Inorganic Pigments

HEUCODUR® YELLOW

Does Yellow beat White?
New Options - New Chances

heubach
COMPETENCE IN COLOR

Does Yellow Beat White?

Formulating a high performance coating system has become an every day challenge. Not only do the technical requirements need to be met, but more and more, economic aspects need to be considered as well.

To meet these challenges, innovative new ideas and concepts in formulating high performance coatings are required.

By optimizing the well known chrome and nickel rutile yellow chemistries, which exhibit outstanding fastness and durability, a new class of pigments has been obtained offering a versatile tool for formulating economic and innovative coatings.

Customers who use these new formulations are achieving 25-30% savings and at the same time receiving improved performance.

The improvement is accomplished by an innovative and proprietary technology to micronize the pigments while keeping their excellent weather and light fastness as well as their exceptional temperature resistance.

The Pigments

Typically chrome and nickel rutile yellows show an average particle size of ›1 µm. After micronizing, a smooth and controlled downsizing of pigment particles, the average particle size is about 0.3µm (Fig. 1).

This micronization technique produces a narrow particle size distribution of spherical shaped pigment particles (Fig. 2), which enhances hiding power as well as opacity, but also reduces the abrasiveness significantly.

A detailed overview of several pigments optimized by this new micronization technique and some of their properties is given in Tab. 1.

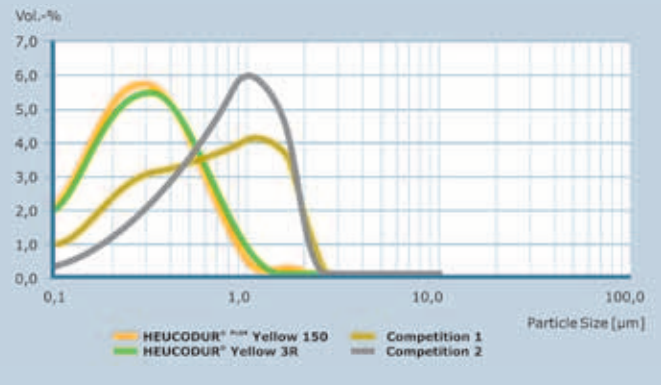

Fig. 1 *Particle size distribution of different rutile yellow pigments*

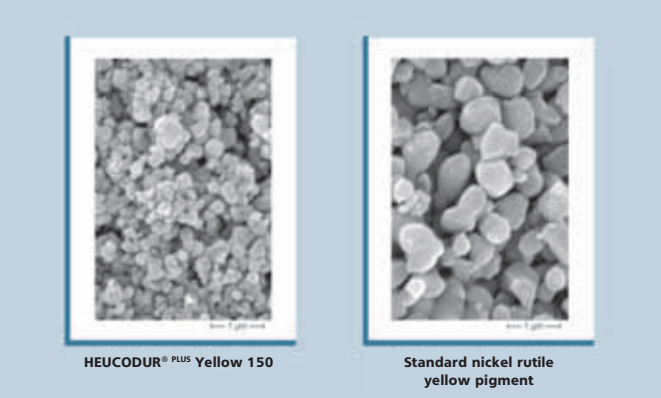

Fig. 2 *Scanning electron micrographs (SEM; 1:10000)*

Micronized Rutile Yellow Pigments

Product	Color Index	Average Particle Size	BET [m²/g]	Oil Absorption	Weather Fastness	Light Fastness
HEUCODUR® Yellow 3R	P.Br. 24	0.1 - 0.2	5.2	20	5	8
HEUCODUR® Yellow 6R	P.Br. 24	0.3	3.9	25	5	8
HEUCODUR® PLUS Yellow 150	P.Y. 53	0.3	4.2	16	5	8
HEUCODUR® PLUS Yellow 154	P.Y. 53	0.2	4.0	17	5	8

Tab. 1 *Overview of micronized rutile yellow pigments*

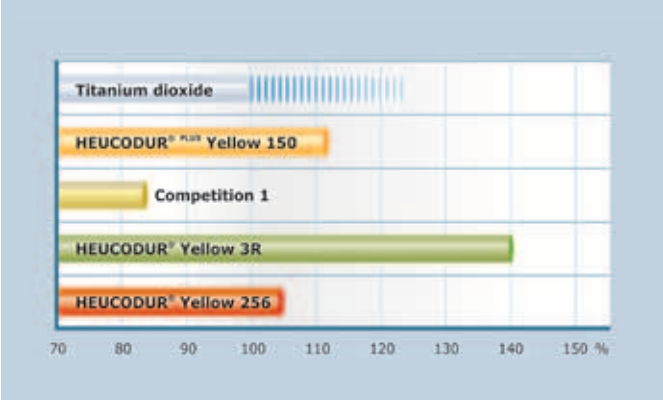

Fig. 3 *Hiding power of different rutile yellow pigments relative to a high performance titanium dioxide*

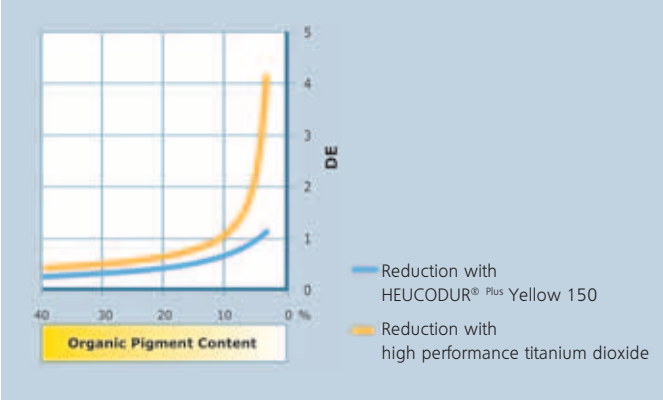

Fig. 4 *Accelerated weathering results after 2000h Xenon test of formulations based on DPP Red (P.R. 254)*

The Performance

In modern coatings systems the high performance of these types of inorganic pigments are a key asset. This is especially seen when they are used in combination with organic pigments where the hiding power and opacity of the inorganic pigments are crucial.

In this case, the micronized grades with their unique hiding power will outperform well known competitive grades or 'conventional' chrome and nickel rutile yellows. Depending on the system they might even be able to show a better or at least equivalent hiding power than high performance titanium dioxide grades (Fig. 3).

This exclusive property of the rutile yellow pigments allows substituting titanium dioxide in formulations by achieving higher cost efficiency. Tab. 2 and 3 show two examples of customary industrial coatings color shades.

In addition to the possible cost savings of about 25% the new formulations based on the micronized rutile yellow pigments provide further valuable benefits.

By deploying the new micronized grades in combination with high performance organic pigments the weather fastness of the organic pigments will be significantly improved (Fig. 4).

Signal Yellow (RAL 1003)

Formulation	Conventional	New
Benzimidazolone Yellow (P.Y. 151)	51.5%	35.0%
Diarylide Yellow (P.Y. 83)	13.5%	5.2%
Iron Oxide Yellow	13.0%	6.5%
High Performance Titanium Dioxide	22.0%	
HEUCODUR® PLUS Yellow 150		38.0%
Chrome Rutile Yellow		15.3%
Cost Ratio	1	0.78

Tab. 2 *Alternative "Signal Yellow" formulations and the comparative cost factor*

Salmon Orange (RAL 2012)

Formulation	Conventional	New
DPP Red (P.R. 254)		3.8%
DPP Orange (P.O. 73)	16.0%	
Iron Oxide Red	6.0%	
High Performance Titanium Dioxide	22.0%	
HEUCODUR® PLUS Yellow 150		56.0%
Chrome Rutile Yellow	33.0%	40.2%
Cost Ratio	1	0.75

Tab. 3 *Alternative "Salmon Orange" formulations and the comparative cost factor*

This improvement is based upon the drastically reduced photo catalytic effect and the absorption of the critical electromagnetic short wave radiation; even when compared to super durable titanium dioxide grades the degradation of the organic pigments will be diminished radically. Hence it is possible to realize higher flexibility in selecting the organic pigment components.

The controlled and optimized particle size distribution of the micronized rutile yellow pigments in combination with their spherical shape allows higher gloss values for brilliant and glossy coatings (Fig. 5).

These optimized pigments also show a reduced abrasiveness. The formulator will see this in a reduction of process costs as well as an easier processability and handling of the micronized rutile yellows (Fig. 6).

In the segment of high-value industrial coatings the formulators focus is not only on the coloristic properties of pigments or their light- and weather fastness, but also on their ease of stabilization in the coatings system.

The challenge is to control the economic efficiency positively while maintaining a maximum of application-oriented flexibility and compatibility of the formulation.

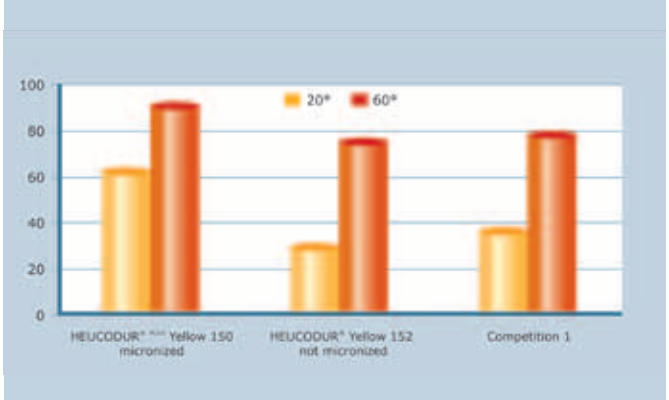

Fig. 5 *Gloss values of different nickel rutile yellows in a solvent-borne alkyd system (pigmentation 20%)*

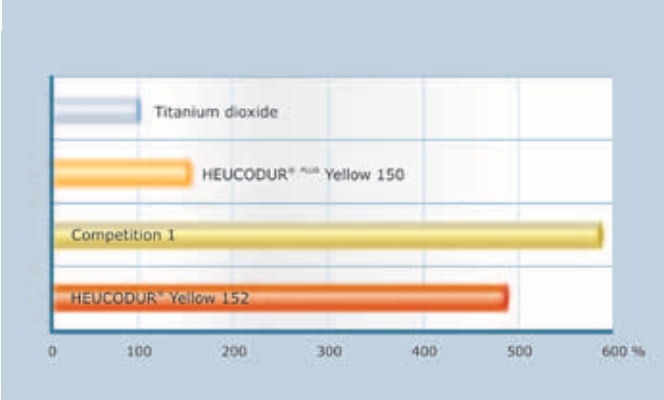

Fig. 6 *Comparison of the abrasiveness of different nickel rutile yellows in relation to a high performance titanium dioxide*

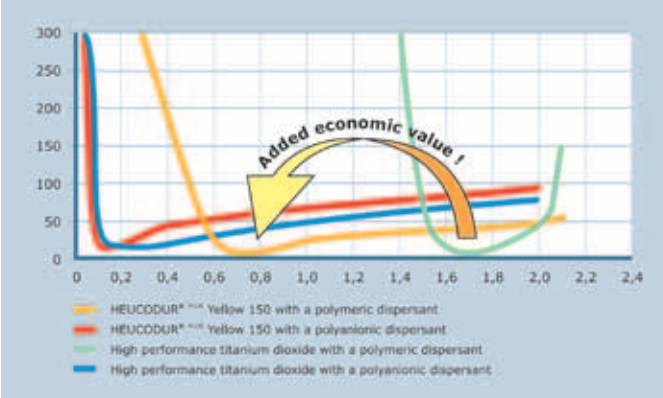

Fig. 7 *Dispersant demand of HEUCODUR® PLUS Yellow 150 in relation to a high performance titanium dioxide with different comercially available dispersants.*

During the development of pigment preparations or multifunctional intermediates it is essential to base the formulations on the excellent ability of pigments in relation to their stabilization by additives.

Therefore the efficient and economic use of valuable dispersing and stabilising additives is the key to successful formulations.

In this regard the micronized rutile yellow pigments show an outstanding performance.

Fig. 7 displays the dispersant demand of common commercially available additives of HEUCODUR® PLUS Yellow 150 in relation to a super durable titanium dioxide pigment.

The comparison reveals a striking advantage of the new micronized pigments. The potential savings of dispersant is 40-60% compared to the use of titanium dioxide.

The selected replacement of titanium dioxide with the micronized rutile yellow pigments leads to a higher economic efficiency along with a reduced use of additives.

This allows for a higher compatibility with a multitude of different coating systems.

Sunflower Yellow

Formulation	Conventional	New
HEUCODUR® PLUS Yellow 150		58.0%
Benzimidazolone Yellow (P.Y. 151)		26.0%
Diarylide Yellow (P.Y. 83)		8.0%
Isoindoline Yellow (P.Y. 139)	6.0%	
Bismuth Vanadate (P.Y. 184)	91.0%	
Titanium Dioxide	3.0%	
Cost Ratio	1	0.55

Tab. 4 *Alternative "Sunflower Yellow" formulations and the comparative cost factor*

Brilliant Orange

Formulation	Conventional	New
DPP Orange (P.O. 73)		24.0%
Benzimidazolone Yellow (P.Y. 151)		24.0%
Benzimidazolone Orange (P.O. 62)	80.0%	
Naphthol Red (P.R. 188)	8.0%	
HEUCODUR® PLUS Yellow 150		30.0%
HEUCODUR® Yellow 6R		22.0%
Iron Oxide	2.0%	
Titanium Dioxide	10.0%	
Cost Ratio	1	0.63

Tab. 5 *Alternative "Brilliant Orange" formulations and the comparative cost factor*

New Options - New Chances

These novel micronized rutile yellow pigments are proving to be true high performers in modern coating formulations. Besides their well known exceptional properties like weather and light fastness or temperature resistance they offer the formulator integral features, that are most essential in formulating high performing, cost-conscious coatings.

The features include outstanding hiding power and opacity, reduced abrasiveness and the significantly beneficial dispersant demand compared to other pigments like titanium dioxide. This allows for a higher degree of flexibility and a higher technological compatibility.

Therefore, these new pigments are an excellent alternative to the widely-used titanium dioxide pigments.

Modern rutile yellow pigments combine synergistic as well as economic advantages to give the formulators the tool they need to develop high performance economically feasible formulations.

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