# Lead free for our Environment

MONOLITE™ & VYNAMON™ & HEUCODUR® & VANADUR® & HEUCO® FIT LR & TICO®

heubach
COMPETENCE IN COLOR

**Lead chromates - alternatives**

Global use of lead chromates has significantly declined in recent years due to the toxicity of the pigments. However, due to the good price/performance ratio of lead chromates and the partial use of the pigments in color mixing systems, complete replacement has failed to occur so far.
Lead chromates are typically used to achieve good hiding power with a high brilliance level of the paint film. In fact, so far there is no individual pigment alternative for an exact 1:1 replacement of specific chrome yellow P.Y. 34 or molybdate red P.R. 104 pigments.
Hybrid pigments and customized pigment preparations are already being used successfully as alternatives to lead chromates. Classic pigments for such combinations include organic yellow and red pigment like Pigment Yellow 151 or Pigment Red 254 and some inorganic pigments like Pigment Brown 24 and Pigment Yellow 184.
In these combinations, the inorganic component contributes to achieving the hiding power, while the organic component is used to adjust the hue angle, chroma and color strength.

### Chroma and hue angle of the individual pigments

While the lead chromates have a chroma on the level of organic pigments, the inorganic colored pigments like P.Br. 24, P.Y. 53 are at a significantly lower level, with the exception of bismuth vanadate.

### Hiding power and color strength of the individual pigments

It is well known that the hiding power of paints and coatings is achieved with the help of inorganic pigments. This does not necessarily depend on the hiding power of the pigments themselves. If the same pigmentation levels are compared, certain organic pigments also exhibit good hiding power.

However, inorganic pigments typically exhibit lower oil absorption and can be used in a higher pigment concentration.

This is also reflected in the maximum pigment concentration that can be achieved by commercial pigment pastes. Correspondingly, higher opacity can be achieved with higher pigmentation in practical applications.

Organic pigments typically exhibit higher color strength than inorganic pigments. Therefore, organic pigments are ideally suited for compensating the deficient color strength of inorganic pigments.

### Light fastness and weather stability

The light fastness and weather stability of lead chromates depend on the types used and their surface stabilization. The majority of lead chromates used on the market are standard types.

Complex Inorganic Color Pigments (CICP) such as P.Y. 53 and P.Br. 24 exhibit excellent properties. Similar to lead chromates, organic pigments vary greatly in weather stability.

In selecting appropriate organic pigments, most of the requirements in this area can be resolved in addition. Cost-designed pigment preparations can replace standard lead chromates. Pigment preparations and hybrid pigments formulated with weather fast organic pigments are suitable alternatives to stabilized lead chromates and can even outperform standard products.

## MONOLITE™ and VYNAMON™

The **MONOLITE™** and **VYNAMON™** portfolio comprises a wide range of yellow and red organic pigments for high end industrial coating applications and superior quality plastic applications like tarpaulins and stadium seating. They can be used to achieve even higher chroma and brilliance than lead chromates.

Excellent overpainting as well as solvent, weather and light fastness make the high performance grades such as the green shade yellow **MONOLITE™** Yellow 115101 over the more medium shade **MONOLITE™** Yellow 115401 to the reddish Yellow **MONOLITE™** 113901 suitable for the most critical coating systems. On the red side the universal Pigment Red 254 as **MONOLITE™** 325402 offers excellent chroma in combination with good fastness properties to replace the lead molybdates.

In the field of plastic applications **VYNAMON™** Yellow 118303 and **VYNAMON™** Yellow 119101 are providing temperature resistances superior to lead chromates and give similar reddish yellow tones like the mid chromes.

The **VYNAMON™** Red 325401 can be used in all major plastic applications with high fastness requirements and could replace lead molybdate in the formulation. With its high colour strength it can be used in significantly lower concentration.

These organic grades are also ideally suited for standard formulations. For example, they can be used in combination with the **HEUCODUR®** Yellow pigments as lead chromates and lead molybdate replacements yielding outstanding hiding power, gloss and chroma.

| Product | Full Shade | Fastness Properties | | | Applications | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Weather | Over-painting | Heat Res. [°C] | Automotive Coatings | General Industrial | Decorative Coatings | Coil Coatings | Powder Coatings | Plastics |
| MONOLITE™ Yellow 115101 Pigment Yellow 151 | | 5 [6] | 5 [1] | 170 [3] | ●● | ●● | ●● | | | |
| MONOLITE™ Yellow 107407 Pigment Yellow 74 | | 4 - 5 [7] | 4 [2] | 140 [4] | | ●● | ●● | | | |
| MONOLITE™ Yellow 115401 Pigment Yellow 154 | | 5 [6] | 4 - 5 [1] | 160 [3] | ●● | ●● | ●● | | ● | |
| MONOLITE™ Yellow 108304 [5] Pigment Yellow 83 | | 3 [7] | 5 [2] | 150 [4] | | ●● | ●● | | | |
| MONOLITE™ Yellow 113901 Pigment Yellow 139 | | 3 - 4 [6] | 5 [1] | 180 [3] | ●● | ●● | ●● | ●● | ●● | |
| MONOLITE™ Red 325402 Pigment Red 254 | | 5 [6] | 5 [1] | 200 [3] | ●● | ●● | ● | ●● | ● | |

| Product | Full Shade | Technical Information | | | Applications | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Specific Surface [m²/g] [8] | Fastness to Migration [9] | Heat Resistance [°C] [10] | Automotive Coatings | General Industrial | Decorative Coatings | Coil Coatings | Powder Coatings | Plastics |
| VYNAMON™ Yellow 118303 Pigment Yellow 183 | | 22 | 5 | 320 | | | | | ●● | ●● |
| VYNAMON™ Yellow 119101 Pigment Yellow 191 | | 19 | 5 | 320 | | | | | ●● | ●● |
| VYNAMON™ Red 325401 Pigment Red 254 | | 27 | 5 | 320 | | | | | ●● | ●● |

Due to the limitation of printing process, some slight variations between the color as illustrated may be observed. ●● Our Recommendation ● Potential Use

[1] Pigments were tested in an alkyd/melamine system with 30 minutes baking time at 160 °C.
[2] Pigments were tested in a 2C-acrylate system with 30 minutes baking time at 80 °C.
[3] Pigments were tested in an alkyd/melamine system.
[4] Pigments were tested in a 2C-acrylate system.
[5] Diarylide pigments should not be used at processing temperatures exceeding 200° C due to potential cleavage to 3,3' - dichlorobenzidine (DCB) under these conditions.
[6] Weathering fastness was tested in a waterborne automotive system. Assessment with Grey Scale according to DIN EN ISO 20105-A02 after 4800h accelerated weathering (Xeno). Rating: 1 = poor, 5 = very good.
[7] Weathering fastness was tested in in a 2C- acrylate system. Assessment with Grey Scale according to DIN EN ISO 20105-A02 after 1000h accelerated weathering (Xeno). Rating: 1 = poor, 5 = very good.
[8] According to [DIN 66132]
[9] According to [DIN EN 14469-4]
[10] [1/3 SD], according to [DIN EN 12877-2]



## HEUCODUR® and VANADUR®

Inorganic pigments from our product range of **HEUCODUR®** and **VANADUR®** can be considered as the backbone for lead pigment replacement.
Nickel rutile (P.Y. 53) and chrome rutile (P.Br. 24) pigments are based on the rutile crystal structure of titanium dioxide. These types of pigments offer outstanding hiding power, light fastness and resistance to temperature, chemicals and weathering resulting in a broad application range for coatings, plastics, concrete, ceramics etc.
By variation of the composition, the calcination time and/or temperature a number of different colors can be achieved.
In combination with organic pigments like **VYNAMON™** (for plastics) or **MONOLITE™** (for coatings) the nickel and chrome rutiles impart the hiding power while the organic pigments enhance color saturation.
These combinations are an ideal choice for lead pigment replacements.

Typical pigments for lead replacement are **VANADUR® 1010** and **VANADUR® 2108**. These are green shade bismuth vanadate pigments with outstanding application properties like improved opacity, high gloss, excellent weather and light fastness and good tinting strength.
**VANADUR® 2108** is based on a zinc-free technology and features an extraordinary high tinting strength.
Both grades are dedicated to waterborne as well as solvent based paint systems.
For lead pigment replacement **VANADUR®** is used for hiding power and brilliance and is shaded with organic pigments for color adjustment.
For applications demanding higher temperature (e.g. plastics applications) or chemical resistance (e.g. $SO_2$- Resistance in industrial areas) **VANADUR® PLUS 9010** (green shade) with a silica encapsulation is recommended.

| Product | Full Shade | Fastness Properties | | | Applications | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Weather [4] | Over-painting | Heat Res. [°C] [1] | Automotive Coatings | General Industrial | Decorative Coatings | Coil Coatings | Powder Coatings | Plastics |
| HEUCODUR® Yellow 152 (C) or (P) Pigment Yellow 53 | | 5 | 5 | 800 | ●● | ●● | ●● | ●● | ●● | ●● |
| HEUCODUR® Yellow 156 (C) or (P) Pigment Yellow 53 | | 5 | 5 | 800 | ●● | ●● | ●● | ●● | ●● | ●● |
| HEUCODUR® Yellow G 9082 (C) or (P) Pigment Yellow 53 | | 5 | 5 | 800 | ●● | ●● | ●● | ●● | ●● | ●● |
| HEUCODUR® Yellow 3R (C) or (P) Pigment Brown 24 | | 5 | 5 | 600 | ●● | ●● | ●● | ●● | ●● | ●● |
| HEUCODUR® Yellow G 9239 (C) or (P) Pigment Brown 24 | | 5 | 5 | 800 | ●● | ●● | ●● | ●● | ●● | ●● |
| HEUCODUR® Yellow 6R (C) or (P) Pigment Brown 24 | | 5 | 5 | 800 | ●● | ●● | ● | ●● | ●● | ●● |

| Product | Full Shade | Fastness Properties | | | Applications | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Weather [4] | Over-painting | Heat Res. [°C] | Automotive Coatings | General Industrial | Decorative Coatings | Coil Coatings | Powder Coatings | Plastics |
| VANADUR® 2108 (C) Pigment Yellow 184 | | 4 - 5 | 5 | 200 [2] | ●● | ●● | ●● | ● | ● | |
| VANADUR® 1010 (C) Pigment Yellow 184 | | 4 - 5 | 5 | 200 [2] | ●● | ●● | ●● | ● | ● | |
| VANADUR® PLUS 9010 (C) or (P) Pigment Yellow 184 | | 5 | 5 | 300 [3] | ●● | ●● | ●● | ●● | ●● | ●● |

(C) or (P): C = specified for Coatings, P = specified for Plastics
Due to the limitation of printing process, some slight variations between the color as illustrated may be observed.

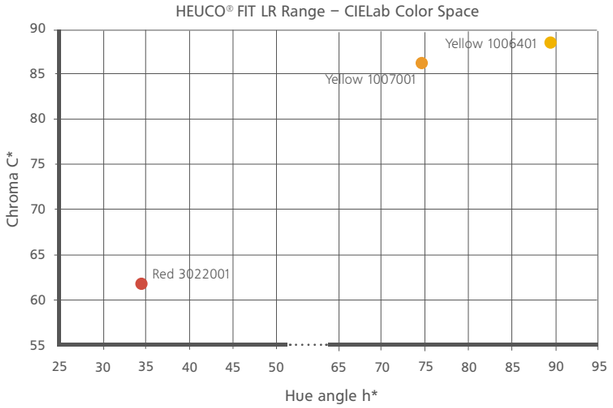
●● Our Recommendation ● Potential Use

[1] Visual judgement of the powder after 30 min. calcination. (AA-00170)
[2] Pigments were tested in an alkyd / melamine system with 30 minutes baking time. Temperature range 140 °C to 200 °C.
[3] Heat Res. in HDPE (5 min) on extruder. (AA-00366)
[4] Weathering fastness was tested in a waterborne acrylic resin system. Assessment with Grey Scale according to DIN EN ISO 20105-A02 after 2000h accelerated weathering (Xeno). Rating: 1 = poor, 5 = very good.

## HEUCO® FIT LR

The search for an alternative solution approach has led to the development of specifically designed dry pigment preparations. These are multiple pigment preparations in powder form that have been developed alongside the special market requirements in a targeted fashion. Thus they permit smart – i.e. rapid and cost-effectiv formulation.

The „HEUCO® FIT Lead Replacement" dry pigment preparations have been developed for direct 1:1 replacement of chrome yellow and molybdate red pigments. In selecting the pigments, the focus was on a good balance of the colorimetric properties and the hiding power in the near-full shade color range.
This is particularly interesting in the area of industrial coatings, since good substrate hiding by a one-coat application of the paint with low layer thickness is necessary. The visual assessment of the full shade coat confirms the good conformity found colorimetrically. These cost-designed pigment preparations meet most of the requirements of general industrial and plastics applications including agricultural, construction and earthmoving equipment (ACE).




| Products for Coatings | Full Shade | Fastness Properties | | | Application | |
|---|---|---|---|---|---|---|
| | | Weather [1] | Overpainting [2] | Heat Resistance [°C] [3] | General Industrial | Plastics |
| HEUCO® FIT LR Yellow 1006401 [4] | | 4 | 5 | 150 | ●● | |
| HEUCO® FIT LR Yellow 1006402 [4] | | 3 - 4 | 4 | 150 | ●● | |
| HEUCO® FIT LR Yellow 1007001 [4] | | 4 | 5 | 150 | ●● | |
| HEUCO® FIT LR Yellow 1007002 [4] | | 4 | 4 | 150 | ●● | |
| HEUCO® FIT LR Red 3022001 | | 4 - 5 | 5 | 170 | ●● | ● |
| HEUCO® FIT LR Red 3022002 | | 4 - 5 | 5 | 170 | ●● | ● |

| Products for Plastics | Full Shade | Fastness Properties | | | Application | |
|---|---|---|---|---|---|---|
| | | Weather [5] | Migration [6] | Heat Resistance [°C] [7] | General Industrial | Plastics |
| HEUCO® FIT LR Yellow 1006401P | | 3 - 4 | 5 | 280 | | ●● |
| HEUCO® FIT LR Yellow 1007001P | | 3 - 4 | 5 | 280 | | ●● |

Due to the limitation of printing process, some slight variations between the color as illustrated may be observed. ●● Our Recommendation ● Potential Use

[1] Weather Fastness: Data on resistance to artificial xeno weathering (DIN EN ISO 16474-2, procedure A, cycle 1) is determined in a 2-comp. polyurethane test system after 2000 hours weathering time. Rating of change in color in accordance with DIN EN ISO 105-A02.
[2] Overpainting: Bleeding was rated, of a white alkyd-melamine topcoat on a pigmented 2-comp. acrylate base coat in accordance with DIN EN ISO 105-A02.
[3] Heat Resistance: Pigment was exposed at different temperatures up to 250°C in a 2-comp. acrylate base coat for 30 minutes. Temperature, above which, a noticeable shade change can be observed.
[4] Pigments partially contain P.Y. 83 and should not be used at processing temperatures exceeding 200°C due to potential cleavage to 3,3' - dichlorobenzidine (DCB) under these conditions.
[5] Weather Fastness: Data on resistance to artificial xeno weathering (DIN EN ISO 4892-2, cycle 1, climate M) is determined in a rigid PVC test system after 2000 hours weathering time. Rating of change in color in accordance with DIN EN ISO 105-A02.
[6] Migration: Migration was tested in a plasticized PVC system and rated in accordance with DIN EN ISO 105-A02.
[7] Heat Resistance: Pigment was exposed in an injection moulding process at different temperatures up to 300°C in a HDPE testing system according to DIN EN 12877-2, procedure B.



## TICO®

TICO®s are a new class of high performance yellow, orange and red pigment preparations.
These titanium based colorants exhibit maximum gloss, opacity, strength and durability, which cannot be achieved with today's well established blends of organic high performance pigments and white / yellow titanium or bismuth vanadate pigments.

### Pigment morphology

TICO® hybrid pigments are a combination of a specially micronized complex inorganic color pigmentary core particle and an organic colorant attached to the surface of the core particle.

As a result TICO®s develop full color saturation and high gloss, low dusting properties and are easy to disperse.

### Outstanding processing characteristics

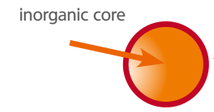
High performance organics and inorganic pigments differ significantly with respect to their surface characteristics and their specific weights.

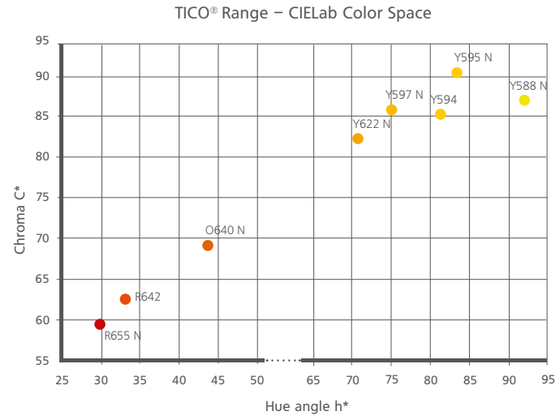
The new technology resolves this problem by its hybrid morphology. TICO® preparations exhibit a significantly reduced dusting during its handling which is the best basis for a perfect manufacturing hygiene.

Due to the pre-dispersed state of its components the TICO® technology also allows significantly shorter grinding times more comparable to that of pure inorganic pigments and less risk for overgrinding and color shift. In comparsion to straight blends the oil absorption can be greatly decreased allowing for high pigment loading in colorant pastes.

### Application areas

TICO® hybrid pigments can be used with the majority of the commonly used binder types. The main application areas are:
› Automotive Coatings
› General Industrial Coatings
› Plastics




| Product | Full Shade | Fastness Properties | | | Applications | | |
|---|---|---|---|---|---|---|---|
| | | Weather [2] | Over-painting [3] | Heat Res. [°C] [4] | Automotive Coatings | General Industrial | Plastics |
| TICO® Yellow 588 N | | 5 [5] | 5 | 170 | ●● | ●● | ● |
| TICO® Yellow 594 [1] | | 5 [5] | 5 | 200 | ●● | ●● | |
| TICO® Yellow 595 N | | 5 [5] | 2 | 140 | | ●● | |
| TICO® Yellow 597 N [1] | | 5 [5] | 4 - 5 | 170 | ●● | ●● | |
| TICO® Yellow 622 N [1] | | 5 [5] | 4 - 5 | 200 | ●● | ●● | |
| TICO® Orange 640 N | | 5 [5] | 4 - 5 | 220 | ●● | ●● | ● |
| TICO® Red 642 [1] | | 5 [5] | 5 | 230 | ●● | ●● | |
| TICO® Red 655 N | | 5 [5] | 5 | 220 | ●● | ●● | ● |

Due to the limitation of printing process, some slight variations between the color as illustrated may be observed. ●● Our Recommendation ● Potential Use

[1] Pigments partially contain P.Y. 83 and should not be used at processing temperatures exceeding 200°C due to potential cleavage to 3,3' - dichlorobenzidine (DCB) under these conditions.
[2] Weather Fastness: Data on resistance to artificial xeno weathering (DIN EN ISO 16474-2, procedure A, cycle 1) is determined in a 2-comp. polyurethane test system after 2000 hours weathering time. Rating of change in color in accordance with DIN EN ISO 105-A02.
[3] Overpainting: Bleeding was rated, of a white alkyd-melamine topcoat on a pigmented 2-comp. acrylate base coat in accordance with DIN EN ISO 105-A02.
[4] Heat resistance: Pigment was exposed at different temperatures up to 250°C in an alkyd-melamine baking system for 30 minutes. Temperature, above which, a noticeable shade change can be observed.
[5] Weather Fastness: Data on resistance to artificial xeno weathering (DIN EN ISO 16474-2, procedure A, cycle 1) is determined in a waterborne acrylic resin test system after 2000 hours weathering time. Rating of change in color in accordance with DIN EN ISO 105-A02.

## Our Service

At Heubach, customer satisfaction comes first. As a supplier of high-quality pigment and pigment preparation solutions we support our customers anywhere where pigments are in use.

With active service centers both globally and regionally we provide our customers with the technical support essential for the implementation of customer-specific requirements and solutions.

Fully equipped technical laboratories and centers enable us to carry out tests for all relevant applications, such as printing inks, paints and coatings, including corrosion protection, coil and powder coatings and plastics.

Custom color adjustments play a significant role both in coatings and plastics applications.

We have extensive expertise in the development of colors for a variety of plastics, paint and coating systems. Depending on fastness properties, application or processing requirements, we can deliver the right color for your application, plastic compounds or even a specific paint system.

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