FERRO
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FERRO PIGMENTS
FOR COATINGS

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SPP-2008	22-5500	21-5801	SPP-6015
10446s	22-5700	21-5901	SMM-6
SPP2006	V-5	21-4345	SPP-6009
Nubicoat HWR	Nubix V-9	21-4045	10401s
Nubicoat HTS	Nubix V-40	V-11633	Nubivan Y-901
Nubicoat HRD	Nubix V-60	21-4700	AD-83
22-4400	28-5333	Nubicrom 02	AR-73

23-6075s	Nubifer Y-805K	Nubifer R-5531	F-6331/2
10408s	Nubifer Y-905K	Nubifer R-5540	24-3303
V-9118s	10550s	Nubifer R-5560	Nubifer NB-803K
Nubifer Y-5010	V-10121	Nubifer R-5580	Nubifer NB-5970
Nubifer Y-5020	Nubifer R-5501	NS-36	V-760
Nubifer Y-7050	Nubifer R-5510	NR-38	SPP-3025
23-6105s	Nubifer R-5520	SPP-3056	24-3095s

The color of the printed images may show a slight deviation from the original shades

FERRO PIGMENTS
FOR COATINGS

About Ferro Corporation

Ferro Corporation (NYSE: FOE) is a leading global supplier of technology-based performance materials, including glass-based coatings, pigments and colors, and polishing materials. Ferro products are sold into the building and construction, automotive, appliances, electronics, household furnishings, and industrial products markets. The Company is headquartered in Mayfield Heights, Ohio, USA.

Our Values and behaviors:

- **CUSTOMER FOCUS**
  Our customers are why we exist. We build relationships with internal and external customers that are built on trust, a desire to understand their needs and challenges, and a genuine interest in making them more successful.

- **ACCOUNTABILITY FOR PERFORMANCE**
  As individuals and teams, we work to achieve the highest performance standards. We prioritize safety and environmental stewardship; providing high-value solutions for our customers; and creating value for Ferro's shareholders.

- **INNOVATIVE THINKING**
  We encourage our associates to seek out new ideas for technologies and business processes, and to always look for ways to improve and to better serve our customers.

- **TEAMWORK AND COLLABORATION**
  We are committed to a work environment that promotes trust, mutual respect, teamwork and collaboration, and that focuses on consistently delivering value to our customers and shareholders.

BLUE

PB28

COBALT ALUMINATE BLUE SPINEL

MAIN CHARACTERISTICS

- $CoAl_2O_4$
- Pigment Blue 28 (C.I. 77346)
- Spinel structure
- Reddish blue shade
- Ease of dispersion
- UV transparent, opaque to visible light, with moderate NIR reflectance (“cool” pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

SPP-2008	Standard grade	**22-5500**	Turquoise Blue
10336	High tinting strength, reddish shade	**22-5600**	Turquoise Blue, high tinting strength
10446s	High tinting strength, reddish shade	**22-5700**	Turquoise Blue, greenish shade

PB36

COBALT CHROMITE BLUE-GREEN SPINEL

MAIN CHARACTERISTICS

- $Co(Al,Cr)_2O_4$
- Pigment Blue 36 (C.I. 77343)
- Spinel structure
- Greenish blue shade
- Ease of dispersion
- UV transparent, opaque to visible light, with moderate NIR reflectance (“cool” pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

22-5070	Standard grade	**22-4400**	Turquoise Blue, greenish shade
22-5096	High tinting strength	**22-4044**	Camouflage Turquoise Blue
SPP-2006	The highest tinting strength		

BLUE

PB29

ULTRAMARINE BLUE

MAIN CHARACTERISTICS

- Sodium Aluminum Sulfosilicate $Na_{8-x}[(Al,Si)_{12}]O_{24}(S_y)_2$
- Pigment Blue 29 (C.I. 77007)
- Unique reddish blue shade
- Excellent ability to make whites “whiter”, greys bluer and blacks “jetter/deeper”
- Ease of dispersion
- Semitransparent to visible light, transparent to NIR (“cool pigment”, but its cool performance will be highly dependent on substrate and formulation)

Heat fastness	350°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (4-5 on grey scale)
Acid fastness	Low, except acid resistant series
Alkali fastness	Excellent
Cement compatibility	Low, except Nubicem series
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

Nubicoat SERIES

Ultramarine Blues specifically designed and quality controlled for coatings

Nubicoat HWR (High Weather Resistance)
New generation, encapsulated Ultramarine Blue to enhance acid and weather fastness, suitable for indoor and outdoor applications

Nubicoat HTS (High Tinting Strength) and **Nubicoat HRD** (Highly Reddish)
For indoor and outdoor applications (the latter, only with highly cross-linked resins and/or highly stabilized-to-UV systems and/or high resistance to industrial/acid environment systems)

Nubicem SERIES

Ultramarine Blues specifically designed to be compatible with cementitious formulations, highly alkaline coatings, paints over highly alkaline substrates and lime paints; quality control in cement

Nubicem B-101
Cement compatible Ultramarine Blue, for indoor and outdoor applications (the latter, only when the contact with water or high humidity is not severe i.e. in dry areas or when the formulation is highly hydrophobic)

Nubicem B-201
Cement compatible Ultramarine Blue modified with Cobalt Blue, for the most demanding applications

VIOLET

PV15
ULTRAMARINE VIOLET

MAIN CHARACTERISTICS

- Sodium Aluminum Sulfosilicate $Na_{8-x}[(Al,Si)_{12}]O_{24}(S_y)_2$
- Pigment Violet 15 (C.I. 77007)
- Unique violet shades
- Excellent ability to make whites “whiter”
- Ease of dispersion
- Semitransparent to visible light, transparent to NIR (“cool” pigment”, but its cool performance will be highly dependent on substrate and formulation)

Heat fastness	300°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (4-5 on grey scale)
Acid fastness	Low
Alkali fastness	High
Cement compatibility	Low
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

V-5	Bluish shade
V-8	Medium bluish shade
Nubix V-9	High tinting strength, unique blue shade
Nubix V-10	Reddish shade
Nubix V-40	High tinting strength, unique reddish shade
Nubix V-60	Reddish/pink shade

STRONTIUM PHOSPHATE VIOLET

MAIN CHARACTERISTICS

- Strontium Phosphate Violet $Sr_5(PO_4)_3Cu_{0.3}O$
- Apatite structure
- Unique violet shade
- Suitable for replacing PV23
- Excellent ability to make whites “whiter”
- Ease of dispersion
- Semitransparent to visible light, NIR absorbent

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	High
Alkali fastness	High
Cement compatibility	High
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

28-5333	Standard grade (pending APAC inventories)

GREEN

PG17
CHROME OXIDE GREEN

MAIN CHARACTERISTICS

- Cr_2O_3
- Pigment Green 17 (C.I. 77288)
- Prismatic/Rhombohedral structure
- Olive green shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance ("cool" pigment)

Heat fastness	800°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

SPP-6009 High tinting strength

SPP-6015 Yellowish shade

SMM SERIES
The micronized Chrome Oxide Greens

SMM-4 Bluish shade

SMM-6 Yellowish shade

Nubicrom SERIES
The highly micronized/high dispersibility Chrome Oxide Greens

Nubicrom 02 Yellowish shade

PG26
COBALT CHROMITE GREEN SPINEL

MAIN CHARACTERISTICS

- $CoCr_2O_4$
- Pigment Green 26 (C.I. 77344)
- Spinel structure
- Dark bluish green shade
- Ease of dispersion
- Opaque to visible light, with moderate NIR reflectance ("cool" pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

21-4700 Standard grade

GREEN

PG50

COBALT TITANATE GREEN SPINEL

MAIN CHARACTERISTICS

- Co_2TiO_4
- Pigment Green 50 (C.I. 77377)
- Spinel structure
- Bright green shade
- Ease of dispersion
- Opaque to visible light, with moderate NIR reflectance (“cool” pigment”)
- Ni free products available

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

21-4045 Standard grade

V-11633 High tinting strength, bluish shade

21-5801 Ni free (CMR classification free), bluish shade

21-5901 Ni free (CMR classification free), yellowish shade

21-4345 Ni free (CMR classification free), color like 21-4045

YELLOW

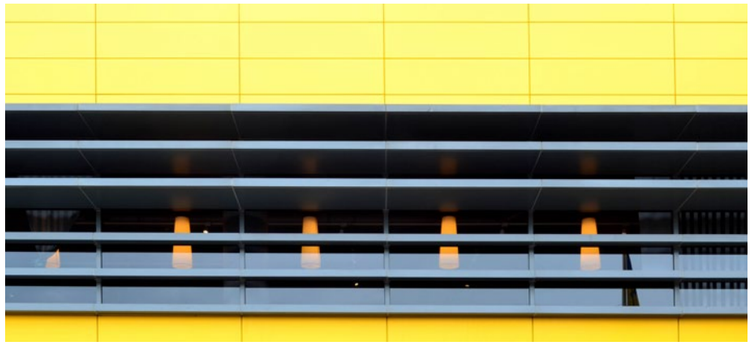
PY53

NICKEL ANTIMONY TITANIUM YELLOW RUTILE

MAIN CHARACTERISTICS

- (Ti,Ni,Sb) O_2
- Pigment Yellow 53 (C.I. 77788)
- Rutile structure
- Light yellow shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance (“cool” pigment)
- Possible replacement of Chrome Yellows in combination with Organics

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent



RECOMMENDED PRODUCTS

10401s Standard grade

PY184

BISMUTH VANADATE

MAIN CHARACTERISTICS

- $BiVO_4$
- Pigment Yellow 184 (C.I. 771740)
- Bright, primrose yellow shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance (“cool” pigment)
- Possible replacement of Chrome Yellows in combination with Organics

Heat fastness	220°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Low
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

Nubivan Y-901 Standard grade, very greenish

YELLOW

PY34

CHROME YELLOW

MAIN CHARACTERISTICS

- $PbCrO_4.PbSO_4$
- Pigment Yellow 34 (C.I. 77603)
- Monoclinic to Rhombic structure, depending on shade
- Bright yellow shade (middle, lemon and primrose)
- Ease of dispersion
- Opaque to visible light

CONVENTIONAL (L/D) SERIES

Heat fastness	180°C, 5 min
Light fastness	Middle/Lemon = Fair • Primrose = Low
Weather fastness	Middle/Lemon = Medium • Primrose = Low
Acid fastness	Fair
Alkali fastness	Low
Cement compatibility	Incompatible
Solvent fastness	Excellent

RESISTANT (R/S) SERIES

Heat fastness	220-260°C, 5 min
Light fastness	Middle/Lemon = High • Primrose = Fair
Weather fastness	Middle/Lemon = High • Primrose = Fair
Acid fastness	High
Alkali fastness	Low
Cement compatibility	Incompatible
Solvent fastness	Excellent

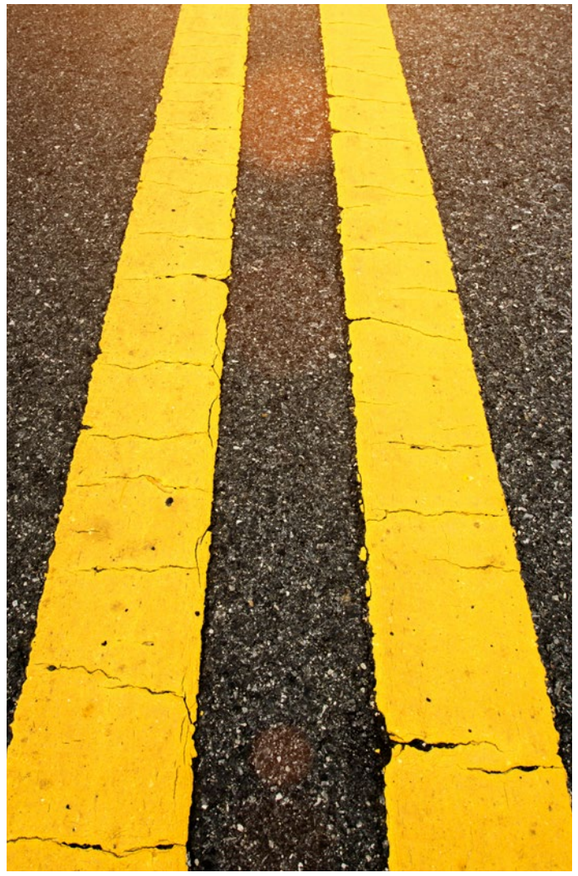
Nubiterm K SERIES

Heat fastness	300°C, 5 min
Light fastness	High
Weather fastness	High
Acid fastness	High
Alkali fastness	Low
Cement compatibility	Incompatible
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

AD-74	Conventional middle yellow
AD-83	Conventional lemon yellow
AL-90	Conventional primrose yellow
AR-73	Resistant middle yellow
ARS-82	Resistant lemon yellow

N.B. Ferro has not requested the REACH authorization for the use of Chrome Yellows in the European Union.



BUFF

PBr24

CHROME ANTIMONY TITANIUM BUFF RUTILE

MAIN CHARACTERISTICS

- (Ti,Cr,Sb) O_2
- Pigment Brown 24 (C.I. 77310)
- Rutile structure
- Clean, buff shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance (“cool” pigment)
- Possible replacement of Chrome Yellows in combination with Organics

Heat fastness	>500ºC, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

23-6075s	Standard grade, yellowish shade
10408s	Standard grade, reddish shade
V-9118s	Yellowish shade
23-6070	Yellowish shade
23-9156	Reddish shade

PY42

IRON OXIDE YELLOW

MAIN CHARACTERISTICS

- FeOOH
- Pigment Yellow 42 (C.I. 77492)
- Goethite structure
- Dull, buff shade
- Ease of dispersion
- Opaque to visible light, with low NIR reflectance
- Possible replacement of Chrome Yellows in combination with Organics
- Good coloristics to combine with Organics and Inorganics to reach specific colors at very competitive cost e.g. natural greens, bright reds, chocolate browns, light beiges

Heat fastness	160ºC, 5 min except Nubifer Y-7050 (260ºC, 5 min)
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

Nubifer Y-5000 SERIES

The micronized/high dispersibility/narrow colorimetric tolerances Yellow Iron Oxides

Nubifer Y-5010	Light shade
Nubifer Y-5020	Reddish shade
Nubifer Y-5028	Reddish shade, enhanced rheological performance

Nubifer Y-7000 SERIES

The micronized, high heat fastness Yellow Iron Oxides

Nubifer Y-7050
Encapsulated grade for high temperature curing coatings (heat fastness = 260°C, 5 min)

BUFF

PY164

MANGANESE ANTIMONY TITANIUM BUFF RUTILE

MAIN CHARACTERISTICS

- (Ti,Mn,Sb) O_2
- Pigment Yellow 164 (C.I. 77899)
- Dark brown shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance (“cool” pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

10550s Standard grade

PBk12

IRON TITANIUM BROWN SPINEL

MAIN CHARACTERISTICS

- Fe_2TiO_4
- Pigment Black 12 (C.I. 77543)
- Buff shade, similar to PBr24, without containing Cr^{3+}
- Ease of dispersion
- Opaque to visible light, with moderate NIR reflectance (“cool” pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

23-6105s Standard grade

BUFF

PY119

ZINC FERRITE BROWN SPINEL

MAIN CHARACTERISTICS

- $ZnFe_2O_4$
- Pigment Yellow 119 (C.I. 77496)
- Spinel structure
- Reddish buff shade
- Ease of dispersion
- Opaque to visible light, with moderate NIR reflectance ("cool" pigment)
- Possible replacement of Chrome Yellows in combination with Organics
- Good coloristics to combine with Organics and Inorganics to reach specific colors at very competitive cost e.g. natural greens, bright reds, chocolate browns, light beiges

Heat fastness	Nubifer Y-805K (300°C, 5 min) Nubifer Y-905K (260°C, 5 min)
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

Nubifer Y-805K
Very high heat fastness
(300°C, 5 min), dark, reddish shade

Nubifer Y-905K
High heat fastness
(260°C, 5 min), light, yellowish shade

RED

PR101
IRON OXIDE RED

MAIN CHARACTERISTICS

- Fe_2O_3
- Pigment Red 101 (C.I. 77491)
- Hematite structure
- Dull red shade
- Ease of dispersion
- Opaque to visible light, with moderate NIR reflectance

Heat fastness	800°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

Nubifer R-5500 SERIES

The micronized/high dispersibility/narrow colorimetric tolerances Red Iron Oxides

Nubifer R-5501	The most yellowish/lightest shade
Nubifer R-5510	Yellowish shade
Nubifer R-5520	Yellowish-medium shade
Nubifer R-5531	Yellowish-medium shade
Nubifer R-5540	Bluish-medium shade
Nubifer R-5560	Bluish-medium shade
Nubifer R-5580	The most bluish/darkest shade

PR104
MOLYBDATE ORANGE

MAIN CHARACTERISTICS

- $PbCrO_4.PbSO_4.PbMoO_4$
- Pigment Red 104 (C.I. 77605)
- Tetragonal structure
- Bright red shade (orange, scarlet and red)
- Ease of dispersion
- Opaque to visible light

CONVENTIONAL (L) SERIES

Heat fastness	180° - 200° C, 5 min
Light fastness	Fair
Weather fastness	Fair
Acid fastness	Fair
Alkali fastness	Low
Cement compatibility	Incompatible
Solvent fastness	Excellent

RESISTANT (R/S) SERIES

Heat fastness	240° - 260° C, 5 min
Light fastness	High
Weather fastness	High
Acid fastness	High
Alkali fastness	Low
Cement compatibility	Incompatible
Solvent fastness	Excellent

Nubiterm K SERIES

Heat fastness	300° C, 5 min
Light fastness	High
Weather fastness	High
Acid fastness	High
Alkali fastness	Low
Cement compatibility	Incompatible
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

NS-36 Resistant, scarlet shade

NR-38 Resistant, orange shade

N.B. Ferro has not requested the REACH authorization for the use of Molybdate Oranges in the European Union.

BLACK

PBk28

COPPER CHROMITE BLACK SPINEL

MAIN CHARACTERISTICS

- $CuCr_2O_4$
- Pigment Black 28 (C.I. 77428)
- Spinel Structure
- Bluish, deep shade
- Opaque to visible light, NIR absorbent

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

24-3095s Standard grade

SPP-3056 High tinting strength

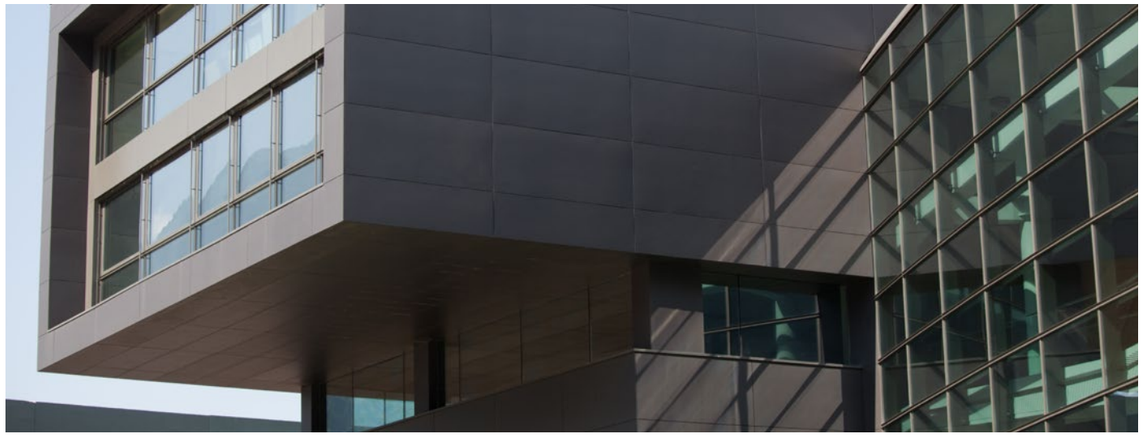
PG17

CHROMIUM GREEN-BLACK HEMATITE

MAIN CHARACTERISTICS

- Cr_2O_3
- Pigment Green 17 (C.I. 77288)
- Hematite structure
- Brownish to bluish black shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance (“cool” pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent



RECOMMENDED PRODUCTS

V-774 High tinting strength, bluish shade

V-775 The most bluish shade

BLACK

PBr29

CHROME IRON BROWN HEMATITE

MAIN CHARACTERISTICS

- $(Cr,Fe)_2O_3$
- Pigment Brown 29 (C.I. 77500)
- Hematite structure
- Brownish to bluish black shade
- Ease of dispersion
- Opaque to visible light, with high NIR reflectance (“cool” pigment)

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

V-760 Reddish shade

V-785 The most bluish shade

V-101 Dark Brown

SPP-3025 Bluish shade

PBk26

MANGANESE FERRITE BLACK SPINEL

MAIN CHARACTERISTICS

- $MnFe_2O_4$
- Pigment Black 26 (C.I. 77494)
- Spinel structure
- Very bluish/deep shade, the strongest black CICP
- Ease of dispersion
- Opaque to visible light, UV/NIR absorbent
- The black CICP with the highest heat fastness, very suitable for high temperature resistant coatings

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

F-6331/2 High tinting strength, very bluish shade

BLACK

PBk33
MANGANESE FERRITE BLACK OXIDE

MAIN CHARACTERISTICS

- $(Mn,Fe)_2O_3$
- Pigment Black 33 (C.I. 77537)
- Hematite structure
- Brownish to bluish black shade
- Ease of dispersion
- Opaque to visible light, with moderate NIR reflectance ("cool" pigment)
- Used when neither Carbon Black nor Black Iron Oxide can be used for technical reasons

Heat fastness	>500°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

24-3303 Reddish shade

Nubifer NB-803K Bluish shade

PBk11
IRON OXIDE BLACK

MAIN CHARACTERISTICS

- Fe_3O_4
- Pigment Black 11 (C.I. 77499)
- Magnetite structure
- Bluish black shade
- Ease of dispersion
- Opaque to visible light, NIR absorbent

Heat fastness	180°C, 5 min
Light fastness	Excellent (8 on blue wool scale)
Weather fastness	Excellent (5 on grey scale)
Acid fastness	Excellent
Alkali fastness	Excellent
Cement compatibility	Excellent
Solvent fastness	Excellent

RECOMMENDED PRODUCTS

Nubifer NB-5970 Micronized, high tinting strength, very bluish shade

COOL PIGMENTS

MAIN CHARACTERISTICS

It is well known that under the sun, dark surfaces become hot and white surfaces remain cooler. When comparing a white coating containing TiO_2 (Near Infrared -NIR- reflecting pigment) with a black coating containing Carbon Black (Near Infrared -NIR- absorbent pigment) the surface temperature difference can reach more than 30°C on a hot, sunny day.

This common effect is not only related to color but also to NIR absorption of the pigments used in a particular application. By using the appropriate pigments, even dark surfaces can stay cool under the sun.

This type of pigments, also referred to as Cool Pigments, do not absorb the NIR portion of wavelengths coming from sunlight. There are 2 types of Cool Pigments: NIR reflecting pigments and NIR transparent pigments. The final behavior of the latter will be influenced by the entire system; therefore, when using NIR transparent pigments it is recommended to apply the coating over a NIR reflecting substrate or use such pigments in combination with NIR reflecting pigments in the coatings formula.

Ferro Pigments has a full range of Cool Pigments and many years of experience developing projects in this field, so we are the ideal partner to support you in your cool projects.

MAIN APPLICATIONS AND BENEFITS

APPLICATIONS

- Coil Coatings for roofs
- Exterior paints for roofs and façades
- Roof shingles
- Sport fields
- Automotive coatings

BENEFITS

- Reduced air conditioning and energy consumption
- Increased building comfort
- Increased service life of the roof, EIFS (External Insulation Finishing System)

MAIN PRODUCTS

Ferro offers a full range of Cool Pigments in the whole color spectra.

FERRO COOL PIGMENTS COLOR SPACE

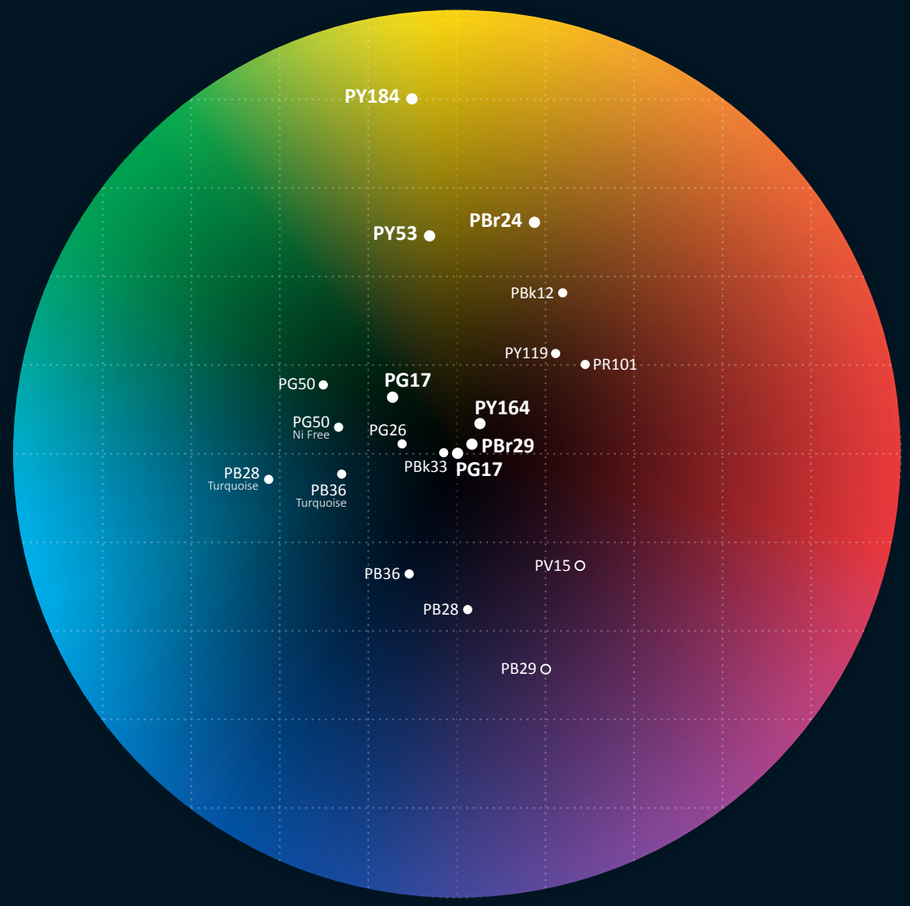
COOL PIGMENTS (High NIR Reflectance)

- **PY53** Nickel Antimony Titanium Yellow Rutile
- **PBr24** Chrome Antimony Titanium Buff Rutile
- **PY184** Bismuth Vanadete
- **PG17** Chromium Green-Black Hematite
- **PG17** Chrome Oxide Green
- **PBr29** Chrome Iron Brown Hematite
- **PY164** Manganese Antimony Titanium Buff Rutile

COOL PIGMENTS (Moderate NIR Reflectance or NIR transparency)

○ Transparent to NIR

- **PBk12** Iron Titanium Brown Spinel
- **PB28** Cobalt Aluminate Blue Spinel
- **PB36** Cobalt Chromite Blue-Green Spinel
- **PBk33** Manganese Ferrite Black Oxide
- **PG26** Cobalt Chromite Green Spinel
- **PG50** Cobalt Titanate Green Spinel
- **PR101** Iron Oxide Red
- **PY119** Zinc Ferrite Brown Spinel
- **PB29** Ultramarine Blue
- **PV15** Ultramarine Violet



CORROSION INHIBITORS

ANTICORROSIVE PIGMENTS

Nubirox ANTICORROSIVE PIGMENTS

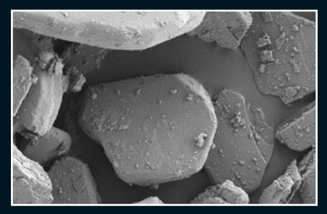
High performance anticorrosive pigments for long term corrosion protection

Suitable for solvent and water based protective coatings

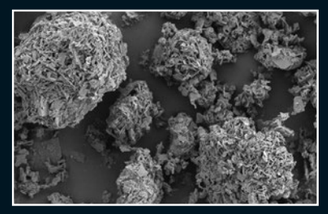
ZINC-BASED ANTICORROSIVE PIGMENTS

Zinc Phosphate ($Zn_3(PO_4)_2 \cdot 2H_2O$)

Nubirox N2
Standard Zinc Phosphate



Nubirox SP
Special particle Zinc Phosphate



- **Nubirox Technology**
  Special particle Zinc Phosphate with higher specific surface area than standard Zinc Phosphate
- **Efficiency at low concentration**

Nubirox 100 series & Nubirox 200 series

Modified Zinc Phosphates of enhanced performance due to specific combinations of active compounds

Nubirox 102
Organophilized Zinc Phosphate and Zinc Molybdate

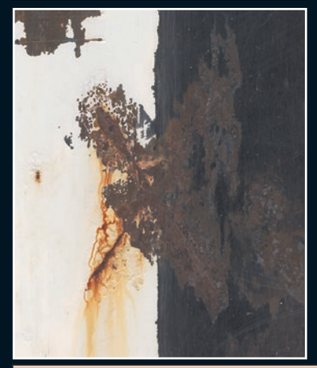
- Direct replacement of Zinc Phosphate with improved activity
- Suitable for high film thickness medium-gloss DTM coatings

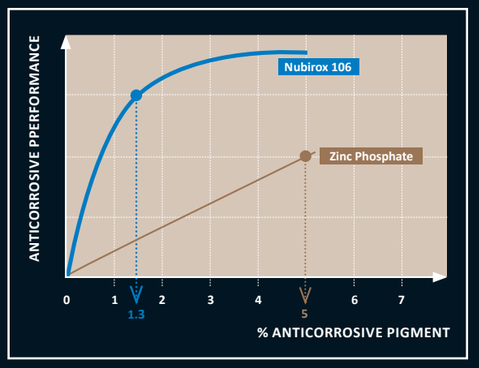
Nubirox 106
Organophilized Zinc Phosphate and Zinc Molybdate

- High anticorrosive activity at low concentrations
- Excellent performance in many water/solvent based systems and thin film applications

Nubirox 213
Iron Phosphate and Zinc Phosphate

- Anticorrosive activity at low concentrations
- Specially suitable for alkyd and epoxy primers

5% Zinc Phosphate	1.3% Nubirox 106
	
Solvent based Short Oil Alkyd primer Cold rolled steel DFT » 35µ	525 hours in Salt Spray (ASTM B-117)



CORROSION INHIBITORS

ANTICORROSIVE PIGMENTS

Nubirox ANTICORROSIVE PIGMENTS

High performance anticorrosive pigments for long term corrosion protection

Suitable for solvent and water based protective coatings

NON ZINC-BASED ANTICORROSIVE PIGMENTS

Nubirox 300 series

Alternative to Zinc-based pigments with excellent performance in many applications, and suitability in systems where Zinc-based anticorrosive pigments are reactive

Nubirox 301

Calcium Strontium Phosphosilicate

- Protection of different metal substrates, specially galvanized
- Good performance in etch/wash primers and DTM coatings

Nubirox 302

Organophilized Calcium Strontium Phosphosilicate

- Wider compatibility and enhanced performance
- Suitable for glossy DTM coatings thanks to low impact on gloss

Nubirox APLICATIONS MAP

CORROSION INHIBITORS		Nubirox N2	Nubirox SP	Nubirox 102	Nubirox 106	Nubirox 213	Nubirox 301	Nubirox 302
Solvent Based	Alkyds	••	•••	•••	•••	•••	••	•••
	Epoxies	••	••	••	•••	•••	•	••
	Urethanes	X	X	X	X	•	••	•••
Water Based	Alkyds	•	••	••	•••	••	••	•••
	Epoxies	•	••	••	•••	•••	•	•
	PVDC	•	•••	••	•••	•••	X	X
	Urethanes	•	•••	••	•••	••	•••	•••
	Acrylics	•	•••	•••	•••	••	•••	•••
Application	Wash & Shop Primers	•	••	••	••	•••	•••	•
	Powder Coatings	•	•••	•••	•••	•	••	•
	Coil Coatings	X	•	X	•••	X	•	•
	DTM Gloss	•	••	•••	•••	•	•••	•••

••• Highly recommended •• Recommended • Limited suitability x Not recommended

Z-952

Zinc Chromate

Yellow anticorrosive pigment used in solvent based paint systems (alkyds, epoxy-polyamides…)

T-902

Zinc Tetraoxychromate

Yellow anticorrosive pigment commonly used in Wash and Shop Primers

ANTICORROSIVE PIGMENTS

CHROMATE BASED PIGMENTS

FLASH RUST INHIBITORS

Liquid inhibitors to prevent flash rust and in-can rust in water based paint systems without detracting from the long-term performance properties

Nubirox FR-10

Nitrite based liquid Flash Rust Inhibitor

- Effective in the liquid and vapor phase at low loading

N.B. For classification and safety please refer to SDS
N.B. Ferro has not requested the REACH authorization for the use of Zinc Chromates and Zinc Tetraoxychromates in the European Union.

APPLICATIONS GUIDE

BLUE PIGMENTS

			Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PB28	Cobalt Aluminate Blue Spinel		●●●	●●●	●●●	●●●	●●●
PB36	Cobalt Chromite Blue-Green Spinel		●●●	●●●	●●●	●●●	●●●
PB29	Ultramarine Blue	Nubicoat series	●●●	●●●	●●●	●	●● (*)
		Nubicem series	●●●	●●●	●●●	●●	●● (*)

VIOLET PIGMENTS

		Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PV15	Ultramarine Violet	●●●	●●●	●●●	●	●● (*)
n.d.	Strontium Phosphate Violet	●●●	●●●	●●●	●●●	X

GREEN PIGMENTS

		Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PG50	Cobalt Titanate Green Spinel	●●●	●●●	●●●	●●●	●●
PG17	Chrome Oxide Green	●●●	●●●	●●●	●●●	●●●
PG26	Cobalt Chromite Green Spinel	●●●	●●●	●●●	●●●	●●

YELLOW PIGMENTS

			Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PY53	Nickel Antimony Titanium Yellow Rutile		●●●	●●●	●●●	●●●	●●●
PY184	Bismuth Vanadate		●●●	●●●	●●	●	●●●
PY34	Chrome Yellow	Conventional (L/D) series	●	●●●	X	X	X
		Resistant (R/S) series	●	●●●	●●	●	X
		Nubiterm K series	●	●●●	●●	●	X

BUFF PIGMENTS

			Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PBr24	Chrome Antimony Titanium Yellow Rutile		●●●	●●●	●●●	●●●	●●●
PY42	Iron Oxide Yellow	Nubifer Y-5000 series	●●●	●●●	●	X	X
		Nubifer Y-7050	●●●	●●●	●●●	X	X
PY164	Manganese Antimony Titanium Brown Rutile		●●●	●●●	●●●	●●●	●●●
PBk12	Iron Titanium Brown Spinel		●●●	●●●	●●●	●●●	●●
PY119	Zinc Ferrite Brown Spinel		●●●	●●●	●●●	●	●●

RED PIGMENTS

			Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PR101	Iron Oxide Red		●●●	●●●	●●●	●●●	●
PR104	Molybdate Orange	Conventional (L) series	●	●●●	X	X	X
		Resistant (R/S) series	●	●●●	●●	●	X
		Nubiterm K series	●	●●●	●●	●	X

BLACK PIGMENTS

		Liquid decorative / architectural coatings	Liquid industrial coatings	High temperature curing coatings (powder, coil, stoving)	High temperature resistant coatings	Cool coatings
PBk28	Copper Chromite Black Spinel	●●●	●●●	●●●	●●	X
PG17	Chromium Green-Black Hematite	●●●	●●●	●●●	●●	●●●
PBr29	Chrome Iron Brown Hematite	●●●	●●●	●●●	●●	●●●
PBk26	Manganese Ferrite Black Spinel	●●●	●●●	●●●	●●●	X
PBk33	Manganese Ferrite Black Oxide	●●●	●●●	●●●	●●	●●
PBk11	Iron Oxide Black	●●	●●	X	X	X

●●● Highly recommended
●● Recommended
● Limited suitability
x Not recommended
(*) Being NIR transparent, cool performance is highly dependent on substrate and formulation
n.d. not defined