Life in Colour

The World of Pigments and Fillers

It‘s light that makes our world colourful

Colour is emotion, and seeing colour is a magical bit of physics. It takes three things to generate an impression of colour in our eye: light, its reflection by an object and the alteration of the reflected light by absorption. The only thing we perceive as a colour stimulus in this process is the wavelength that is not absorbed by the surface of the object.

The primary materials of colour, namely the pigments that were bound into brushable paints by various means, were always valuable. The names of colours were associated with emotions and acquired an additional meaning. For instance, royal blue owed its name, and also its status as a luxury, to the high price of ultramarine pigments.

Although ultramarine has long since not been obtained from the gemstone lapis lazuli, and royal purple not from the secretions of various sea snails, pigments continue to be valuable. After all, they give colour its brilliance. To do so, pigments have to be ground so finely that their particles do not stick together and every single one of them can shine.

The colour names used by the automotive industry already indicate how much passion is associated with the colours of objects: cars roll up in Mangaro Brown, Secret Lavender and Sepang Blue, and even though a spectrometer would reveal the same colour shade on a saloon and a micro car, their difference in class would at least have to be indicated in the name.

In technological terms, the effect pigments used in automotive finishes have experienced a quantum leap in recent decades. They became finer, more brilliant and nowadays even imitate nature. They display a „flip-flop“ effect, as the paint experts say, meaning that they can produce a different colour, depending on the viewing angle, and even simulate the shimmering chitin cuticle of insects thanks to extremely thin, semi-transparent layers.

Colour as a selling point

Fashion thrives on colour, and it changes its range from season to season. Its nuances are inspired by the spirit of the times and current social trends. And with their fast-moving vitality, fashion colours themselves provide stimuli for other design fields. On a supermarket shelf, on the other hand, colour turns into a visual guidance system, an enticing incentive to reach out and buy, and an appetite whetter. Many of the colours chosen in this context appear to be coded – even after decades, they change just as little as the fresh blue used for milk or the gold for butter.

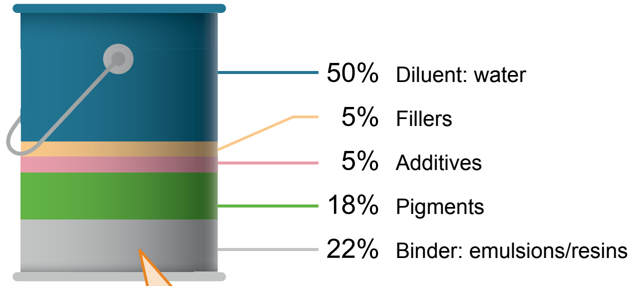
In contrast, cleaners and detergents use combinations of luminous colours in the most aggressive possible shades in order to communicate the promise of a particularly effective active formula, whereas soft, pastel shades appear to be the only thing that goes with the gentle nature of multiply toilet tissue. The rustic, red-and-white chequered pattern on a packet of farmer‘s ham indicates its origin in a rural environment – even if the plastic film has absolutely nothing to do with hand-woven linen cloth and the slaughterhouse was somewhere on an industrial estate in a big city.

Architecture is discovering colour

For a long time, it seemed that the rendering on dwellings in Germany only came in shades of beige and grey, while the houses on the Venetian island of Burano shone in every colour of the spectrum and Dutch local authorities even drew up elaborate colour bye-laws for their streets.

The green of the water, the red shades of the bricks of the neighbouring „Speicherstadt“ district and the sand colour of the River Elbe were imitated to turn this drawing-board district into an organic link to its surroundings.

Anyone strolling through the „Hafencity“ district of Hamburg today will see a colourfulness on the modern facades that helps create its identity – the buildings there are a kind of „Who‘s Who“ of contemporary architects.



Did you know:
An emulsion paint that you use to paint your walls with only consists of just under 20% colorants, i.e. pigments. The greater part is water, which serves as a diluent.

Pigments and their categories

The word pigment comes from the Latin „pigmentum“, and means something like decorative paint. In principle, these chromatic or achromatic substances are virtually insoluble and primarily serve as colorants, although they can also be used as fillers or for modification.

A fundamental distinction is made between organic and inorganic pigments:

While organic pigments are based on carbon compounds, inorganic pigments are generally obtained from mineral raw materials by precipitation. However, both types require additional mechanical processing, heating or chemical treatment, before they can be used as pigments. They also differ in terms of particle size, this being of decisive importance for their light transmission, among other things: most organic pigments are classified as transparent, while the inorganic ones are opaque. In addition, inorganic pigments have the property of demonstrating great thermal stability. Organic pigments, on the other hand, are characterised by greater brilliance and colouring strength.

TiO_2

The most important white pigment is titanium dioxide. It is often used to increase the hiding power or opacity of a paint. The most commonly used black pigments are industrial carbon blacks. Alongside the two achromatic types, black and white, there are also numerous colour pigments. The most frequently used colour pigments are yellow and red iron oxides, which are particularly used in building materials and paints. Numerous other colour pigments are to be found in a wide range of applications in every sphere of daily life, e.g. in printing inks for magazines and in food packaging, in automotive finishes, in ceramic goods, in plastic articles and man-made fibres, or in artists‘ and school paints. Special effects are obtained with metallic-effect pigments and pearlescent pigments, which are used in cosmetic products and packaging, for example.

Fillers improve the application properties

Fillers are added to paints, coating and plastics because of their application-related properties. Their contribution to colouring plays only a secondary role.

Synthetic silicas and silicates are used as reinforcing fillers in tyres, shoe soles and technical rubber articles. They act as flow-promoting agents in readily-agglomerating powders or as abrasives in toothpaste. As fillers, industrial carbon blacks reinforce rubber products and contribute to reducing the abrasion of vehicle tyres.

Special silicas serve to set the required flow properties in paints and coatings. Beyond this, silicas can be used for the targeted matting of surfaces and also contribute to giving them a scratch-resistant finish.

All pigments and fillers are analysed by the manufacturer and assessed in accordance with the European laws on chemicals, in order to ensure that they can be used in the various fields of application.

Pigments can do more – Additional functions

IR reflection

Photocatalysis

High resistance

Corrosion protection

IR reflection

It's something we're all familiar with: dark objects can get unpleasantly hot in summer. To lessen this effect, pigments have been developed that reflect infrared light, rather than absorbing it.

These pigments „reflect“ the thermal radiation of the sun (infrared radiation), without allowing its heat to penetrate into the object. Consequently, surfaces treated with IR pigments remain much cooler in sunlight, but their colours remain just as intensive in visible light as when using other, comparable pigments.

Heat-reflecting pigments are used in a wide variety of fields: they are already often used in the building sector, especially in the USA, where metal and plastic are popular roofing materials. In a house with an air-conditioning system, the use of reflective pigments increases its efficiency and cuts the costs. Demand in Europe is also growing rapidly, and not only in the sun-drenched South.

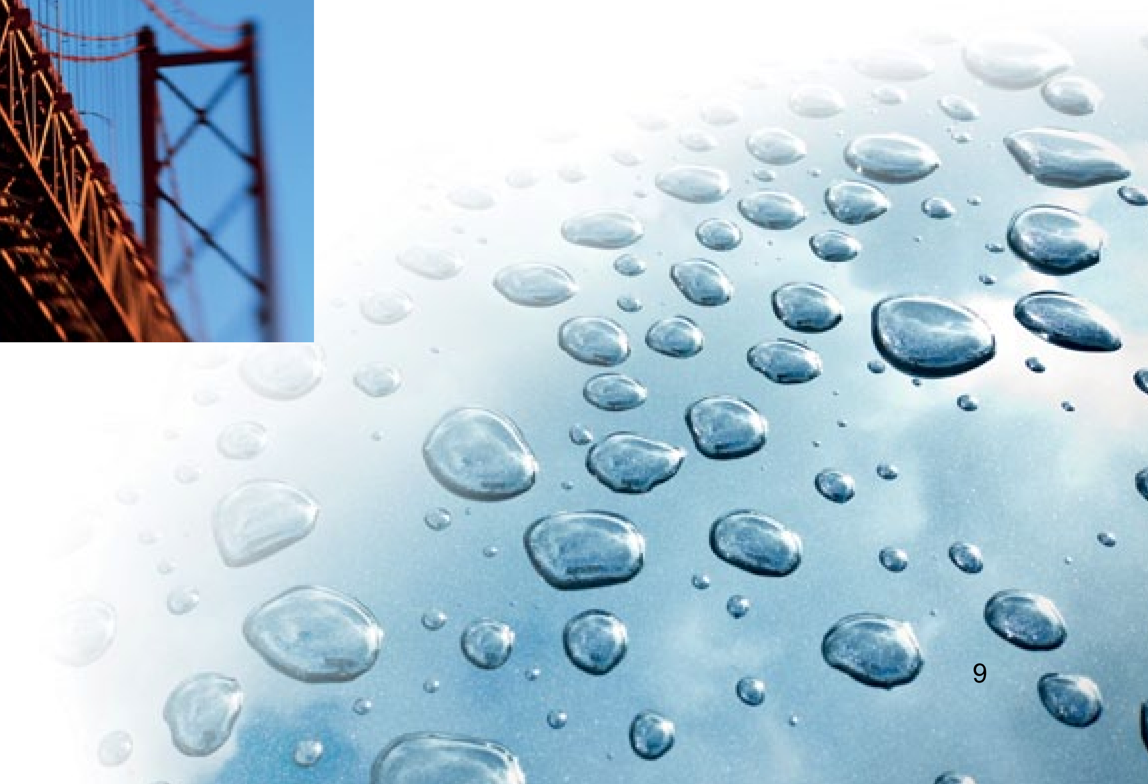
In the automotive sector, IR-reflecting coatings are an important factor in view of the constantly growing surface area of vehicle glazing. Infrared pigments reduce the temperatures of the bodywork, interior trim, seats and dashboards – without requiring any additional energy at all.

Did you know:
A surface coated with IR pigments can be up to 20 °C cooler, and also cools off again faster.

Anticorrosion pigments

Due to their chemical and physical properties, certain pigments (e.g. graphite, red iron oxide) can enhance the effectiveness of anticorrosion coatings. These pigments delay the penetration of water and other aggressive substances through a coating on metal surfaces.

This protective function of the pigments contributes to maintaining value wherever exposure to the weather favours corrosion: pigments are used to protect bridges, ships and railings and to guarantee their durability.



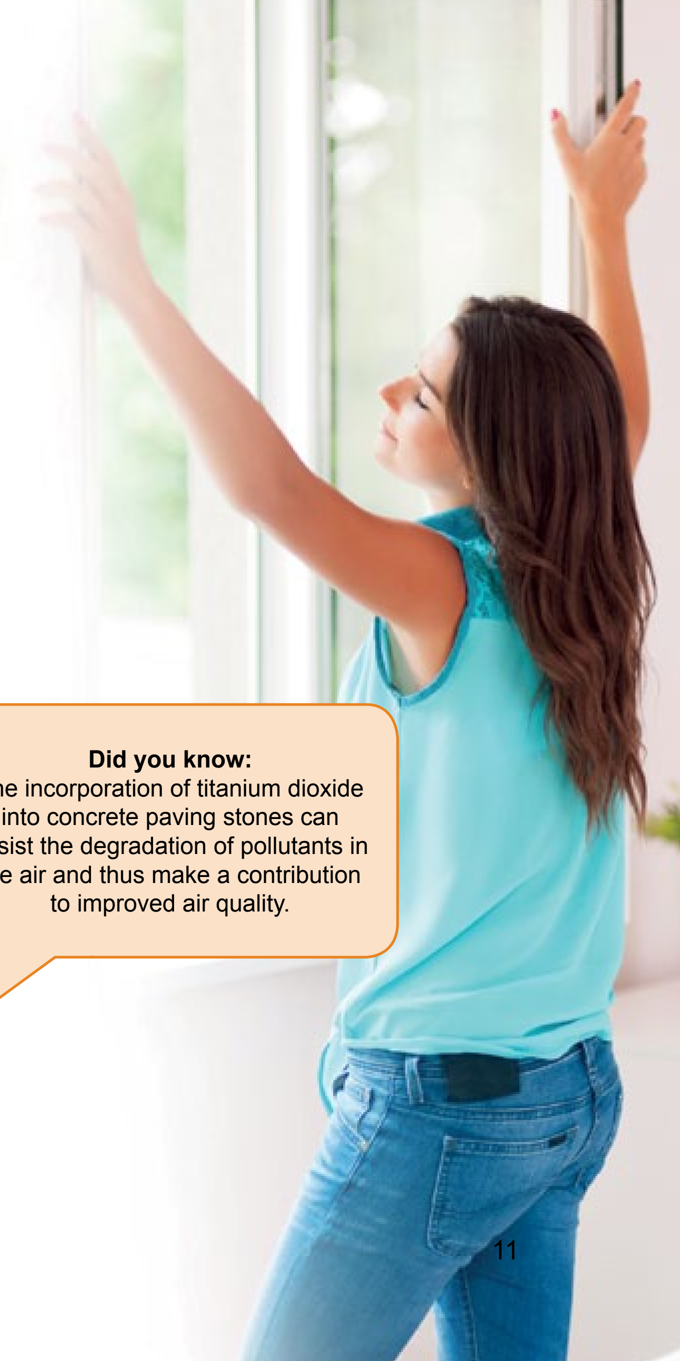
High resistance

In many spheres of our daily life, the pigments used in paints, coating and plastics have to withstand severe stresses. There are enormous temperature differences – in the case of aircraft coatings or when producing plastics, for instance. Greenhouses and agricultural films are exposed to intense UV radiation. In contrast, swimming pool sheeting or plastic troughs have to demonstrate good resistance to acids and alkalis. Finally, marine paints have to defy not only mechanical stresses, but also algal growth and glittering light.

Photocatalysis

In the process known as photocatalysis, a so-called photo-semiconductor – usually titanium dioxide – is activated with the help of light. The effect of „switching on" the semiconductor in this way is that, with the help of oxygen and moisture, the treated surfaces not only reduce the level of pollutants in the air, but in some cases even eliminate them completely. All that is left is environmentally compatible substances, such as nitrate, which can be taken up by plants as a fertiliser. In this way, building materials with photocatalytic treatment, such as coatings, paints, roof tiles or concrete surfaces, can contribute to reducing nitrogen oxides (NOx) in the air we breathe.

Did you know:
The incorporation of titanium dioxide into concrete paving stones can assist the degradation of pollutants in the air and thus make a contribution to improved air quality.



Verband der
Mineralfarben-
industrie e. V.

Mainzer Landstraße 55
60329 Frankfurt am Main
Germany
info@vdmi.vci.de
www.vdmi.de