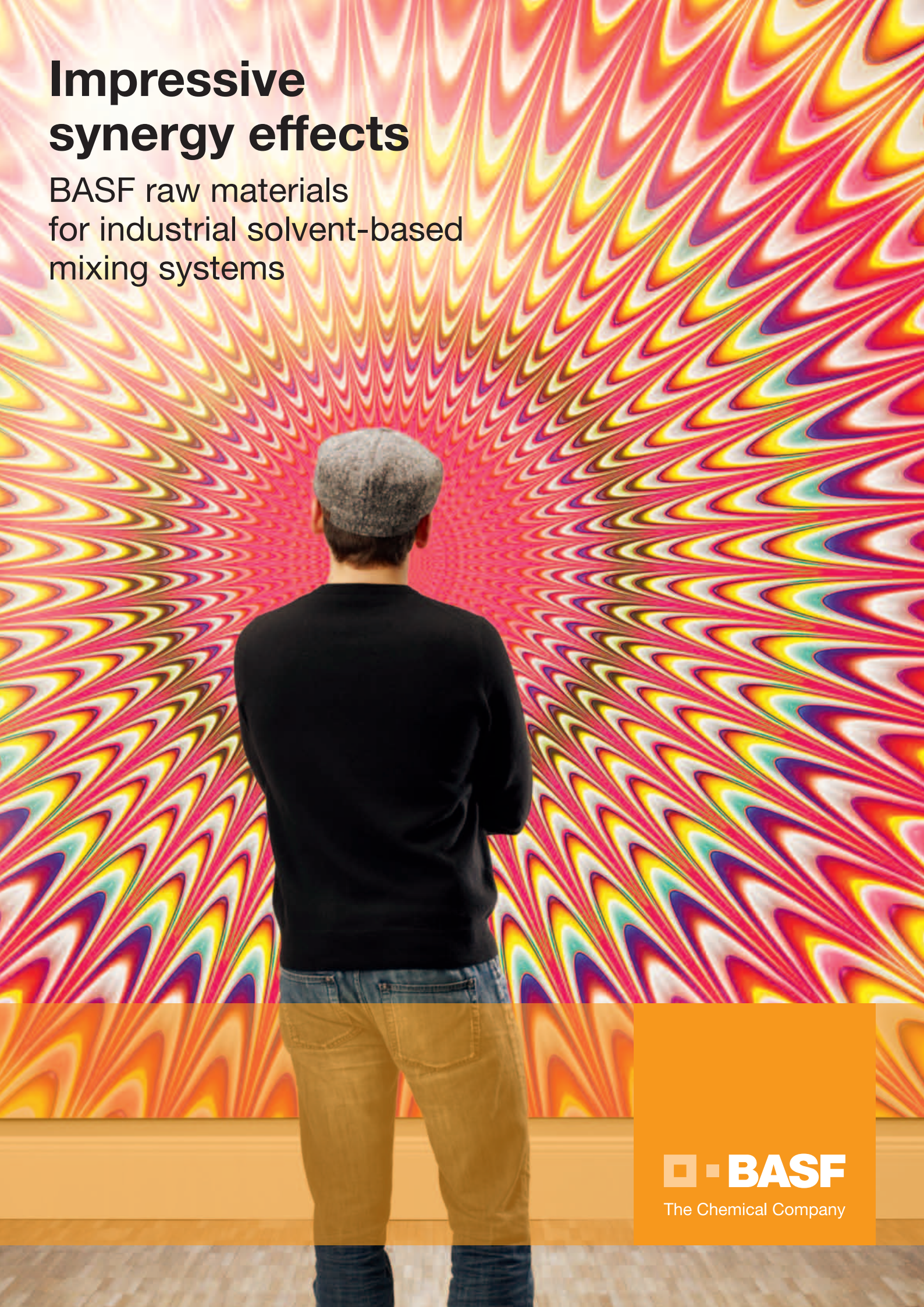
# Impressive synergy effects

## BASF raw materials for industrial solvent-based mixing systems



BASF
The Chemical Company

# Top quality and excellent performance, every time

## Introduction to industrial solvent-based mixing systems

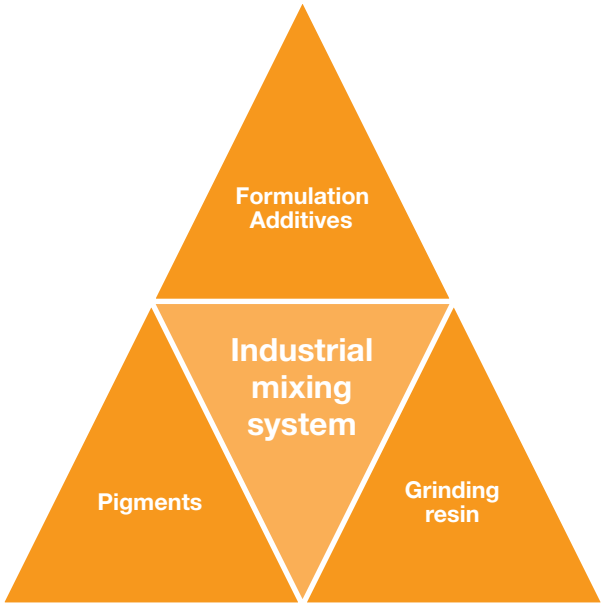
BASF offers the world's broadest portfolio of raw materials for the paint industry. Our pigments, resins and formulation additives enable paint manufacturers to produce high-quality pigment dispersions for industrial mixing systems. The greatest advantage we offer is consistently high quality. Whether pigments, formulation additives or grinding resins, we actually produce all the necessary raw materials. This gives us complete control over the manufacturing process and enables us to guarantee the quality of all our products. In addition, all ingredients are balanced to achieve the best results, whether produced on a lab or production scale.

Industrial users and retail consumers are becoming ever more demanding. Not only do they want more color choice, they also demand speed, reliability, accurate color reproduction and flexibility. BASF raw materials for industrial mixing systems help you meet all these challenges.

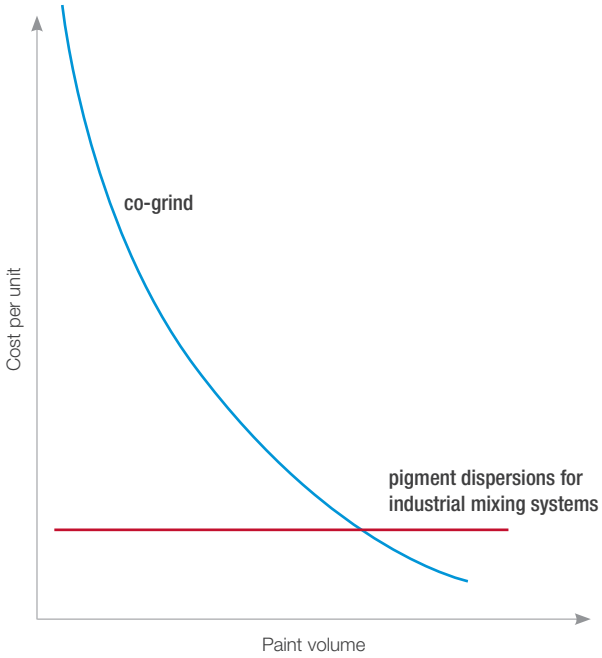
In principle, there are two ways of creating colors, both requiring pigments, formulation additives and a grinding resin. In the conventional process, pigments are directly ground together to obtain a single color. This process is only economic for so-called 'corporate' colors that are produced in large quantities. Where more colors in small quantities are required, the mixing system is the more flexible and economic solution. In this system, multiple pigment dispersions are mixed into a white, colored or transparent base paint to achieve a full color palette. Mixing systems are ideal for end-customers who want a wide variety of colors in various paint qualities. Whatever your goal, BASF has the product range, quality control and experience to optimize your production processes.

**So if one supplier can provide everything you need to produce pigment dispersions, that's because at BASF, we create Chemistry.**

## Tinting concept – economic advantages




BASF's comprehensive range of raw materials for industrial mixing systems




Pigment dispersions for industrial mixing systems: more economic and more flexible

**Our wide range of solutions for industrial mixing systems maximizes the color palette you can offer your customers while driving down costs. BASF products can be used to enhance color stability, reduce viscosity, improve pigment loading and more.**

# The grinding resin

## Laropal® A 81

This aldehyde resin has an established reputation as a high-quality grinding resin. Its outstanding compatibility with all the main binders and organic solvents used in industrial coatings makes it the preferred solution for universal mixing systems and pigment pastes alike.

When combined with Efka® dispersing agents by BASF (see page 6), it enables the formulation of pigment pastes with high pigment loading, excellent color strength and good flow behaviour combined with the highest stability.
Laropal® A 81 does not yellow and is highly resistant to the effects of humidity and temperature. This means that it can be used for all outdoor applications in 1K-acrylic, 2K-PU or stoving systems. Laropal® A 81 aldehyde resin by BASF is a world-class binder, for producing highly compatible solvent-based pigment pastes.

### Typical properties of Laropal® A 81

| | |
|---|---|
| Delivery form | solid / pellets |
| Softening temperature | 80 - 95 °C |
| Iodine color number | ≤ 3 |
| Acid value | ≤ 3 mg KOH/g |
| Density at 20 °C | ~ 1,11 g/cm³ |
| Hydroxyl value | ~ 40 mg KOH/g |
| Saponification value | ~ 65 mg KOH/g |
| Glass transition temperature Tg | ~ 57 °C |

### Solubility of Laropal® A 81

| | |
|---|---|
| alcohols | ■ |
| esters | ■ |
| ketones | ■ |
| aromatic hydrocarbons | ■ |
| aliphatic hydrocarbons | ■ |

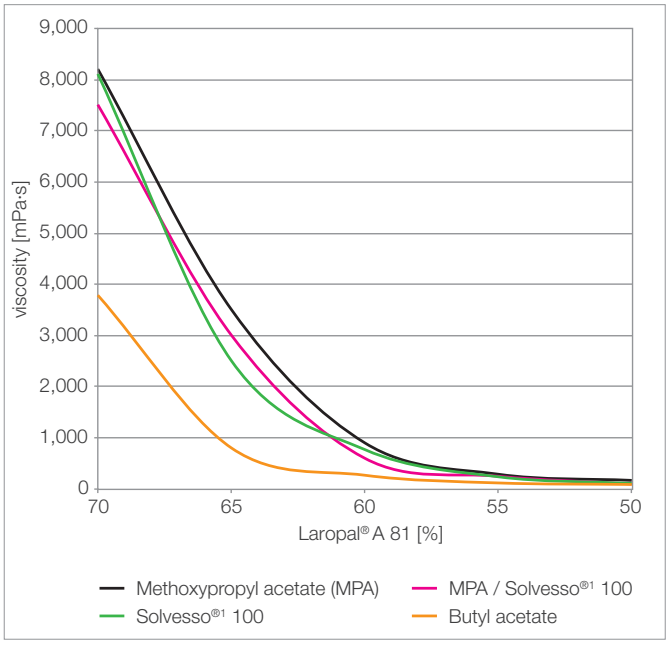
■ soluble
■ solutions tend to separate at temperatures below 15 °C (59 °F); adding 2 - 5 % of an aromatic solvent produces stable solutions

### Compatibility of Laropal® A 81

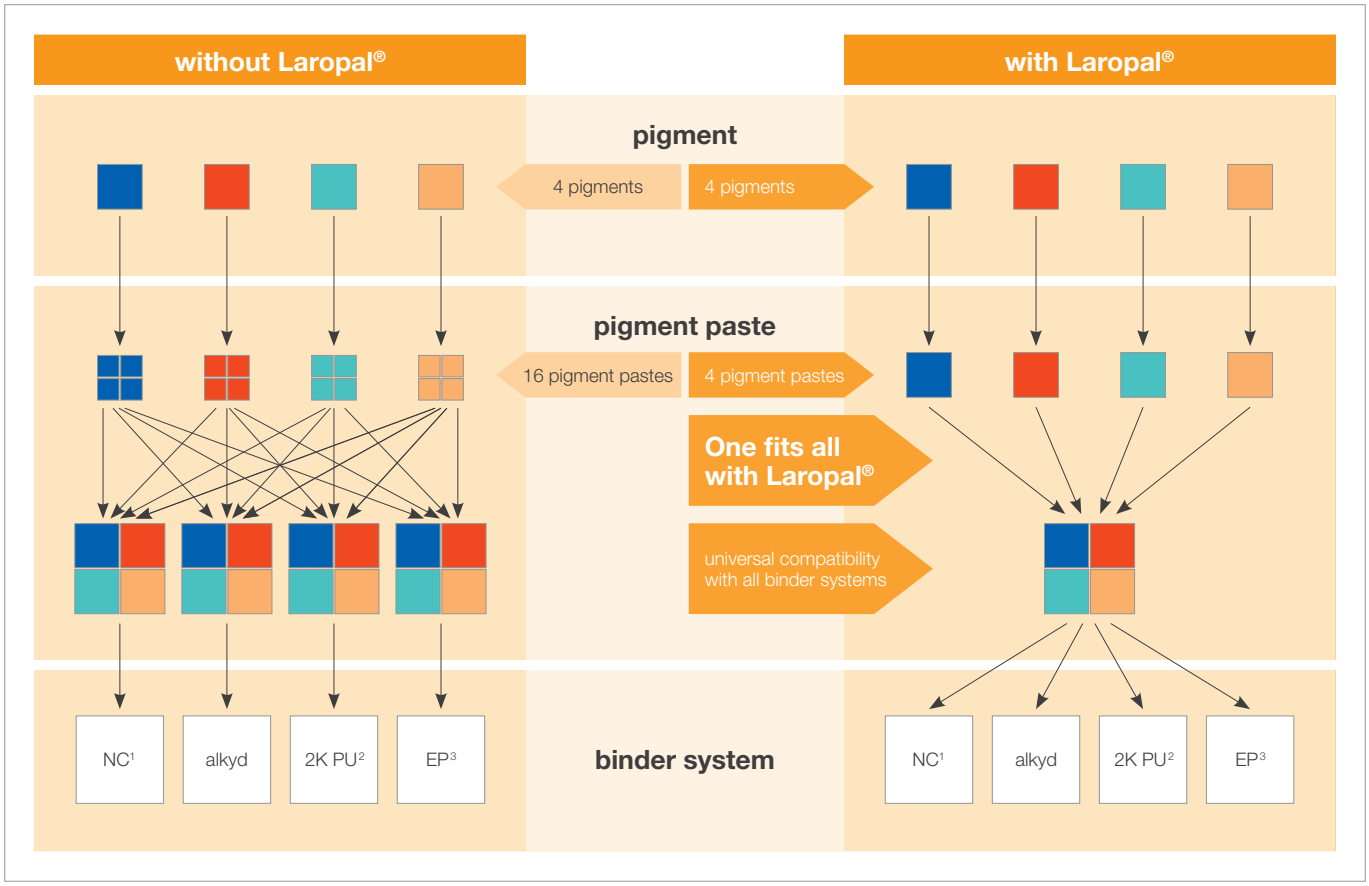
| | |
|---|---|
| cellulose nitrate | ■ |
| ethyl cellulose | ■ |
| cellulose acetobutyrate | ■ |
| chlorinated rubber | ■ |
| VC copolymers | ■ |
| acrylic resins | ■ |
| urea-formaldehyde resins | ■ |
| melamine-formaldehyde resins | ■ |
| alkyd resins | ■ |
| epoxy resins | ■ |
| hydrocarbon resins | ■ |

■ compatible ■ limited compatibility

### Viscosity profiles of Laropal® A 81 in various solvents



## One fits all – Laropal®, the universal grinding resin for mixing systems




[1] nitrocellulose [2] two component polyurethane [3] epoxy

**BASF's universal Laropal® grinding resin is compatible with all the latest mixing systems. As well as increasing the efficiency of your mixing processes, this highly flexible product reduces inventory and saves you time, space and money.**

# The dispersing agent

## Efka®

Dispersing agents play a central role in pigment performance. Pigment dispersing is a key step in the paint preparation process. It involves expensive pigments, consumes energy and largely determines the properties of the final coating. To maximize the color strength, it is necessary to use dedicated pigment dispersants. This is especially true for high-performance coatings.

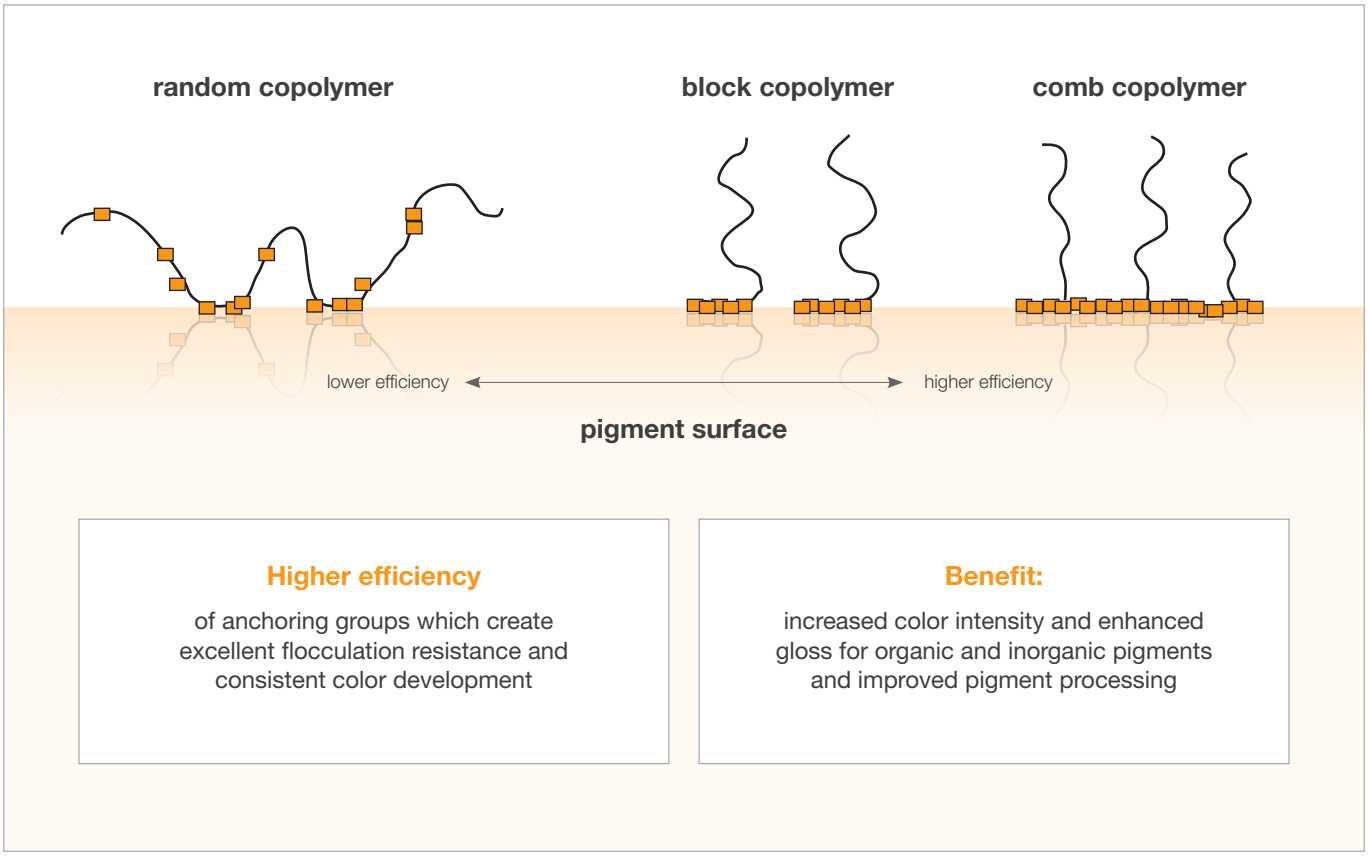
Dispersing agents provide color strength, gloss and stable viscosity whilst preventing particle sedimentation. They are used to wet and stabilize pigments and other particles within paints and coatings formulations.

Dispersing agents facilitate the pigment processing step by enabling high pigment loading. At the same time, they provide a low-viscous mill base that is resistant to flocculation. In addition, dispersing agents need to be compatible with a broad range of resin systems to maximize the coloristic properties in the final coating. This compatibility is achieved in combination with Laropal® by BASF.

To meet the high requirements of the industrial processes industry, BASF offers a new CFRP* technology for dispersing agents that enhances pigment performance and coating efficiency. Although conventional technologies can lead to good dispersing agents – based on random copolymers, for example – polymers with a defined architecture can be much more effective. Examples of this group include comb and block copolymers.

BASF has extensively studied the use of block copolymers as pigment dispersants. Our research has shown that CFRP* technology is both highly suitable and industrially viable when used in coatings, especially in combination with Laropal®.

### Controlled Free Radical Polymerization technology




* Controlled Free Radical Polymerization

## Selection of High Molecular Weight Dispersants (HMWD) agents for solvent-based industrial applications

| | | Efka® PX 4330 (old: Efka® 4330) | Efka® PX 4300 (old: Efka® 4300) | Efka® PX 4340 (old: Efka® 4340) | Efka® PU 4063 (old: Efka® P63) | Efka® PU 4020 (old. Efka® 4020) |
|---|---|---|---|---|---|---|
| Alkyd resins | long oil | ■ | ■ | | | ■ |
| | medium oil | ■ | ■ | | | ■ |
| | short oil | ■ | ■ | | ■ | ■ |
| Acrylate resins | OH-functional | ■ | ■ | | ■ | |
| | thermoplastic acrylates | ■ | ■ | | ■ | |
| Epoxy resins | solvent-free | ■ | | ■ | ■ | ■ |
| | solvent-based | ■ | | ■ | ■ | ■ |
| Polyester resins | OH-functional + NCO | ■ | | ■ | ■ | |
| | unsaturated + melamine | ■ | | ■ | ■ | |
| Nitrocellulose | | ■ | | ■ | | |

Selection of the wetting and dispersing agent depends on compatibility with the resin system and on the desired properties, such as:

- **color stability**
- **viscosity reduction**
- **anti-flooding and floating effect**
- **pigment loading of the grind**

# The dispersing agent

## Efka®

### Pigment loading in the universal resin pigment concentrate

| Pigment type | Pigment loading* |
|---|---|
| $TiO_2$, opaque iron oxides, chrome oxide green, bismuth vanadate yellow | 55 - 70 % |
| Phthalocyanine blue and green, organic violet | 15 - 25 % |
| Organic yellow, red and orange | 30 - 40 % |
| HCC** carbon black | 10 - 15 % |
| Remaining carbon black | 20 - 30 % |

**High Color Channel

*see our BASF pigment offer at page 12

## Method to calculate quantity of High Molecular Weight Dispersants (HMWD) agent needed, based on active substance per pigment type

| Pigment | Oil absorption value | HMWD active on pigment |
|---|---|---|
| inorganic pigments: approx. 10 % of the oil absorption value e.g. | | |
| Titanium Dioxide | 19 | 1.9 % |
| Iron oxide Yellow | 35 | 3.5 % |

| Pigment | BET value ($m^2/g$) | HMWD active on pigment |
|---|---|---|
| organic pigments: approx. 25 - 50 % of the BET value e.g. | | |
| Irgazin® Red L 3670 HD | 26 | 6.5 % |
| Heliogen® Blue L 7101 F | 64 | 30 % |

| Pigment | DBP value | HMWD active on pigment |
|---|---|---|
| organic pigments: approx. 25 - 50 % of the BET value e.g. | | |
| Black FW 200 | 150 | 30 % |
| Special Black 100 | 100 | 20 % |

In combination with Laropal®, well-defined universal resin pigment concentrate systems based on modern HMWD show wide compatibility over a broad range of decorative and industrial solvent-based resin systems, including:

- **alkyds** (short, medium and long oil)
- **stoving-based systems** (alkyd/MF, acrylic MF)
- **nitro cellulose**
- **2-pack epoxy**
- **2-pack polyurethane**
- **thermoplastic acrylates**

The consistent color stability and compatibility results in homogenous color development in many solvent-based coating systems. Homogeneous color development properties enable the paint producer to easily incorporate a new coating line into an existing universal resin pigment concentrate system.

# The color makers

## Pigments

BASF offers the broadest pigment portfolio in the market and our aim is to provide our customers with products suitable for all existing industrial mixing systems.

Rather than concentrate on a single product, we offer our customers the opportunity to customize their pigment selection based on their specific needs, from both a cost and performance perspective. This gives them the flexibility to meet the varying demands of the many different end applications and systems used in the market.

Further detailed technical data is provided in our industrial pigment porfolio brochure EDC 0112 e.

In recent years, paint manufacturer requirements for specialty colors have gown alongside consumer demand for more individual color solutions. As a result of this, the need for pigments with high chroma and hue properties has become a prerequisite for any new mixing scheme. The following diagram illustrates our ability to meet customer and end-user demands through the continued development of pigments fit for purpose and focused on the industrial paint market.

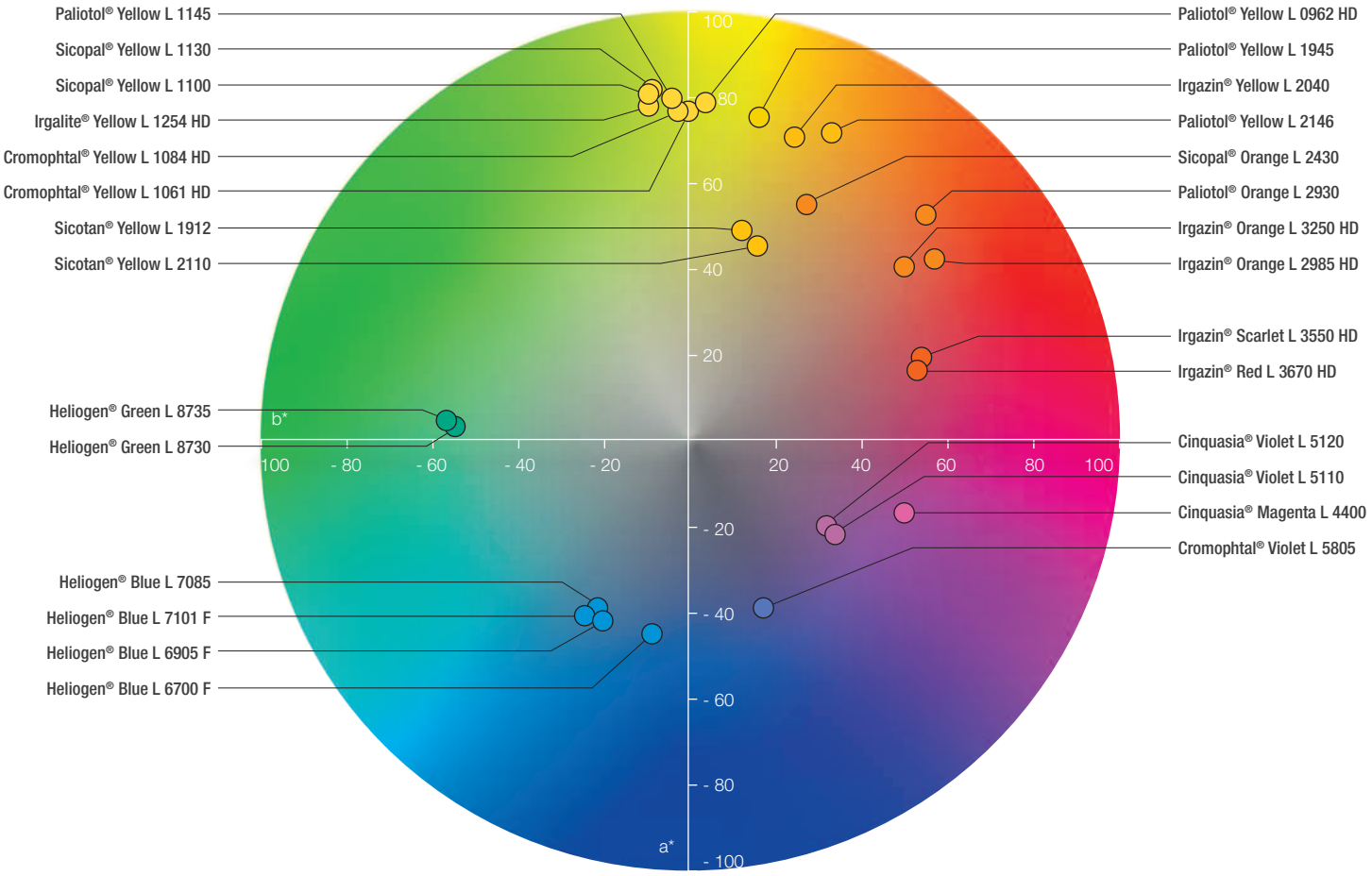
# Product overview

| Color shades | | | Trade name | Color | Reference | Colour Index | Type |
|---|---|---|---|---|---|---|---|
| full shade | 1/3 SDS | 1/9 SDS | | | | | |
| yellow color shades | | | | | | | |
| | | | Paliotol® | Yellow | L 0962 HD | PY 138 | organic |
| | | | Cromophtal® | Yellow | L1061 HD | PY 151 | organic |
| | | | Cromophtal® | Yellow | L 1084 HD | PY 154 | organic |
| | | | Sicopal® | Yellow | L 1100 | PY 184 | inorganic |
| | | | Sicopal® | Yellow | L 1130 | PY 184 | inorganic |
| | | | Paliotan® | Yellow | L 1145 | | hybrid |
| | | | Irgalite® | Yellow | L 1254 HD | PY 74 | organic |
| | | | Sicotan® | Yellow | L 1912 | PBr 24 | inorganic |
| | | | Paliotan® | Yellow | L 1945 | | hybrid |
| | | | Irgazin® | Yellow | L 2040 | PY 110 | organic |
| | | | Sicotan® | Yellow | L 2110 | PBr 24 | inorganic |
| | | | Paliotol® | Yellow | L 2146 | PY 139 | organic |
| orange color shades | | | | | | | |
| | | | Sicopal® | Orange | L 2430 | PO82 | inorganic |
| | | | Paliotol® | Orange | L 2930 | PO 67 | organic |
| | | | Irgazin® | Orange | L 2985 HD | PO 73 | organic |
| | | | Irgazin® | Orange | L 3250 HD | | hybrid |
| red and scarlet color shades | | | | | | | |
| | | | Irgazin® | Scarlet | L 3550 HD | PR 255 | organic |
| | | | Irgazin® | Red | L 3670 HD | PR 254 | organic |
| magenta and violet color shades | | | | | | | |
| | | | Cinquasia® | Magenta | L 4400 | PR 282 | organic |
| | | | Cinquasia® | Violet | L 5110 | PV 19 | organic |
| | | | Cinquasia® | Violet | L 5120 | PV 19 | organic |
| | | | Cromophtal® | Violet | L 5805 | PV 23 | organic |
| blue color shades | | | | | | | |
| | | | Heliogen® | Blue | L 6700 F | PB 15.6 | organic |
| | | | Heliogen® | Blue | L 6905 F | PB 15.2 | organic |
| | | | Heliogen® | Blue | L 6960 F | PB 15.2 | organic |
| | | | Heliogen® | Blue | L 7085 | PB 15.3 | organic |
| | | | Heliogen® | Blue | L 7101 F | PB 15.4 | organic |
| green color shades | | | | | | | |
| | | | Heliogen® | Green | L 8730 | PG 7 | organic |
| | | | Heliogen® | Green | L 8735 | PG 7 | organic |

| High performance systems | Mid performance systems | BET surface area [m²/g] | Opacifier | Durability | | | Chemical resistance | | Solvent resistance | Heat stability |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | full shade | 1/3 SDS | 1/9 SDS | acid | acid | | |
| | | | | | | | | | | |
| | ● | 15 | ■ | ■■■ | ■■ | ■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | ● | 26 | ■■ | ■■■ | ■■ | ■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 19 | ■■ | ■■■ | ■■■ | ■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 10 | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 13 | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | ● | 16 | ■ | ■■■ | ■■ | | ■■■ | ■■■ | ■■■ | ■ |
| ● | | 6 | ■■■ | ■■■ | | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 13 | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 48 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 3 | ■■■ | ■■■ | | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 25 | ■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | | | | | | | | | | |
| ● | | 7 | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | ● | 14 | ■■ | ■■■ | ■■ | ■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 15 | ■ | ■■■ | ■■■ | ■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | ● | 18 | ■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | | | | | | | | | | |
| ● | | 15 | ■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 27 | ■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | | | | | | | | | | |
| ● | | 64 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | ● | 86 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | ● | 70 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 99 | ■ | ■■■ | ■■■ | ■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | | | | | | | | | | |
| ● | | 54 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | ● | 76 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 70 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | ● | 57 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | | 64 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| | | | | | | | | | | |
| ● | ● | 61 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |
| ● | ● | 61 | ■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ | ■■■ |

■■■ excellent ■■ moderate ■ poor

## Color space diagram



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