FULLN® 丰霖新材料
FULLN CHEMICAL

Metal oxide mixed-phase pigments

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About MMO pigment

Metal oxide mixed-phased pigment is a powdery inorganic coloring pigment synthesized chemically using various metal oxides or metal salt compounds as the main raw materials. Firstly, they are mixed in proportion and uniformly blended, followed by ball milling. Then, the mixture is placed in a saggar and subjected to high-temperature(700-1150°C) calcination in a kiln for a long period of time. The semi-finished product undergoes a series of processes including ball milling, washing, drying, jet milling, pigment dispersion, etc., before obtaining the final product.

Contents

Product Categories

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- **COPPER CHROMITE BLACK**

  Product Name: Copper chromite black

  Chemical composition: Cu-Cr-O

  Color Index: Pigment Black 28/C.I: 77428

  CAS Number: 68186-91-4

  Appearance: Black Powder

Product Categories

- **CHROMIUM IRON BLACK**

  Product Name: Chromium iron black

  Chemical composition: Cu-Cr-O

  Color Index: Pigment Brown 29/C.I:77500

  CAS Number: 12737-27-8

  Appearance: Black Powder

Product Categories

- **CHROME ANTIMONY TITANIUM BUFF RUTILE**

  Product Name: Chrome antimony titanium buff rutile, Titanium-chrome yellow

  Chemical composition: Ti-Cr-Sb-O

  Color Index: Pigment Brown 24/C.I:77310

  CAS Number: 68186-90-3

  Appearance: Yellow Brown Powder

Product Categories

- **NICKEL TITANIUM YELLOW**

  Product Name: Nickel titanium yellow

  Chemical composition: Ti-Ni-Sb-O

  Color Index: Pigment Yellow 53/C.I:77788

  CAS Number: 8007-18-9

  Appearance: Yellow Powder

Product Categories

- **CHROMIUM IRON ZINC BROWN**

  Product Name: Chromium iron zinc brown

  Chemical composition: Zn-Fe-Cr-O

  Color Index: Pigment Brown 33/C.I:77503

  CAS Number: 68186-88-9

  Appearance: Reddish brown powder

Product Categories

- **COBALT TITANIUM GREEN**

  Product Name: Cobalt titanium green

  Chemical composition: Co-Ni-Zn-Ti-O

  Color Index: Pigment Green 50/C.I:77377

  CAS Number: 68186-85-6

  Appearance: Green powder

Product Categories

- **COBALT BLUE**

  Product Name: Cobalt blue

  Chemical composition: Co-Al-O

  Color Index: Pigment Blue 28/C.I:77346

  CAS Number: 1345-16-0

  Appearance: Blue Powder

Product Categories

- **COBALT CHROMITE BLUE GREEN SPINEL**

  Product Name: Cobalt chromite blue green spinel

  Chemical composition: Co-Al-Cr-O

  Color Index: Pigment Blue 36/C.I:77343

  CAS Number: 68187-11-1

  Appearance: Blue Powder

Product Usage

PORCELAIN ENAMEL

- Enamelware
- Industrial porcelain enamel
- Tactile porcelain enamel
- Porcelain enamel art

BUILDING MATERIALS

- Wall materials
- Diatomaceous earth
- Craft and color sand
- Cement decor

GLASS

- Glass printing(frit) ink
- Decorative glass
- Stained glass
- Lamp glass

PLASTIC

- General plastic
- Enginnering plastic
- Modified plastic
- Color masterbatches
- Plastic cement

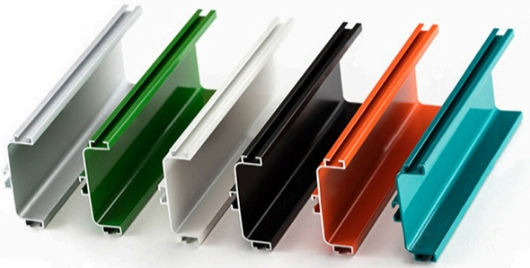
COATING

- Profile Coating
- Coil coating
- Heat-resistant coating
- Exterior coating
- Traffic coating
- Powder coating
- Oil-based paint
- Water-based paint

This series of products has excellent Weatherability, Lightfastness, high temperature resistance, acid-alkali resistance, and chemical resistance. They have strong covering power, do not migrate or bleed, and easily dispersed. Among the known inorganic pigments, organic pigments, and dyes, the color mixed phase inorganic pigments have the best durability and resistance, which provide values and offer advantages in applications such as ultra durable coatings and plastics. Additionally, most environmentally friendly color mixed phase inorganic pigments have excellent infrared reflection , making them highly applicable for fields such as architectural coatings

Coating

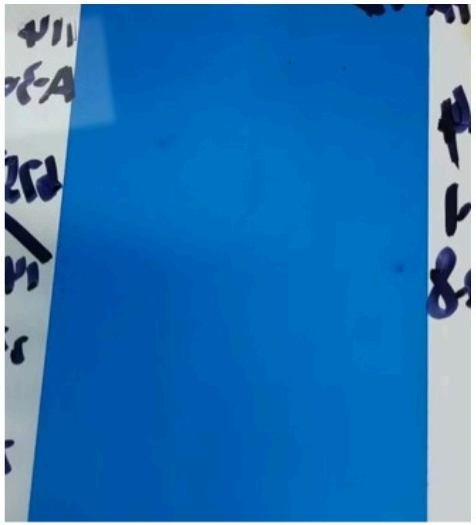
Coating is composed of resin, pigments (inorganic pigments, organic pigments, dyes), fillers (for performance enhancement), and additives (leveling agents, dispersants, anti-settling agents, etc.). It is applied to the surface of an object using different application methods to ensure strong adhesion, durable, and continuous solid film. This film is commonly referred to as a coating film or paint film.



Printing inks for glass

Printing ink for glass is a type of ink used for surface decoration on glass. It is prepared by mixing glass pigments, glass powders, and varnish. The mixture is then subjected to grinding and sieving processes to achieve a strong adhesion on glass. Glass ink can be printed onto glass surfaces and forms a strong adhesion.

The glass pigment content in printing ink for glass generally ranges from 20% to 35%, with the sintering temperature between 650°C and 720°C based on the type of glass powder used and its melting point



Color Masterbatches

Color masterbatches are composed of color pigments, carriers(resins), and additives

PRODUCTION PROCESS:

(PIGMENTS, DISPERSANTS, ADDITIVES) → Wetting → Dispersion → Stabilization → Mixing → Extruder → Granulation → COLOR MASTERBATCHES

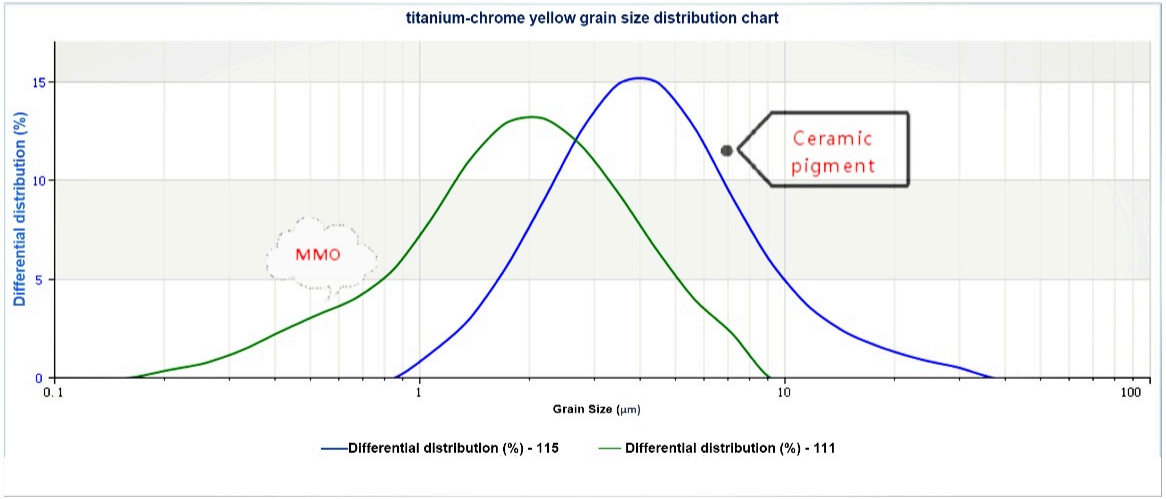
Difference from ceramic pigments

1. Sintering temperature

Name/pigment type	Chromium iron oxide	Titanium chrome yellow	Chromium iron zinc brown	Copper chromite black
Mixed-phase	900℃~1000℃	950℃~1050℃	1100℃~1150℃	900℃~1000℃
Ceramic	1200℃~1250℃	1100℃~1150℃	1250℃~1300℃	/

For most metal oxide mixed phase pigments, the sintering temperature ranges from 800°C to 1150°C, which is generally lower by 100°C to 200°C compared to ceramic pigments(1150°C to1300°C)

3. Product fineness



In the field of coatings and plastics, the pigment toner is an important indicator, and it is directly related to the grain size of the pigment toner. Smaller grain size generally results in better dispersibility of pigment toner. The average grain size(D50) is typically in the range of 1μm to 2μm, which is significantly smaller than the average size of ceramic pigments

Technical indicators and detection methods

Project		Chrome antimony titanium buff rutile	Nickel titanium yellow	Chrome Oxide Green	Cobalt Blue	Copper chromite black
Appearance		buff-color brown Powder	Yellow Powder	Green Powder	Blue Powder	Black Powder
Color		agreed upon				
Relative tinting strength		Not lower than the standard sample				
105℃ Volatile Matter/%		≤0.3				
Water-soluble fraction/%		≤0.4				
Average Grain Size(D50)		1-2 μm				
Oil Absorption/（g/100g）		≥10，≤25			≥25，≤40	≥10，≤25
pH value of aqueous suspension		≥6，≤9				
Chemical Resistance	Acid Resistance/Grade	5				≥4~5
	Alkali Resistance/Grade	5				
Heat Resistance/℃		≥800			≥1000	≥600

Equipment

Each indicator corresponds to a standard testing method and equipment, some of our testing equipment are shown below:

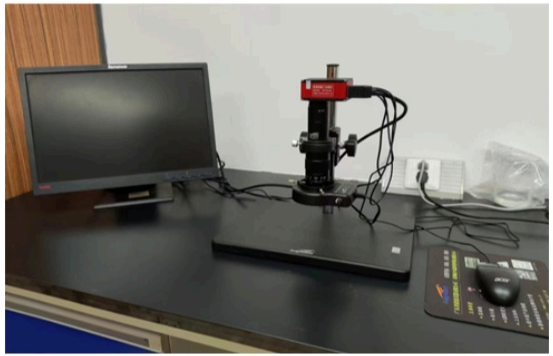
Conductivity Meter

Digital Rotational Viscometer

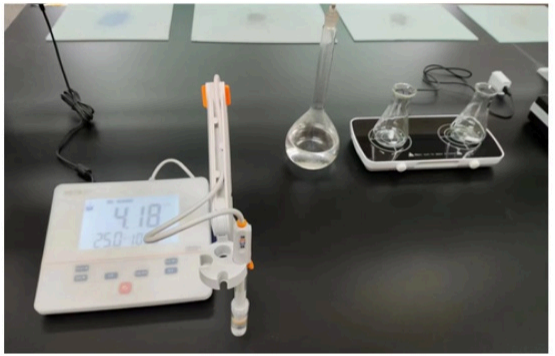
Laboratory Three Roll Mill

Research and Development Equipment

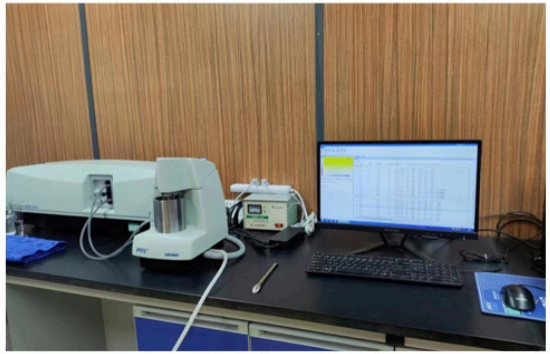
High-Temperature Furnace



High-Resolution Camera

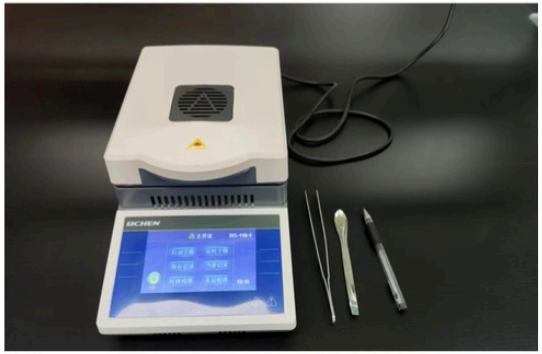


pH Meter



Laser diffraction particle size analyzer

Laboratory Sand Mill



Moisture analyzer

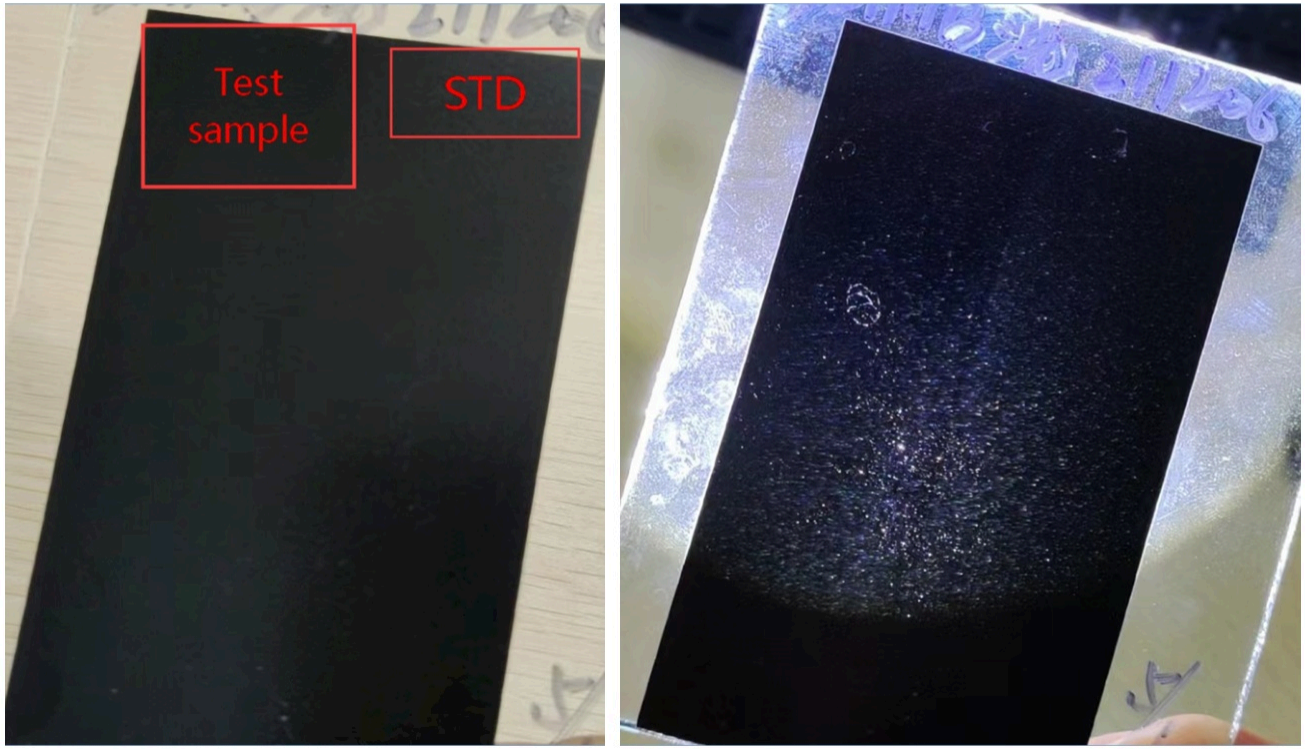
Issue: Test sample not black enough

We started to research and develop this type of product since 2017. During the process, we noticed the difference between metal oxide mixed phase pigments and ceramic pigments. We started from scratch in developing this type of product, including designing the formula, selecting raw materials, and experimenting with process routes. We have put in a lot of effort, and we have been able to stabilizing production

Issue: poor covering(hiding) power

Issue: not black enough

Now we have solved the problem of color mismatch and insufficient covering(hiding) power of copper chrome black pigments in glass inks



Thank you