers have expressed a desire for a “global” crosslinker technology that performs as well as or better than the existing systems.

Gingras, Arkema Coating Resins: In order for powder coatings technology to advance, there must be acceptance from the entire value chain. The end customers must appreciate the value high-performance powder coatings provide, while the powder coating supplier must invest resources to develop and

promote the new technology. To this end, in the past nine months, Arkema announced capital investments in polyamide 11 chemistry to demonstrate its commitment to the market.

Functional powder coatings also protect valves and fittings for fluid and gas handling systems, fire hydrants, and even large storage tanks

Roop, Axalta Coating Systems: A gap Axalta is addressing is coating performance on blasted steel substrates vs hot or cold rolled steel or smooth/polished aluminum. Currently, we have to formulate differently depending on the surface type particularly for grit blasted profiles. Customers are coating complex parts, and in some cases, will have both preparations on a finished part. In addition, Axalta is developing a new generation of FBEs to protect the world's pipelines. As oil and gas producers drill into deeper reservoirs, pipeline operators must raise temperatures to facilitate the movement of this thicker, more viscous crude. Traditionally, FBEs formulated for high-temperature service are more brittle, less flexible, and have less adhesion to the substrate. Axalta's new generation of FBEs are changing that. With respect to quality gaps, Axalta has created an approved applicator program for architects working on global projects that involves evaluation and approval of the consistency of all applicators of Axalta powder products globally. We've found that this grants our customers peace of mind when choosing Axalta for their aluminum façade and architectural projects.

Czeczatka, BYK: The drawback of powder coatings continues to be their optical surface appearance, which differs from the visual properties of liquid systems. The finish and surface quality are a little lower than wet-look systems. The visual effects, for instance of metallic finishes, is slightly less brilliant in powder coatings, than in liquid coatings. All of these drawbacks are known, but new and further developments in raw materials and processing of powder coatings will tackle some of them.

BYK as an additive supplier actively works in areas where our products can overcome existing gaps, with adjustments to local requirements in different regions from a global perspective. In addition, we are working closely together with our customers to support their new development activities.

Kumar, Clariant Plastics & Coatings USA: Achieving high gloss like that obtained for liquid solvent-based coatings is still a challenge for powder systems. Cool coatings with IR reflective pigments (duller shades only; bright ones are too expensive) are also needed. Clariant is also focused on the development of unique pigment combinations based on pigments with high opacity, high chroma, high gloss, and high durability. Metallic shades remain far poorer in appearance than those achieved with liquid coatings, which is another issue we are looking to address.

Houweling, DSM: We keep improving the sustainability of our powder coating solutions because we see this attribute as the key success factor for powder in combination with lower curing temperatures (heat-sensitive substrates and heavy mass), improved appearance, improved corrosion resistance, and epoxy replacement.

Coutts, Erie Powder Coatings: Our focus has been on corrosion control. We see many gaps and potential for advances in this area. Our main focus has been on solving problems such as the re-coatability inter-coat adhesion issues that were common with existing products, and developing new technologies with new chemicals, pigments, and smart technologies.

Pearson, Estron Chemical: Challenges continue to exist with increasingly stringent specifications for degree of cure without sacrificing appearance or performance. Estron is focused on overcoming

performance deficiencies associated with manipulation of coating components—the physical mobility of the resin reactive groups finding each other during the cure process at a pre-determined time and manner—and how to determine the most effective method to deliver a product that aligns with the needs of the individual markets.

Estron has developed a proprietary manufacturing process resulting in the uniform dispersion of additives while minimizing the potential for reaction between resin functionalities and additives. The process has also been proven effective for dispersion of additives into coatings that are challenging to work with using conventional methods.

Biller, The Powder Coating Research Group: PCR Group is working on a wide array of new technologies, including improvements in corrosion resistance for both primers and polyester topcoats; coating technology for composites, MDF, and hardwood; and sustainable resin systems based on plant material feedstocks. Significant advancements are being realized with formulating techniques, new materials, and corresponding processes such as infrared and UV curing.

Q. Is there anything else about advances in powder coating technology you would like to mention?
Czeczatka, BYK: Powder coatings have clear environmental benefits. Their VOC content and carbon footprint are often far superior to those of liquid, i.e., solventborne and even waterborne, systems.

Watson, allnex: Recent regulatory reclassification for some crosslinking agents will drive reformulation. New architectural standards for the Chinese market will also drive development to obtain the specified performance. In addition, there is focus on identifying the use of sustainable raw materials and eliminating materials of concern, which will further underpin the green credentials of powder coatings.

Pearson, Estron Chemical: There are areas that readers may be interested in with respect to architectural powder coatings and their advancement in Europe vs North America. The acceptance of powder in the architectural market in Europe is greater than in the United States, with a recognized barrier to entry being color and gloss variations. Europe is more accepting of the low gloss that is achieved with technology blends, but this technique results in a sparkle effect that has not been widely adopted or accepted in North America.

[Note that Biller disagrees. He states that the difference in consumption is due to different requirements for UV protection. Europe requires coatings with significantly less UV resistance. The continental United States is exposed to significantly higher doses of UV, hence the need for higher performance. Fairly standard resin technology meets most European architectural standards. In the United States, fluoropolymers are required to meet commercial architectural specifications, creating the higher barrier to market entry.]

Vlad, AkzoNobel Powder Coatings: Customers want to be able to make faster and better-informed decisions. The growth of digital innovation in the powder coatings industry is bringing powder coatings closer to the end users, making the decision process easier. Color digitalization and digital tools are a key area of development; AkzoNobel has rolled out a number of digital apps across different market segments supported by Instamatch, a highly accurate color-measurement tool that pairs with mobile software to allow fast and accurate color selection while on the go.

Apps enable easy and convenient research and in some cases, like AkzoNobel Design, can even be used to develop a bespoke technical specification in a matter of minutes, by offering a choice of filters at each stage of the decision process. Filters might range from type of substrate/construction material, environment, geographical location, durability requirements, color choices, finished look, etc.

Fruth, Arkema Coating Resins: Not much has changed for powder coatings in the past 40 years. Most innovation seems to come as technology transfer from the plastics engineering sector. Until there is a significant breakthrough in polymer design and how coatings are manufactured, powder will continue to occupy a niche position in the coating market. That said, Arkema continues to look for new ways to serve and support our customers in this market sector.