Effetti innovativi e funzionali nel coating

Merck Effect Pigments in evereday life

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Introduction to „Pigments“

Substances which are used as colorants and are insoluble in the application medium.

DIN 55943: Insoluble substances with corrosion inhibiting or electromagnetic properties are also “pigments“

Inorganic color pigments: e.g.
Titanium dioxide, Carbon black, Iron oxides, Metallics, Mica pigments

Organic color pigments:
Azo pigments
Polycyclic pigments (e.g. phthalocyanine, perylene)

Functional pigments: e.g.
Zinc phosphate (anti-corrosive)
Antimony-doped tin dioxide (conductive pigment)

Colorants which are soluble in the application medium are called “dyes“
Introduction to „Effect“

Specially designed optical multilayer films as well as parallel oriented effect pigments in an application medium can reflect a certain portion of the visible light.

Consequently, they can act as decorative or functional optical systems by directed reflection, multiple reflection, interference, and color travel.
pigment classes

**absorption pigments**
Specific color by **light absorption**
Hue/color does not change with angle
Color comes from the surface

**metal effect pigments**
Metallic gloss by **light reflection**
Brightness strongly depends on angle

**pearlescent pigments**
Specific color, gloss and color flop due to **interference effects**
Hue/color may have a strong dependence on angle
Colors come from the depth
pearlescent pigments

interference color

transmitted part of the light

layer with a high refractive index

transparent substrate with laminar structure
Interference effect

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Different particle size
Different particle size

Particle size distributions

<table>
<thead>
<tr>
<th>Size</th>
<th>Range</th>
<th>µm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>&lt; 15</td>
<td>µm</td>
<td>low gloss, very good hiding power</td>
</tr>
<tr>
<td>F</td>
<td>5 - 25</td>
<td>µm</td>
<td>silky gloss, good hiding power</td>
</tr>
<tr>
<td>N</td>
<td>10 - 40</td>
<td>µm</td>
<td>pearlescent, hiding</td>
</tr>
<tr>
<td>S</td>
<td>10 - 130</td>
<td>µm</td>
<td>shimmering, low hiding power</td>
</tr>
<tr>
<td>L</td>
<td>40 - 200</td>
<td>µm</td>
<td>glittering, non-hiding</td>
</tr>
</tbody>
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Advantages of Effect Pigments versus Extended Optical Films

- easy to incorporate in all relevant application systems
- many possibilities to blend effect pigments with other pigments
- textural effects caused by single particles
- different particle sizes vary optical and functional effect
- easy to manufacture with acceptable costs
- environmentally save to produce
- flexibility to equip surfaces with the desired effects by e.g. spraying,
- printing, extruding
Overview of Pearlescent Pigments

**iriodin**
- Natural raw material mica
- Limited control of the substrate properties

**xirallic**
- Substrate is produced synthetically
- Exact control of the substrate properties

**colorstream**
- Substrate is produced synthetically
- Exact control of the substrate properties

**miraval**
- Substrate is produced synthetically
- Exact control of the substrate properties
Merck’s effect toolbox

- natural mica substrate
- optimized natural mica substrate
- Al oxide substrate
- silica substrate
- glass flake substrate

- iriodin®: pearl luster effect pigments
- pyrisma®: effect pigments designed for coatings
- xirallic®: high chroma crystal effect pigments
- colorstream®: multicolor effect pigments
- miraval®: high sparkle effect pigments

- meoxal®: Luminous metal effect pigments
Coatings market applications

- Automotive OEM Coatings
- Automotive Repair Coatings
- Powder Coatings (architectural panels, window and door frames, furniture etc.)
- Plastic Coatings (for telecommunication and phono articles, automotive parts, sport utilities)
- Industrial Coating (metal furniture, cooking ware, domestic appliances etc.)
- Coil Coating (architectural building)
- Dispersion paints (decorative paints for indoor and outdoor on buildings)
- Leather Coatings (shoe, handbag, interior design and automotive interior)
- Wood Coatings (paint for wood indoor and outdoor, kitchen design and furniture)
- Artist paint (paint for professional and hobby artist)
Cross-section through a Weather Resistant Pearl Lustre Pigment

- Additional coating for external applications: Iriodin – Xirallic – Colorstream
- Florida Test – Humidity test - UV Light - TiO2 photo-activity
Basic Rules for Formulating

- Pearl pigments can be incorporated in all coating systems.
- Use the most transparent formulation possible:
  - the less opacity = the better is the effect, = lower is the concentration
- Opaque formulations = higher pigment levels. An excess of light scattering destroys pearlescence.
- Avoid grinding and milling of pearlescent pigments:
  - If mechanical stress on the pigments is too high, the pigment particles might break or the metal oxide layer might be removed from the mica platelet, resulting in loss of luster and color change.
- Pearlescent pigments disperse well without grinding due to their large particle size and the virtual absence of agglomeration.
Sedimentation

Mica/Metal oxide pigments have a density of approx. 3g/cm³ so they have a tendency to settle.

Easy re-dispersion (by simple stirring) is the most important requirement (no formation of a hard layer/cake)

⇒ Solutions

- Continual movement of the paint system during processing
- Use of suitable additives for easy re-dispersion, which have no negative effect on the pearl lustre.
Orientation:
Influence of the paint system on the appearance

- wet film

- dry film with low shrinking

- dry film with high shrinking

parallel orientation = good effect
in the transportation market
iriodin® in the transportation market
iriodin® in the transportation market
iriodin® in the transportation market
Merck’s effect toolbox

- Natural mica substrate
- Optimized natural mica substrate
- Al oxide substrate
- Silica substrate
- Glass flake substrate

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Improvement of color saturation with the “Merck Color Space” Concept

“Merck Color Space” is a concept based on color metric calculations for a given number of pigments that each possess at least one interference layer. The calculations help to determine their optimal hue angle for the largest possible gamut.
pyrisma® in the transportation market
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Xirallic® in the transportation market
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colorstream® in the transportation market
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colorstream® in the transportation market

xirallic®
in the transportation market
in the transportation market
stunning architecture
applications

dispersion paint

powder coating

coil coating

wood coating
iriadin® in dispersion paint
iriodin® in dispersion paint
iriodin® in powder coating

Frankfurt am Main, Germany / Main Tower
iriodin® in powder coating

Esslingent, Germany / Festo Building
iriodin® in powder coating

Darmstadt, Germany / Merck Pigments Building
iriodin® in powder coating

Barcelona, Spain / Torres Fira / Arch. Toyo Ito
colorstream® in coil coating
colorstream® in coil coating

Singen, Germany / School Cafetaria / Riede Architects
colorstream® in coil coating
colorstream® in coil coating

61 Ananti Club, Seoul, South Korea / Ken Min Architects
xirallic® in coil coating

Chongqing Zhong Yu Aiduhui - China
iriodin® in wood coating
consumer & lifestyle markets

- household appliances
- consumer goods
- sports goods
- fashion
iriodin® for household appliances
iriodin® for household appliances
xirallic® for household appliances
iriodin® for consumer goods
iriodin® for consumer goods
xirallic® for plastic coated consumer goods
xirallic® for plastic coated consumer goods
for leather coated sports goods
pyrisma® for sports goods

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meoxal® for sports goods
iriodin® for leather fashion
for leather fashion

\textbf{colorstream}®

\textbf{miraval}™
meoxal ® for leather fashion
Functional Pigments made by Merck

Two special product families provide specific functionalities to coatings applications:

minatec® Light conductive pigments
Minatec® conductive pigments

- Mica
- Sn/Sb-oxide

Particle size:
- Minatec® 31 CM
- Minatec® 51 CM
- Minatec® 40 CM
- Minatec® 60 CM
Conductivity range with Minatec®

Surface Resistance

- Metallic conductor
- Electromagnetic shielding
- Static-dissipative
- Antistatic behavior
- Insulators
Advantages of Minatec®

- permanent antistatic properties (in contrast to inorganic salts with hygroscopic properties)
- resistance to acids and bases
- resistance to organic solvents/ surfactants
- stability at temperature > 800°C
- easily dispersible in paint systems - simply by stirring
- Floorings containing Minatec® are reparable
Bright Floorings containing Minatec

Acrylate Resin Conductive Top Coat

14 weight-% Minatec® 40 CM
layer thickness: 500 µm
$R_E = 6 \cdot 10^4 \Omega$
Minatec 230 A-IR

- Special Pigment for use as additive

- Improves drying time for coatings in IR oven

- It is not color neutral, but quite nearly white formulation is possible
Infrared properties

IR-Absorption / Reflexion und Transmission

Reflection

Absorption

Transmission

Infrared Radiation

Absorption
Minatec 230 A-IR absorber pigment

Chemical: (Sn/Sb)O₂
Color: light grey
Morphology: spherical
Particle size: 1 µm (d₅₀)
Form: free flowing powder
Physical behavior: absorbs short wave infrared

A white which is black!

Novel absorber pigment
Minatec 230 A- IR: The Benefit

Reduce process costs
- Energy
- Lamps
- maintenance

Reducing Investment costs
- Equipment
- Building (dimensions)

Increase production speed
Increase flexibility
Improve handling performance
Merck SpA
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No One’s an Island!
This presentation was compiled with the help and presentation material prepared by my colleagues from Merck Technical Services Coatings.