FERRO

InstantColor®*Plus*

Ceramic colours for the 21st century

Performance Pigments and Colors

www.ferro.com

Ferro touches your life every day

Headquartered in Cleveland, Ohio, USA, Ferro Corporation is a world leading producer of Performance Materials, with operations in 20 countries across Europe, Asia, and the Americas.

We apply core technologies in organic and inorganic chemistry to develop leading market positions in a diverse range of industries.

Our mission is "to achieve market leadership through a customer-focused and highly creative organisation committed to delivering top quality products and outstanding services to customers worldwide".

Our materials are used to add value to, and to improve the performance of products in a variety of end markets including building and renovation, home appliances, cookware, giftware and tableware, transportation, household furnishings, leisure, electronics, and industrial products.

We are among the world's leading suppliers of ceramic glazes and colours, glass decoration, precious metal preparations, speciality glasses, porcelain enamel coatings, auxiliary materials, and pigments. We pioneered the development of forehearth colour technology for colouring of glass.

Our global commitment to quality, reliability, innovation, and personal customer care is founded on over 80 years of experience in serving the changing needs of the industry, from our international network of manufacturing plants and service centres. Our commitment to quality management has been recognized with the award of ISO 9000 accreditation to all of our global manufacturing and research facilities.

Meeting the needs of the Colour World calls for great foresight, flexibility, and innovation ...

- Our global presence is a strong competitive advantage. Technical, marketing, and management personnel are in continuous contact with customers in every major region. Multinational customers can be assured of standard products and consistent quality wherever they have operations.

- We co-ordinate our R&D activities globally and use our international talent to ensure that product specifications and performance are designed to satisfy the specific requirements demanded by regional markets.

- Ferro views the growing world-wide concern for the environment as an opportunity to develop improved products and also to participate in Chemical Industry efforts to address public concern. Environmental concerns are a major driving force behind the evolution of our lead- and cadmium-free technology and our low VOC decoration systems.

- The markets we cover are extremely service-intensive. Ferro has established regional colour matching, blending/pasting, and technical support facilities, to provide the level of service demanded by our customers in all time zones.

Think of us as High Performance Partner to manufacturers around the world ...

...Helping to create and enhance many of the products you use and enjoy every day of your life.

InstantColor® Plus

Solutions for the ceramic industry

Pigments and Special Products is a business unit of the Performance Pigments and Colors division of Ferro. We develop, produce, and market our pigments, special glasses, glazes, and special coating materials.

In the ceramic industry, we are worldfamous for our innovative, high-quality colouring products. Our most important goal is to maintain a high level of product quality and to maximize customer satisfaction. To ensure this, we emphasize dialogue and partnership with our customers, focusing on the challenges of their markets and on their suggestions and requirements, as well as on our mutual desire to protect the environment. As a result, we are always ready with the most creative and ambitious new products our customer need.

Ongoing research and development is the basis of the high quality of our stains, as we continually improve not only their composition, but also our production technology and test methods.

Following the success of our InstantColor® Plus stains range, we wanted to further develop our range of dispersible glaze stains in the entire colour spectrum. The resulting development is our new, improved InstantColor® Plus stains range.

The newest solution: InstantColor® Plus

Our daily life grows increasingly fast-paced with its mobile phones, e-mail, internet, and e-commerce. At every step, a new solution is required, tailored to suit an individual problem. Flexible and innovative product development makes it possible to fulfil these demands. Automation and rapid prototyping enable us to anticipate and meet your changing requirements with new products.

For the ceramic industry, our answer is: Fast-firing combined with InstantColor® Plus. With the help of InstantColor® stains you save precious time, time spent traditionally in slurry preparation using a ball mill. All the stains in our InstantColor® Plus range consist of uniformly minute particles that are dissolved instantly. Practically all primary grains are smaller than 32 µm with no coarse agglomerates to grind for the slurry. Extremely fine grains mean far easier dispersibility, and for our customers this means no ball mills, much less production time, and much less waste. All this is offered in the complete colour spectrum. (And of course you can prepare InstantColor® Plus stains the traditional ball mill way if you wish.)

InstantColor® Plus: A complete colour spectrum to meet the most demanding requirements

Brilliant colours:
The 30 stains in this range exhibit the purity, intensity, and brilliance you want, in the complete colour spectrum.

Extremely fine, uniform particles:
99.9 % of InstantColor® grains (with exception of the inclusion pigments and the product 230 967, melba) are guaranteed to be smaller than 32 µm, making the ideal for modern sreenprinting applications and for roller printing (e.g. Rotocolor®).

Easy dispersibility:
Readily dispersed in standard slurries, InstantColor® offers safe, easy handling.

Environmental compatibility:
InstantColor® Plus stains are leadfree (with the exception of some sphenes) and so are particularly suitable for leadfree glazes. Even our sphenes contain so little lead that – even when adding 10 weight-% – the coloured glaze needs no hazards identification. Stains using cadmium to achieve brilliant reds and oranges encapsulate the colour crystals in zirconium silicate, creating inert inclusion pigments.

Optimum glaze compatibility:
Even in opaque glazes, InstantColor® stains create uniform, defect-free surfaces, no matter what the firing conditions are (traditional or fast-firing).

Flexible production:
Not restricted by the need to fill big ball mills, producers can easily prepare small batches, and switch from one colour to another. Just-in-time production is a reality. No mills to clean, no colour contamination, and no waste.

Intermixability:
An infinite number of colours can be prepared using the InstantColor® Plus range of 30 shades. Colours can be easily adjusted right in the barrel.

Cost effectiveness:
With minimal waste, no capital investment, no mill clean-up time, less water to dispose of, and high efficiency intense colour, the InstantColor® Plus range is extremely cost-effective to use.

Proven quality

All stains are tested in a fast-firing process at 1100 °C for 75 minutes and compared to an established standard. The stain is released only if the colour difference of CIELAB-system ΔE is less than 1. InstantColor® grain size distribution, sieve residue, and dispersibility are checked. Cadmium inclusion pigments are further investigated to analyze their cadmium release rate.
We are also ready to meet individual customer specifications, when requested. The detailed test conditions for all our products are specified in the corresponding data sheets, which we will gladly send to you on request.

Table 1: InstantColor® Plus stains: composition, crystal structure, firing conditions

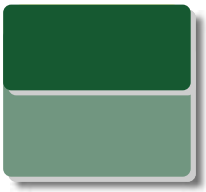
Pigment	System	Colour	Crystal structure	Tmax/°C	Firing conditions
210 950	Cr-Al	Olive Green	Corund	1400	ox./red.
210 946	Co-Al-Cr	Green Blue	Spinel	1400	ox./red.
210 960	Zr-Si-Pr-V	Grass Green	Zircon	1250	ox./slightly red.
210 952	Co-Mg-Zn-Cr	Chrome Green	Spinel	1400	ox./red.
220 942	Zr-Si-V	Turquoise	Zircon	1350	ox./red.
220 943	Co-Zn-Al-Si	Indian Blue	Spinel	1450	ox./red.
220 944	Co-Al	Blue	Spinel	1450	ox./red.
220 946[1]	Co-Si	Cobalt Blue	Olivine	1450	ox./red.
220 955	Zr-Si-V	Azure Blue	Zircon	1350	ox./red.
230 942	Zr-Si-Cd-S-Se	Brilliant Orange	Zircon	1350	ox./red.
230 944	Zr-V	Havanna	Baddeleyite	1400	ox./red.
230 946	Zr-Si-Pr	Intense Yellow	Zircon	1250	ox./slightly red.
230 955	Zr-Si-Pr	Yellow	Zircon	1250	ox./slightly red.
230 967	Zr-V-In	Melba	Baddeleyite	1400	ox./red.
240 942	Co-Ni-Fe-Cr	Black	Spinel	1300	ox./red.
240 944	Ni-Mn-Fe-Cr	Black	Spinel	1300	ox./red.
250 942	Sn-Sb-V	Blue Grey	Cassiterite	1300	ox./red.
250 946	Sn-Sb	Neutral Grey	Cassiterite	1300	ox./red.
250 950	Zr-Si-Co-Ni	Zircon Grey	Periclase	1350	ox./slightly red.
250 955	Zr-Si-Co-Ni	Zircon Grey	Periclase	1350	ox./slightly red.
260 946	Zn-Al-Cr-Fe	Bright Brown	Spinel	1300	ox./red.
260 952	Zn-Cr-Fe	Wood Brown	Spinel	1300	ox./red.
260 954	Zn-Al-Cr-Fe	Middle Brown	Spinel	1300	ox./red.
260 955	Zn-Mn-Fe-Cr	Black Brown	Spinel	1300	ox./red.
270 941	Ca-Sn-Si-Cr	Rosé	Sphene	1250	ox.
270 944	Zr-Si-Cd-S-Se	Intense Red	Zircon	1350	ox./red.
270 946	Zr-Si-Fe	Coral	Zircon	1250	ox.
270 965[2]	Ca-Sn-Si-Cr	Maroon	Sphene	1250	ox.
270 966[2]	Ca-Sn-Si-Cr	Dark Maroon	Sphene	1250	ox.
280 942	Sn-Cr	Violet	Cassiterite	1250	ox.

[1] Hazards identification Xn, R phrases 20/22

[2] Hazards identification T, R phrases 61-20/22-33

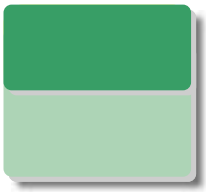
InstantColor® Plus

The following printed colour samples were achieved by dispersing InstantColor® stains in glazes A and B (see table 2).



210 950
Olive Green / Cr-Al

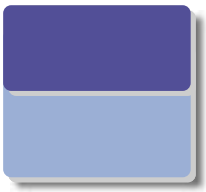
210 946
Green Blue / Co-Al-Cr



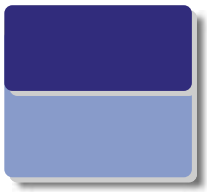
210 960
Grass Green / Zr-Si-Pr-V

210 952
Chrome Green / Co-Mg-Zn-Cr

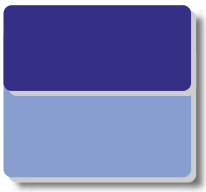
220 942
Turquoise / Zr-Si-V



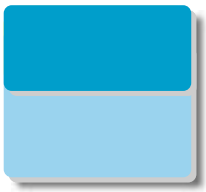
220 943
Indian Blue / Co-Zn-Al-Si



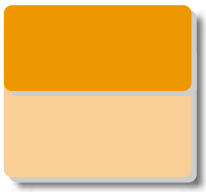
220 944
Blue / Co-Al



220 946[1]
Cobalt Blue / Co-Si

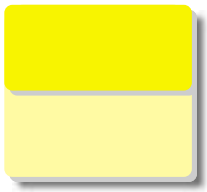


220 955
Azure Blue / Zr-Si-V

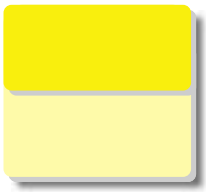


230 942
Brilliant Orange / Zr-Si-Cd-S-Se

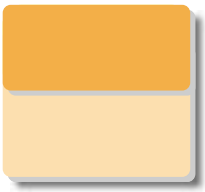
230 944
Havanna / Zr-V



230 946
Intense Yellow / Zr-Si-Pr



230 955
Yellow / Zr-Si-Pr



230 967
Melba / Zr-V-In

240 942
Black / Co-Ni-Fe-Cr

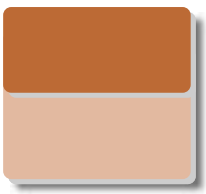
240 944
Black / Ni-Mn-Fe-Cr

250 942
Blue Grey / Sn-Sb-V

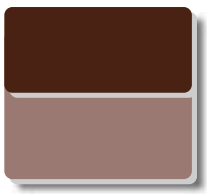
250 946
Neutral Grey / Sn-Sb

250 950
Zircon Grey / Zr-Si-Co-Ni

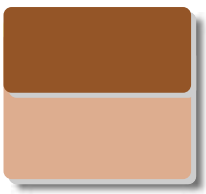
250 955
Zircon Grey / Zr-Si-Co-Ni



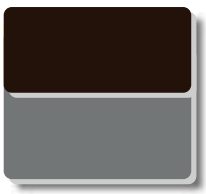
260 946
Bright Brown / Zn-Al-Cr-Fe



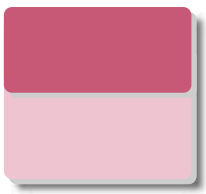
260 952
Wood Brown / Zn-Cr-Fe



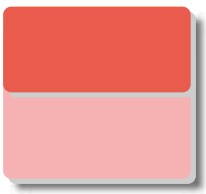
260 954
Middle Brown / Zn-Al-Cr-Fe



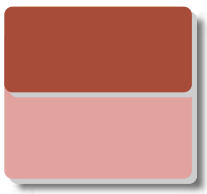
260 955
Black Brown / Zn-Mn-Fe-Cr



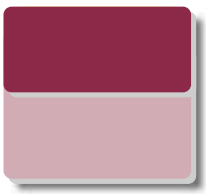
270 941
Rosé / Ca-Sn-Si-Cr



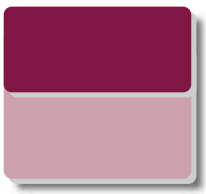
270 944
Intense Red / Zr-Si-Cd-S-Se



270 946
Coral / Zr-Si-Fe



270 965[2]
Maroon / Ca-Sn-Si-Cr



270 966[2]
Dark Maroon / Ca-Sn-Si-Cr

280 942
Violet / Sn-Cr

While every attempt has been made to reproduce colours exactly, the samples printed here may differ slightly from fired ceramic products. Each InstantColor® stain must be used according to the parameters stipulated on its accompanying technical data sheet. Please refer to these sheets for full information.

Table 2: Glaze composition

Glaze	A	B
SiO_2	60.8	54.7
ZrO_2	-	6.1
B_2O_3	1.5	3.9
Al_2O_3	9.6	7.6
CaO	12.1	8.9
ZnO	9.5	12.4
MgO	1.7	2.4
Na_2O	0.8	0.3
K_2O	4.0	3.7

Our new InstantColor® Plus glaze stain range: Stain and glaze compatibility

Chromium green⁺ and cobalt-chromium green blue⁺
210 950 Cr-Al / 210 946 Co-Al-Cr / 210 952 Co-Mg-Zn-Cr
These stains offer clear, very intense colours. Not suitable above 1000 °C for glazes rich in zinc, tin, and magnesium. Suitable for reducing and oxidizing atmosphere up to 1400 °C. Miscible with all cobalt- and chromium-containing greens and blues. Mixing of 210 950 with other types of stains for adjusting colours is not recommended.

Cobalt blue
220 944 Co-Al / 220 946[1] Co-Si / 220 943 Co-Zn-Al-Si
Cobalt stains show high firing stability and offer universal applicability. Zinc-containing glazes intensify the colour development. 220 944 could cause glaze-matting in large additions. Mixed with our sphenes, the Co stains create lilac and violet colour shades.

Zirconium silicate green, blue, yellow, red
210 960 Zr-Si-Pr-V / 220 942 and 220 955 Zr-Si-V / 230 946 and 230 955 Zr-Si-Pr / 270 946 Zr-Si-Fe
Very suitable for highly viscous glazes, especially for zircon glazes; less suitable for glazes rich in lead, boron and alkali. Good miscibility with each other, with inclusion pigments, with zircon grey and with zirconium oxide yellow. Not suitable for mixing with sphenes.

Zirconium oxide yellow
230 944 Zr-V / 230 967 Zr-V-In
Suitable for highly viscous glazes; less suitable for glazes with high lead-, zinc- and lime-content. Combining with Co-Cr containing stains should be avoided. The intensity of the stains may be drastically reduced if they are milled too long.

Black
240 942 Co-Ni-Fe-Cr / 240 944 Ni-Mn-Fe-Cr
The cobalt containing black is ferro-magnetic. Almost universally suitable for all glaze systems. Mixing with other stain systems, however, is not recommended.
The cobalt-free black shows good colour development in lead containing glazes. In zinc-containing glazes, a brown shade develops. Mixing with stains other than brown or black is not recommended. We do not recommend using black stains to produce pale grey shades.

Tin antimony grey
250 942 Sn-Sb-V / 250 946 Sn-Sb
These stains can be universally used up to 1300 °C due to their colour stability. They are miscible with nearly all glaze and stain systems. 250 942 is a neutral grey, 250 946 a blue grey.

Zirconium grey
250 950 and 250 955 Zr-Si-Co-Ni
Like the true zircon stains, these grey stains are also very suitable for highly viscous glazes, in particular zircon glazes. Glaze composition, however, strongly influences the colour. They develop a bluish shade in glazes rich in zinc, and a greenish shade in those rich in lead.

[1] Hazards identification Xn, R phrases 20/22

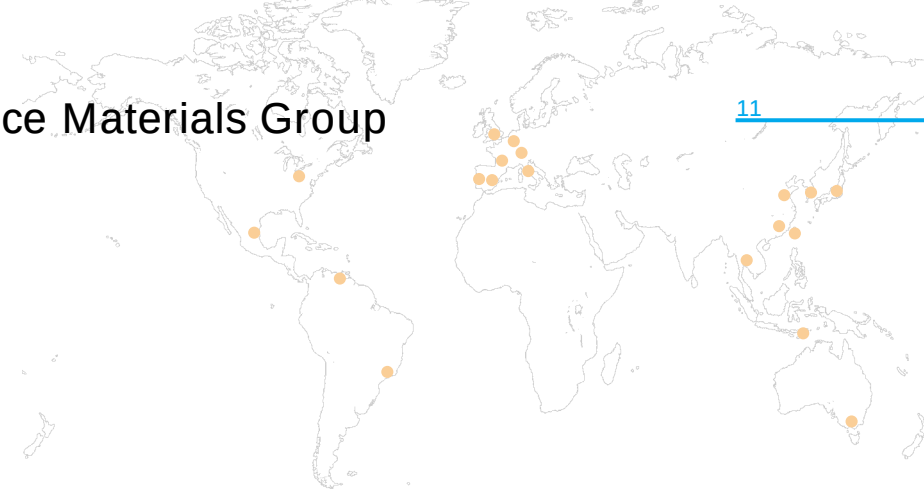
Brown[+]
260 952 Zn-Cr-Fe / 260 954 and 260 946 Zn-Al-Cr-Fe / 260 955 Zn-Mn-Fe-Cr
With the exception of stain 260 955, all these stains are very suitable for zinc-containing glazes. The colour develops extraordinarily well in transparent glazes. The stains can also be used in zircon glazes, and are miscible with brown, black and Zr-yellow stains. 260 955 has a tendency to develop surface defects in highly viscous glazes.

Chromium tin burgundy (maroon) / violet[+]
270 941, 270 965[2], 270 966[2] Ca-Sn-Si-Cr / 280 942 Sn-Cr
Particularly suitable for lime-rich and lead containing glazes. Not suitable for zinc-containing and boron-rich glazes. Small additions of tin oxide as well as of wollastonite increase colour stability. Reducing impurities such as SiC, C, Fe, Cu, Al etc. lead to local discolouration in the form of white spots. Miscible with stains based on cobalt and tin.

Inclusion pigment yellow, orange and red
230 942 Zr-Si-Cd-S-Se / 270 944 Zr-Si-Cd-S-Se
Highly suitable for glazes containing lead, lime, zinc, and boron; less suitable for alkali-rich glazes. The highest colour strength is achieved in transparent glazes with high optical refraction. Inclusion pigments create firing-stable colours under oxidizing and reducing conditions up to 1350 °C. Never add inclusion pigments to the mill until 95 % of the total milling time has been completed.

[+]Chromium-containing stains
Chromium (III) oxide has significant evaporating pressure above 1050 °C, which increases considerably as the temperature rises. In a compound, Cr_2O_3 evaporates more slowly the more closely it is incorporated into the stain, and the lower the concentration. Particular care must be taken with green and black stains. Even small amounts of Cr_2O_3 vapour can give a dirty-green tinge to light-coloured glazes fired near a chromium source. Tin oxide-containing glazes turn into a reddish colour because of this reaction.

[2] Hazards identification T, R phrases 61-20/22-33



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