

THIS ISSUE

Ferro Glass Goes Digital



HIGHLIGHTS

WORLD KITCHEN COMBINES WITH FERRO TO CREATE THE PYREX®
WATERCOLOR COLLECTION™ PAGE 4

PINTURAS BENICARLO ORGANIC COATINGS INTEGRATION COMPLETE PAGE 8

SPECIAL GLASSES FOR SAFETY CABLES PAGE 10

www.ferro.com



Ferro acquires Dip-Tech, leading technology for digital printing on glass.



CONTENTS

WORLD KITCHEN COMBINES WITH FERRO TO CREATE THE PYREX® WATERCOLOR COLLECTION™

PAGE 4

ENVIRONMENT, HEALTH & SAFETY MATTERS

PAGE 5

FERRO GLASS GOES DIGITAL

PAGE 6

PINTURAS BENICARLO INTEGRATION COMPLETE

PAGE 8

NEW IMPROVED HIGH DURABLE AUTO BLACKS

PAGE 8

FERRO TECHNOLOGY SPARKS INDUSTRIAL CERAMICS

PAGE 10

SPECIAL GLASSES FOR SAFETY CABLES

PAGE 10

FERRO TODAY

PAGE 11



FOREWORD CONTINUING TO GROW AND ADD VALUE

On behalf of my Performance Colors and Glass (PCG) team, welcome to the Autumn 2017 edition of Color and Glass World, our newsletter designed to keep you informed about our activities around the globe.

PCG experienced strong growth in the first half of 2017, supported by integration of the five acquisitions that were completed in the last 2 years – Vetriglas, TherMark, Ferer, Pinturas Benicarlo and ElectroScience Laboratories (ESL) – and we are well positioned for sustainable growth in the future.

In August, we have further added to our portfolio of products with the acquisition of Dip-Tech. Headquartered in Israel, Dip-Tech have pioneered the process of digital printing of high performance durable ceramic inks on glass. Their technologically advanced printers and ink systems are helping to transform the decoration of architectural, appliance and automotive glass across the globe, and there is more about this acquisition in our leading story.

The acquisitions made by Ferro since 2014 have enhanced our global footprint. All the businesses we have acquired offer a good fit with our core philosophies that call for a local service approach, and a commitment to add value to our customers around the globe. Each of the six companies mentioned add to our PCG product portfolio and provide significant opportunities for future growth. For example, Pinturas Benicarlo is proving to be an excellent strategic fit. We have acquired a strong portfolio of organic coatings for the container glass market that can be used in combination with our existing organic inks. Furthermore, through our strong global reach, we are able to introduce the 'Benicarlo' sales team to a whole new world of Ferro container glass customers and end product brands that have traditionally purchased our ceramic glass colors, organic inks and forehearth colors. You can read more about Pinturas Benicarlo inside.

The addition of Pinturas Benicarlo will help to enhance our reputation with brand leaders as a one-stop shop for decoration products for use both in – and on-the-glass. Our portfolio of products for packaging glass markets has been helping brand upscaling, also known as premiumisation for many years, and we are proud to be associated with iconic brands such as Absolut, Johnnie Walker, Bacardi, Corona, Gallo, Coke, Pepsi, Evian, Ralph

Lauren, YSL, and many more. Glass is increasingly branded as the responsible container choice to protect both the environment and consumer health. It is the only truly 100% recyclable packaging material, and it can be endlessly recycled without loss of quality. Premiumisation helps to reinforce a manufacturer's brand as a whole, where their reputation acts as a guarantee of quality and performance.

It is not only packaging glass that Ferro is helping with premiumisation. There is enormous, growing interest in digital printing technology. Dip-Tech's digital glass printing solutions using ceramic inks allow you to infuse any image, design or pattern onto glass with brilliant accuracy and sharp resolution. Never before has it been so easy to give curtain walls and buildings expressions of culture, identity, and innovative glass designs. For automotive replacement glass (ARG) and specialty transportation applications, digital is supporting individualised printing of edge bands, logos and other marks. And digital printing speeds are getting faster all the time.

We are also featuring in this edition our long association with World Kitchen's iconic brands and our involvement with their new Pyrex® Watercolor Collection™. Additionally, I am pleased to report that we have recently concluded an arrangement with Cabro Chemicals & Coatings based in Arezzo, Italy to market their line of precious metal preparations (PMP) for premium glass and ceramics in selected regions around the world.

As we move through 2017, our R&D teams are working hard to maintain a pipeline of new products, and we are continuing to identify and complete further acquisitions that will strengthen our position as a premium supplier of functional coatings and color solutions.

As ever, thanks for the trust you place in us as we strive to bring you products and service to help fuel your success!

Dieter Binder
Vice President, Performance Colors and Glass
dieter.binder@ferro.com

WORLD KITCHEN COMBINES WITH FERRO TO CREATE THE PYREX® WATERCOLOR COLLECTION™

World Kitchen LLC – headquartered in Rosemont, Illinois, USA – is a world leader in the housewares industry, manufacturing housewares products for preparing, cooking, serving and storing food. World Kitchen brands have been leading the housewares industry for over 100 years.

Ferro has a long association with World Kitchen's iconic brands, many of whose stories began decades ago with materials scientists at Corning Inc. At the beginning of the 20th century, Corning invented a revolutionary heat and cold-resistant glass used for railroad lanterns. As the story goes, the wife of a Corning scientist later repurposed the glass to bake a delicious pie – and the Pyrex® brand was born! Another innovative material, Pyroceram®

glass ceramic, was developed in the 1950s and originally used during the space race to safely absorb huge temperature fluctuations in rocket nose cones. This technology triggered the introduction of CorningWare® cookware. Finally, Corelle® glass dinnerware was introduced nearly 50 years ago and was quickly loved around the world for its outstanding durability.

To date, this proprietary three-layer sandwiched glass material has not been replicated.

In 1998, Corning Inc. decided to spin off its US and Asia consumer housewares business, which resulted in the creation of the independent company World Kitchen LLC.

Ferro has been a supplier of decoration products for many of World Kitchen's famous brands, including Pyrex®, CorningWare® and Corelle®. Ferro glass colors are used for surface decoration and our forehearth colors technology helps to create unique coloration in-the-glass.



ENVIRONMENT, HEALTH & SAFETY MATTERS

PROPOSAL FOR HARMONIZED CLASSIFICATION OF TITANIUM DIOXIDE

In 2016, ANSES (French competent authority for Food, Environmental and Occupational Health & Safety) submitted a proposal to the European Chemicals Agency (ECHA) for titanium dioxide to be classified as a **Category 1B carcinogen** by inhalation. The French proposal was reviewed by the Risk Assessment Committee (RAC). The scientific panel dissents the proposal of the French government agency ANSES and suggests a harmonised classification of titanium dioxide as **carcinogen, Category 2** through the inhalation route. This recommendation will now go before the REACH committee of the EU Commission, which consists of representative authorities of the EU member countries, and this committee will make the final decision.

In the meantime, the VdMI (the German Institute of minerals manufacturers) has made the following statement concerning this issue:

“Titanium dioxide is broadly used as a white colorant because of its excellent coloristic performance which cannot be achieved by known alternatives. With this situation in mind, we emphasize that the decision on a classification that would essentially ban the use of the substance must involve a particularly thorough and critical evaluation of all existing animal and human epidemiological data. Obviously a carcinogenic substance should be classified, but a substance should not be declared as carcinogenic without adequate and convincing evidence.

Classification of titanium dioxide as Carc Cat 1B or 2 would group titanium dioxide with CMR substances (carcinogenic, mutagenic, toxic to reproduction) in general, although the postulated mode of action would only apply for inhalable forms. This currently results in various legal bans even for non-inhalable forms of the substance as the affected regulations do not have provisions for such an unprecedented case.

Furthermore, a classification would not contribute to improve the protection of health and the environment, while it would have serious and disproportionately legal consequences in almost all market segments. The submitted proposal for classification and labeling of titanium dioxide is inappropriate from the toxicological perspective. As a consequence no classification as hazardous should be made.”

The Titanium Dioxide Manufacturers Association (TDMA) and the Titanium Dioxide Industry Consortium (TDIC) have also released a scientific position paper regarding the French proposal. Their summary states: “The TDMA and TDIC consider the French competent authority proposal to be scientifically unjustified and argue that TiO₂ should not be classified.”

Ferro pioneered the development of forehearth colors in the 1970s as an alternative to tank coloration. Compared to coloration in the tank, forehearth color technology allows for fast changeovers from color to color, or from color back to flint, resulting in more cost effective production of small to medium-size campaigns of colored glasses. Special colors can also be designed and produced, which would not normally be possible by coloring in vast quantities in the tank. Forehearth coloring can also help with the test marketing of new colors where small runs are required. Originally developed for the cosmetics and perfumery industries, today forehearth coloration is also widely used in the production of premium beverage bottles for wines, beers, liquors and soft drinks, as well as for tableware, stemware, tumblers, cookware and architectural glass.

World Kitchen's Pyrex® Watercolor Collection™ is a good example of how Ferro forehearth colors are utilised to support the development of new products. World Kitchen wanted to create a product that would truly stand out in the kitchen and on the table. By combining Ferro forehearth color concentrates with a special production process introduced at their Charleroi, PA, USA production site, they have managed to create a collection that is truly like a work of art in that each piece is unique and no two pieces are alike. A specially formulated blue forehearth color introduced into the molten glass at the gob produces a swirling effect that snakes through the body of the glass in a random effect. Launched in 2016, Watercolor Collection™ cookware displaying this effect comprises a range of bakeware and serveware dishes in various sizes.

The Watercolor Collection™ demonstrates World Kitchen's ability to merge technology with evolving trends, to create innovative new products that consumers love. We are proud to be associated with these brands.

IMAGERY SUPPLIED BY WORLD KITCHEN





Kuopio University Hospital, Finland
Architects: Partanen & Lamusuo
Glass processor: Rakla Tampere Oy

FERRO GLASS GOES DIGITAL

In August, Ferro completed the acquisition of Dip-Tech, the pioneer and a world-leading provider of digital printing solutions using ceramic colors on glass, based in Kfar Saba, Israel.

Dip-Tech, which was founded a little over a decade ago, has pioneered the digital printing of high performance ceramic inks on glass. With their state of the art technologically advanced printers, and unique vivid and durable ceramic inks, Dip-Tech delivers superior printing productivity and quality solutions for architecture, interior design, appliance, industrial, automotive and transportation markets. Dip-Tech opens the door to unlimited possibilities in glass innovation and design, and offers exciting capabilities and opportunities for glass processors, architects and designers alike.

Digital printing of ceramic inks on glass presents many challenges, of which here some examples: Ceramic glass colors are

formulated from a combination of lead-free glass fluxes, ceramic pigments and other additives; the materials are fundamentally abrasive, dense and generally of a relatively large particle size compared to say, organic inks. The printheads used in ink-jet printers have ultra-fine nozzles which can be easily blocked, and require sophisticated maintenance cycles and recirculation systems to meet the demands of industrial glass printing. Not only is glass an inert, non-absorbent surface but typical jumbo size architectural glass can be 6m x 3.3m. Huge developments in machine engineering, printhead design, ink chemistry, as well as image processing software have been required over the last decade to meet these challenges.

Today, DipTech's innovative technology is proven, with thousands of projects completed around the world on laminated, bent tempered and insulated glass units for architectural, appliance, industrial and automotive applications. With hundreds of equipment installations globally, Dip-Tech's digital glass printers are used to produce millions of square meters of printed glass every year. Dip-Tech is the only digital glass printer supplier that provides technical, graphic and design support, in addition to marketing support and business support provided by Dip-Tech's in-house architects, for generating leads and winning new projects and clients – a true full service partner.

Dip-Tech digital technology has shattered the traditional restrictions of architectural

glass printing and glass decoration methods, allowing architects and engineers to explore new possibilities in modern and sustainable design. With digital printing of ceramic inks on glass, it becomes possible to cost-effectively create designs that reflect your artistic vision – without sacrificing material durability, quality and functionality.

Furthermore, with faster set up times and no expensive screen costs, glass processors and decorators benefit from increased productivity and flexibility compared to traditional screen printing, allowing them to serve their customers faster and better. In 2014, DipTech was awarded a prestigious "Guinness World Record" for the largest commercialised flatbed digital printer, capable of printing a single glass pane of 3.3m x 18m. DipTech's latest machine development on the market is the versatile NEra family of printers, which allows decorators to print different applications in high speed and quality, without modifications to the machine between the different applications. This allows for easy switching, for example, between fast single color patterns to full color photo-realistic prints, or between architectural and automotive projects, and is a further big advantage for flexibility, productivity and to serve customers faster.

Peter Thomas, Chairman, President and CEO of Ferro Corporation, said, "This acquisition equips us with a fully commercialized and patent-protected digital glass printing business. Dip-Tech's digital glass printing technology is attracting customers because of the high-precision, multicolored effects possible with durable glass-based inks, along with greater production flexibility and efficiency."

Mr. Thomas added, "Dip-Tech's printing solutions and glass coatings carry patent protection in all of its major markets. Their technology know-how, along with their patent portfolio, is unmatched in the industry. Our acquisition of Dip-Tech is a clear demonstration of the culture of innovation that we are developing at Ferro. We are pleased to welcome the Dip-Tech team to Ferro and look forward to leading the way in digital glass technology together."

Dieter Binder, Vice President of Ferro's Performance Colors and Glass business, and Vice President, Europe, said, "The addition of Dip-Tech to Ferro expands our offering to the fast-growing digital glass printing segment. Together, we look forward to actively shaping change in the glass industry. Combining the strengths

of Ferro and Dip-Tech will enable us to better serve customers by providing them with a complete, optimized solution of printers, software, inks, and service. With Ferro's extensive colors, ink development, production, and logistics capabilities, and with Dip-Tech's technology and know-how, we are equipped to further enhance customers' productivity, efficiency and business opportunities."

Alon Lumbroso, Chief Executive of Dip-Tech, stated, "We are excited to join forces with Ferro to develop and provide advanced products and solutions to the worldwide glass market. As we unite our teams and our common culture of innovation that drives customer success, we look forward to presenting glass markets with a wider range of leading-edge products and capabilities."

Together, the combined strengths of Ferro and Dip-Tech are positioned to lead multiple glass markets in the transition to digital printing technology.



Harlem Hospital, NY, USA
Architects: HOK, NY
Glass processor: GGI, USA



Cafeteria 2016, Mexico
Architect: Aberlado Guzman
Glass processor: Cristacurva





NEW IMPROVED HIGH DURABLE AUTO BLACKS

The black glass enamels used in automotive glass decoration must fulfill a wide range of properties and quality aspects. In addition to the very high optical density, the busbar hiding property and the antistick effect for pressbend production, chemical durability has also become an extremely critical material property for the car industry.

The increasing demand for high resistant black colors was initiated with the construction trend to exposed edges on automotive backlights. With this design the black color is directly in contact with rainwater and the surrounding atmosphere of the car. Due to this kind of attack, the chemical durability of the exposed

black color has become more and more important for the car manufacturer.

Nowadays the most common acid test for automotive colors is performed with 0.1N H₂SO₄ at 80°C for several hours and sometimes days. The requirement to pass longer exposure times is constantly increasing. Depending on the time of exposure during which no color change through glass is visible, the colors actually are classified in groups, e.g. >24hours, >72hours, or even >140hours.

This test and requirement started with automotive backlights. Due to the demand for general valid color specifications to

apply for all automotive glasses and quality competition, the request for more resistant colors has been expanded to windshields and also sidelights.

As a global market and technology leader, Ferro was able to develop more acid resistant glass formulations, which have delivered new generations of black automotive colors fulfilling the highest resistance classifications. These new product families are also improved in terms of a wider firing range, better busbar hiding, more antistick effect and higher optical density.

PINTURAS BENICARLO INTEGRATION COMPLETE

Pinturas Benicarlo, based near our Spanish headquarters in Almazora, Castellon, develops and produces decorative organic water-borne coatings, almost 100% dedicated to the glass packaging market, most notably the perfumery and cosmetics segment.

The business, acquired in 2016, is proving to be a perfect fit for the Ferro Performance Colors & Glass (PCG) family, both in terms of product range and operating philosophy.

Pinturas Benicarlo is now fully integrated into our PCG operations and our primary goal is to ensure that the successful business model, built over many years around fast color matching and speedy deliveries, continues unaffected. Packaging markets such as perfumery and cosmetics demand flexible, fast turnaround of colors and designs; organic waterborne coatings fit this model well and have become an essential ingredient in the total product mix. Typically, we are supplying color matches within one day, and following up with the final product within days of final approval. We also provide a service where we can maintain stocks of carefully controlled intermixable colors and coatings ingredients at or close to our

customers, as a further aid to reduce the time from design to final product delivery.

For many years, Pinturas Benicarlo has been a product leader, proud to count amongst its customers some of the world's largest suppliers of packaging glass, such as Vitro and Verescence (formerly SGD). Benicarlo's products are associated with many famous brands, including L'Oreal (Polo, Ralph Lauren), Carolina Herrera, Avon, O Boticário, Natura, Zara and many more. As we continue to expand the business supported by Ferro's broad global customer reach, our goal is to open up many new opportunities across Europe and Asia, and into a wide range of glass container markets, including foodstuffs, beverages and also tableware. In parallel, our development teams are bringing new products to market with improved levels of dishwasher resistance and scratch resistance, lower VOC, as well

as new colors such as fluorescent, neon, relief, metallic and mirror-like effects.

We are excited about the opportunities our Pinturas Benicarlo acquisition can bring for our customers, and we are looking forward to working closely with all our partners to help deliver on this potential.



NEW PRODUCTS INTRODUCED BY FERRO IN THE LAST TWO YEARS

FLAT GLASS

Product	Application	Benefits
System TEA (True Edge Application)	Architectural	TEA allows structural glazing with glass enamels at the edge of PVD-coated glass
LustReflex coating	Appliance and Architectural	Almost invisible coating to enhance durability of glass and ceramic glass surfaces
Cool Color coatings	Architectural and Appliance	Enamels with IR-reflecting properties for cool surface and energy saving
High Opaque/High Durability Black	Appliance	Bismuth-free, cost-efficient, passes appliance chemical durability and foodstuffs testing

AUTOGLASS

Black inks for LaserTransfer Printing (LTP)	Digital printing	Exclusively for use with LPKF LTP printers. Printing of edge bands, logos, serialisation
Conductive silver inks	Digital printing	Exclusively for use with LPKF LTP printers. Printing of fine line conductive tracks, bus bars, antennae
High resistant surface 4 black-band enamels	Laminated windshields	Passes 72 hour H ₂ SO ₄ Toyota test; wide firing range
Low Bi anti-stick enamels	Tempered Glass	Single-fire and pre-fire systems; lower cost processing; hides busbars and other functional coatings
Surface 2 black band enamels	Laminated windshields	Single-fire and pre-fire systems; lower cost processing; hides busbars and other functional coatings
High resistant press bend enamels	Laminated windshields	Benchmark products for application on laminated glasses in press bend technology, passing 72 hour H ₂ SO ₄ Toyota test

CONTAINER GLASS

VNS series Metallic-effect colors	Beverage bottles Cosmetic bottles/Giftware Tumblers/Tableware	Special effect metallic shades with good scuff resistance
Organic HTP neon inks	Beverage bottles Cosmetic bottles/Giftware Tumblers/Tableware	Intensive neon color shades with good dishwasher resistance
Fluorescent effect forehearth colors	Beverage/ Cosmetic bottles/Tableware	Feeder frits or pearls to create fluorescence under UVA and Laser
Chrome pearl forehearth colors	Beverage/ Cosmetic bottles/Tableware	Environmentally friendly, allows to achieve a yellow shade (Cr6 ³⁺) in compliance with REACH
Nickel-free black forehearth colors	Bottles Tableware	Environment-friendly; concentrate/frit mixtures allow low feed rates for high intensity colors reduced cost

CERAMIC DINNERWARE

Starlight100 Metallic colors for high temperature fast-firing	Dinnerware	Lead content < 100ppm
Carnival100 onglaze colors	Dinnerware	Lead content < 100ppm
Xpression New 1C+ 2C Protective Coat	Decoration	More flexible and increased resistance
Xpression 1C satinated Protective Coat	Decoration	Better strip-off behavior
New Strippable Coat 80 2070 for Xpression	Decoration	For dextrin as well as PVA coated paper
New Primer for glass and ceramic	Decoration	For better wetting

INDUSTRIAL

ZTH/ZTL rings	Process Temperature Control	Working range 560-660°C
UTH/UTL rings	Process Temperature Control	Working range 660-900°C
Ultrafine filler Glasses for Dental	Dental Composites	0,4-0,7µ to get higher filling grades in dental composites
Phosphate glasses	Dental	Dental cements

FERRO TECHNOLOGY SPARKS INDUSTRIAL CERAMICS

The success story of spark plugs started with the patent registration of a spark plug combined with a high-voltage magneto. This invention led to a reliable ignition of the fuel-air mixture in combustion engines and leveraged the spark-ignited engine, as well as the automobile.

As a specialty glass supplier, Ferro has been involved in this success story for many years and today, is one of the leading suppliers of granulated glass and glazes for manufacturing spark plugs worldwide.

The granulated glass for sealing the electrode sits inside the spark plug. The glass serves for fixing the electrode inside the spark plug's body and as a resistor suppressor.

The outside of the spark plug is coated with a glaze with special electrical and mechanical features. In compliance with the strict ROHS-regulation 2002795/EG, we developed a lead-free glaze in

close collaboration with customers which is now well established in the market.

Changed geometry to slimmer spark plugs, as well as higher impact caused by modern engines are new challenges to Ferro's products, and we will continue to support new requirements for spark plug advancements as they occur.



SPECIAL GLASSES FOR SAFETY CABLES

The risk of fire in high-rise buildings has been tragically highlighted in recent months, following high profile cases of major fires in several cities around the world.

Ferro is playing its part in helping to contain the spread of fires by developing and promoting special glasses for use with electrical safety cables.

In the case of an outbreak of fire, any relevant safety equipment such as fire detectors, communication devices, emergency lighting, transportation systems with an evacuation function, water pressure systems, smoke and heat flues must remain workable for as long as possible. Of course, this is especially important for highly occupied buildings such as offices, hospitals, old people's homes, schools, tower blocks and the like.

In case of fire, the electrical systems have to remain insulated and functioning at least over a certain period of time which is stipulated by the legislation.

During a fire, ordinary cables already lose their functional ability after a short time. Although flame retardant cables made of halogen-containing polymers can limit the expansion of a fire, they emit corrosive and toxic gases with simultaneous release of heavy smoke. Inhalation of toxic gases and smoke emitted by and as a result of a fire is by far the biggest danger to human life.

A possible solution for maintaining the required electrical function during a fire is based on winding mica around the electric cables. However, this method is very costly and in most cases, it is combined with common polymers which release toxic gases when burnt.

The challenge is to develop a cost/benefit optimized cable system, which guarantees their functionality even in case of fire, and which does not release toxic gases.

Together with a noted manufacturer of silicon polymers, Ferro have developed a formulation for a glass containing safety mass that is added directly to the silicon polymer. Out of this mixture, silicon cables can be made which meet the standard requirements for safety cables. Therefore no costly and complicated mica winding technology is needed.

By themselves, "standard" silicon cables show some advantages over other polymer cables. For example, they have extremely high weather and UV resistance, very good flexibility and very high stability against high temperatures of the surrounding atmosphere. In addition, they contain no halogens and no toxic components or decomposition products (even in case of a fire or smoldering fire). In addition to these advantages, silicon cables filled with our special glasses guarantee the functionality and insulation properties of the safety cable for a certain period of time in case of fire.

In spite of the high filler content of around 50% by weight, such a safety cable still meets the requirements of elasticity and resistance to tearing, according to DIN VDE 0472 part 602.

During a fire the cable insulation sinters to a solid ceramic coating. The conducting core of the cable is therefore still insulated, so that the functionality and insulation stay intact. There is neither a short circuit nor an interruption of the current.

Our special glass is ideal for compounders who offer cable material for the safety market, as well as for cable manufacturers who compound their polymers by themselves.

The combination silicon – special glass is ideal for the production of effective, inexpensive safety cables. Compared to winding mica around cables, the system using Ferro glass is more cost effective, non-toxic and does not require any investment in expensive winding equipment.



FERRO TODAY

Ferro Corporation is a leading global supplier of technology-based functional coatings and color solutions. Ferro supplies functional coatings for glass, metal, ceramic and other substrates, and color solutions in the form of specialty pigments and colorants for a broad range of industries and applications.

Ferro products are sold into the building and construction, automotive, appliances, electronics, household furnishings, and industrial products markets.

Headquartered in Mayfield Heights, Ohio, USA, the Company has approximately 5,230 associates globally and reported 2016 sales of \$1.15 billion.

Our associates work in 29 countries, speak more than 17 languages and bring a wealth of knowledge and cultural perspective to our offices, laboratories and plant facilities every day. While we learn and benefit from the unique experiences that arise from our diversity, we also share a common set of core values and operating philosophies. We believe that our long term success will be determined by who we are and how we act.

Our core values apply equally to all interactions with customers, suppliers and colleagues:

- **Customer Focus:** Our customers are why we exist; we want to build trusting relationships that make customers successful.
- **Accountability and Performance:** We work to the highest performance standards to create value for customers and shareholders.
- **Innovative Thinking:** We seek new ideas for technologies and business processes, and are always striving to improve and serve our customers better.
- **Teamwork and Collaboration:** We are committed to a work environment of trust and respect, working together to consistently deliver value to customers and shareholders.

Where innovation delivers performance.

	KEY PRODUCTS	END-USE APPLICATIONS
PERFORMANCE MATERIALS	Tile coatings and digital inks; Porcelain enamel coatings; Structural and fine ceramics coatings; Glass enamels; Conductive metal pastes, powders and flakes; Forehearth colorants; Specialty colors and glasses; Organic coatings and inks; Electronics packaging materials and multilayer materials; Inorganic colored pigments; Organic pigments High-performance polishing materials	Ceramic floor and wall tiles; Appliances; Dinnerware; cookware; Roof tiles; sanitaryware; Water heaters and industrial products; Automotive, architectural, furniture and container glass; Dental products; Electronics packaging; Semi-conductor wafers and capacitors; Paint & plastics; Vinyl siding, pipe and flooring; Touch sensitive displays; Ophthalmic lenses



Cleveland Headquarters, USA



Frankfurt, Germany



Washington, PA, USA

Performance Colors and Glass Main Production Locations

info-pcg@ferro.com

Americas

Washington, PA, USA
Phone: +1 724-207-2300

Orrville, OH, USA
Phone: +1 330-765-4400

Penn Yann, NY, USA
Phone: +1 315-536-3357

Villagrán, Mexico
Phone: +52 41-1155-1225

Europe

Frankfurt, Germany
Phone: +49 69-271160

Saint Dizier, France
Phone: +33 32-5073333

Asia

Tsukuba, Japan
Phone: +81 29-889-2144

Zibo, China
Phone: +86 533-576-9609

Saraburi, Thailand
Phone: +66 36-375027



www.ferro.com

© Copyright Ferro 2017
Ferro reserves the right to alter specifications.



Automotive Architectural Appliance Containers Tableware Laser Marking Industrial

For outstanding color and coating technologies – both decorative and functional – Ferro are global market leaders.

www.ferro.com