

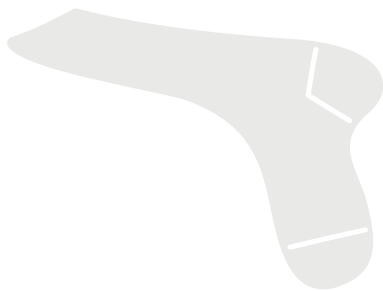
finish

INSIGHTS INTO THE WÖRWAG COMPANY



The goods on white

This hue has it all—
except for colour



WÖRWAG
Farbe. Beschichtung. Kompetenz.



WHITE

White wisdom from the launderette **6**

The colourful world of white goods **12**

Developing white automotive coatings is a matter of feel **22**



LOGISTICS

Delivering Wörlag products to France—a job halfway between long-haul trucker romance and hard labour **34**

CUSTOMER PORTRAIT

A global market leader, with a business that's anything but a house of cardboard **42**

CUSTOMER APPLICATIONS

From street sweepers to door closers: Wörlag's world of products **46**

PROTECTIVE COATINGS

Innovative clearcoat and primer for sports equipment in China **32**



ESSAY

The colour yellow is not just a stimulant. It dominates traffic in New York City **50**

A bit of an eye full

POWDER COATING

Wörwag's new chrome powder raises the bar **40**

SERVICE

All locations, all addresses: Wörwag at a glance **51**

PAINT FOR MOUNTAIN BIKES

What the frame coating has to withstand **28**



And a shirt full. On shoes, hair and everywhere. Even under fingernails. It was a furious paint fight marking the finale of an extraordinary undertaking, in which we dealt with colour in a completely different way. In this issue, we're presenting white goods—radiators, refrigerators and washing machines—in a way I have never seen before: in a purpose-built white room (page 12).

Have you ever thrown paint at your colleagues? I haven't. It was a new experience for the participating employees, too. The photographer had one shot to get it right. What if something went wrong? The temptation to take up the challenge won. Experience has taught us that it always takes courage and creativity to venture into uncharted territory. Wörwag comes up with new ideas every day—and now, for a change, we prove it in front of the camera. The result is surprising (page 20), as are the tricks involved in the manufacture of white paints (page 22).

After the colourful spectacle, the participant's clothes were ripe for a main wash with pre-wash cycle. Fortunately, it was not our indestructible paint on the fabric. The dirty business of laundering is, incidently, the speciality of a fantastic laundromat in the heart of Barcelona. We were there when things started spinning (page 6). We hope you enjoy the read!



DR. PETER MORITZ,
MANAGING DIRECTOR

“World-white”

Big white world. The facets of the colour of light are as numerous as the themes. A colourful patchwork of facts about white.

1908

White City, London

White City is the name of the northern area of London's Shepherd's Bush. After being used for agriculture up to 1908, the area then served as trade fair grounds until the First World War. It owes its name to the white exhibition pavilions. But they are long gone history.

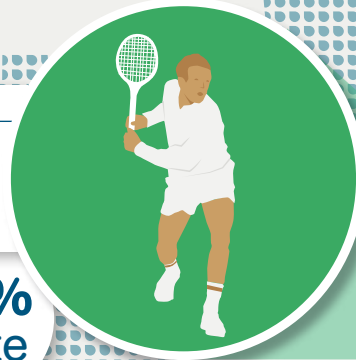
WHITE CITY



White sport, Wimbledon

Since 1963, the tradition-rich Wimbledon tennis tournament has a 90-percent-white rule: male and female players must all wear almost entirely white clothing. No other tournament in the world has a similar rule.

90% white



700 km²

White Sands, Alamogordo (New Mexico)

White, as far as the eye can see. The nature reserve “White Sands National Monument” in the US state of New Mexico comprises the southern half of the largest gypsum desert in the world. Seven hundred square kilometers and 4.5 billion tons of gypsum sand rise in billowing snow-white dunes.



470 \$ mio.

Great White Shark, Amity (New York State)

The little town with 2,245 inhabitants in the State of New York was made world famous by Steven Spielberg's horror film Jaws in 1975. Although it is about 400 kilometers (220 miles) from the sea as the crow flies. The “Amity Island” depicted in the film does not exist. Global box-office sales for Jaws were around 470 million dollars, with production costs of seven million.



White rum, Jamaica

The name rum, rhum (French) or rom (Spanish) for an alcoholic drink dates back to the mid-17th century. The first recorded use is found in a decree made by the governor of Jamaica on July 8, 1661. Since about that time, members of the Royal Navy received a daily ration. White rum, which is actually colourless, has to mature for at least three months in stainless steel barrels.

3 months



10 gigatons

Salar de Uyuni, Bolivia

Even beyond the horizon it is still white: The world's largest salt sea, Salar de Uyuni with its, 10,582 square kilometers (4082 square miles) is located at the foot of the Andes at an altitude of 3,650 meters (11,980 feet). The sea is estimated to hold about ten billion tons of salt. Each year, 25,000 tons are harvested.





**140
km**

Snow White, Norway

Snøhvit or Snow White is not just a fairy tale by the Brothers Grimm, it is also the name of a natural gas field in the Barents Sea. Discovered in 1984, it is located about 140 kilometers (87 miles) northwest of Hammerfest on the Norwegian continental shelf.

**9 mio.
hl**



Weissbier, Erding (Bayern)

Each year in the state of Bavaria in Germany, people drink nearly nine million hectoliters (237,800,000 gallons) of "white" beer. In today's terminology, all white beers contain wheat but not all wheat beers are white. Originally the term Weissbier (white beer) was solely meant to refer to the colour in contrast to brown, red and black beer.



**March
14**

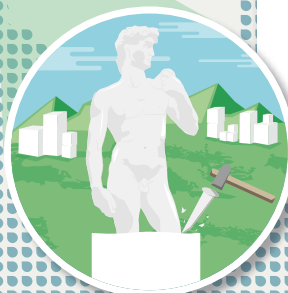
White Day, Japan

Every March 14th, Japan celebrates White Day. It was conceived by an enterprising confectioner in 1977. On this day, men should thank women for gifts that they were given one month earlier on Valentine's Day—with (white) chocolate, candy or other small gifts.

White marble, Carrara (Italy)

Half a millennium ago, the Renaissance artist Michelangelo chipped away at a block of Carrara marble to create a work for eternity: the 5.20 meter (17 feet) tall David. It became the most famous sculpture in art history and still stands in Florence. Carrara marble has been mined since the late Roman Republic and is now marketed under some fifty trade names. Not all varieties are white.

**5.20
m**



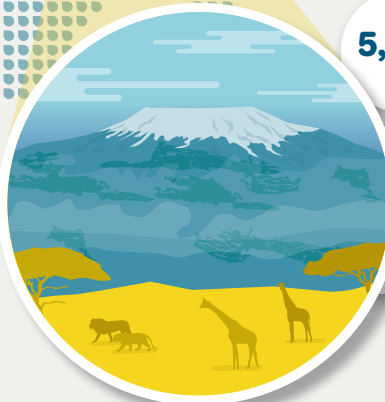
**One
among
ten thousand**



White Tiger, India


There are an estimated three to five thousand tigers left in the wild today. In theory one in every ten thousand is white. In captivity, there are about 250 white tigers—they all descend from one male, caught in the Indian state of Madhya Pradesh in 1951. The last wild white tiger was killed in 1958 by humans.

**5,895
m**



The White Mountain, Tanzania

The highest mountain in Africa, is "kilima njaro", 5,895 meter (19,340 feet), which is Swahili for the White Mountain. Since 1880, its ice cap has shrunk to one-tenth of its former area. Kilimanjaro could be ice-free within 10 years.



Boundless warmth:
Laundromat owner
Reyes Hugueta (left)
with Cristina Falco.



A woman with short blonde hair, wearing a grey patterned t-shirt, a grey scarf, black leggings, and white sneakers, is sitting on the top of a large industrial washing machine. She is smiling and looking towards the camera. Her hands are clasped in her lap. To her left, a hand is pointing towards her. The background shows a laundromat setting with other washing machines, a sink, and various laundry items. The text 'A LAUNDROMAT IN BARCELONA' is at the top right, followed by the title 'White-wise' and a paragraph of text. At the bottom right, there is a byline and a page number.

A LAUNDROMAT IN BARCELONA

White-wise

It's a dirty business. But since 1957, in a wonderful laundromat in the heart of Barcelona, whites turn white again and colours regain their vitality. From theatrical costumes to cuddly toys: a working day in the Tintoreria Hugué, where almost everything that goes around comes around.

By Michael Thiem; photos by José Carlos Zarcero



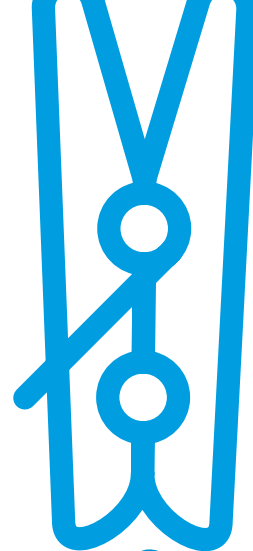
Wash by hand?
An amusing idea
for Reyes Hugueta:
In the Tintoreria
the machines
are plus-sized.



Business is looking good! Mountains of dirty laundry and a shirtless, waiting customer.



And how did FC Barcelona do? The laundromat is the place to catch up on the news.



Shortly after ten o'clock in the morning, Barcelona awakens. Slowly. The Carrer Nou de la Rambla is a sleepy little street in the Poble Sec district, at the foot of the 173-meter (567.6-ft) high Montjuïc. A delivery van unloads beverage crates and slides them under the half-open rolling shutter of the Montjuïc bar. On the other side of the street, the Sanwar hair salon is opening. There is a poster offering you the exact cut sported by the Brazilian soccer star Neymar. No one has dared to try it yet. In the Bodega Vidal, the type of corner bar that you see at almost every intersection of the city, Tallat is flowing liberally. It's a strong espresso with a dash of hot milk—a true Catalan classic that really gets your blood pumping.

Nobody at the unassuming-looking business next door at number 143 needs such a powerful morning kick-start. In Tintoreria Huguet everything is already running perfectly smoothly. It is a beautiful *la undromat*. "Come in—the show is about to start", says the sign over the door in Catalan (*"Entra i que l'espectacle comenci"*). The spectacle usually arrives in the form of Reyes Huguet who quickly approaches each visitor. The proprietor combines vitality with boundless warmth, exuberant energy and irrepressible zest. Visitors are not just customers, but friends. If you don't believe it, you know it after you experience one of her hugs.

The perfect ending

"We wash a lot of costumes for the theater," says Reyes, showing her small collection of big memories under a glass countertop: a Venetian mask, feather boa, opera glasses, black gloves. Silent witnesses. "I love these things because I love the theater," she rhapsodizes. "On stage, dreams come true. And everyone who goes to the theater, expects a perfect ending. The same applies to the laundry that customers leave here. They come here expecting everything to turn out perfectly in the end." →

→ Drum-roll. In this theater of dreams, sixteen washing machines play the leading roles. Most are on heavy rotation schedules from early morning onwards. The smaller ones accommodate seven kilograms, the two larger ones handle twice the volume. Dirty laundry is washed here six days a week. Then everything runs in circles, except the conversations! Opened in 1957 by Reyes' parents, the laundromat is more than a place to do laundry. It's a meeting place, a living room where customers like to hang out. Some pour out their hearts while waiting here. Lost love, family celebrations, bereavement—soap opera up close and personal.

The business is a charmingly quirky place barely 4 meters wide (13 ft) and about 30 meters long (100 ft). The family used to live in the rear part of the building. Now it's home to the storage room and the ironing area for two employees. The business currently employs three people in addition to a driver who picks up the dirty laundry and delivers the clean laundry.

“White is white and red is red. Laundry must be clean, no matter what colour it is.” Reyes Huguet

Small, framed photos hang on the walls. They are souvenir shots made by Reyes' son. He has taken pictures of people doing their washing in India, the Philippines, Burkina Faso, Togo, Ethiopia, Sri Lanka and Vietnam. A truly impressive gallery of memories. Impressive also applies to the smell of fresh laundry, which tickles the visitor's nose immediately. It's almost like a walk through a field of flowers, enriched with a hint of lemon.

When bedspreads, curtains and towels are packed carefully and waiting to be picked up, you easily forget that it always begins with dirty, musty bags stuffed with crumpled clothes or home textiles that are too large for their owners' machines. Reyes and her team are challenged every day. Washing, drying ironing, folding, wrapping, delivering. The re-

sult has to sparkle. Their goal: not just clean, but immaculate. Do experts prefer washing whites? Won't that show off the quality of the work best? “No,” replies Reyes. “White is white and red is red. Laundry has to be clean, no matter what colour it is. That is all that counts.”

And Cristina Falco adds: “Some customers just want some advice.” She remains confident even when faced with a Sangria stain on a white shirt. There is a stain remover in a little bottle for that. It's a German product that works on almost anything. Yellowed fabrics are more likely to cause concern. “Some costumes are decades old, and the material has started to degrade, so you have to be extreme-



White remains white, colours bright. In the end it just has to be clean.



Same but different: Whether ruffles or lace—the experts always have the best advice.



Curtain up, the spectacle begins: The laundromat owner Reyes Hugueta loves the theatre.



Do not wash or dry clean, bleach or iron—for the experts that's still not a problem.



"When some customers deliver their laundry, it is as if they were handing over their children to our care."

Cristina Falco

ly careful," explains Cristina while lifting white blankets and towels from wire mesh containers, reminiscent of shopping carts, and stuffing them into a silver-coloured industrial washing machine. The cycle is finished twenty minutes later. Quick wash.

Not everyone comes to do their laundry. With a grin Cristina, recalls the recent visit of a man who stormed in to get his shirt ironed. The customer waited with his torso bared because he was in such a hurry. "He looked pretty good to me," says the 47-year-old woman. "Too bad we finished the ironing in only five minutes." That's a new meaning for "hot wash job".

Prominent customers

Ironing a shirt is one of the easiest tasks. But Tintoreria Hugueta is now well-known for their ability to solve even the most difficult cases. Since the salon is located in the middle of the theater district, the women have always been part of the Barcelona theater scene. The Apolo, one of the oldest theaters in the city, the Molino, the Victoria and the Teatre Nacional de Catalunya are only four big names on the long list of customers. That means washing the stage wear of international stars such as the iconic Spanish actress Sara Montiel or the ensembles of the musicals *Jesus Christ Superstar*, *We Will Rock You*, *Hair*, *Thriller Live* and *Mamma Mia*.

Even the flamboyant costumes of Lady Gaga's dancers land in Reyes' machines as do the outfits of U2's singer Bono, or others like Bruce Springsteen. And film crews are always knocking on the door. They have washed for Woody Allen's *Vicky Cristina Barcelona* and for *Red Lights* starring Robert de Niro. Even the sweat of victories and tears of defeat have been washed from "Periquito", the colourful budgie mascot costume of the Spanish premier league team Espanyol Barcelona. And of course, stuffed animals en-masse—the big stars of the little ones. Cristina: "Some customers really need a lot of encouragement. When they are dropping off their washing, you would think they are handing over their children."

The customer satisfaction is evident by the extensive autograph collection on the wall. Reyes knows many of them personally. She gets regular invitations to theater premieres. There is another one the day after tomorrow. The piece is called *Patas arriba*, which translates as "Chaos." The 68 year-old loves these evenings. Tune out and dive in, knowing that in a short time, the show will be repeated at the laundromat. Why? Because a superstition has it that costumes should never be washed before the premiere. The day after is always busy. Reyes laughs. And perhaps for once, her day will also start with a Tallat ...

NOT ONLY CLEAN, BUT FLAWLESS

Thorsten Bollinger has a special relationship with washing machines. For five years, the market manager has been in charge of the white goods segment. Which by the way, aren't always white. For commercial washers, Wörlag usually delivers silver paint.





WHITE GOODS

Some like it white

Powder coatings for white goods such as washing machines or refrigerators are mass products. But Wörwag manages to stand out from the crowd with tailored solutions. As the photos of the white rooms show, it can all get quite colourful in the end.

By Michael Thiem; photos by Rafael Krötz



THE MILK MAKES
THE DIFFERENCE

Annett Schräpler who works
in the laboratory for indoor
powder coatings juggles with a
carton of milk from the white
refrigerator and proves that
she is a good catcher.

It is hard to discover new aspects of the colour white. Especially if you are intensely involved with it on a daily basis. Still, the six co-workers are amazed when they enter the warehouse in Zuffenhausen. Where sacks of white pigments and semi-finished products used to be stored waiting for further processing, the paint experts now encounter an entirely white microcosm. Welcome to Wörwag's kitchen studio. Three by four meters (ten by thirteen feet) with an two meters sixty (eight-foot) high ceiling. It's a room that has been transformed into a stage setting after four days of work, and is now ready for an unusual photo shoot.

Thirty spray cans and twenty liters (5.2 gallons) of paint were needed to reinvent the room with its one hundred everyday objects—from the cutlery and the ladle to the fruit basket, from the half-eaten piece of bread to the pizza and the watering can. Even the curtains, carpet and plants radiate "whiteness". And the already white goods—the washing machine, dishwasher, refrigerator, microwave oven and radiator—all received a fresh coat of paint for the shoot. They are all wearing all-white clothing. Now the effect is perfect. White, wherever you look.

White overload

"I like white," says Sonja Cramer, who works at Wörwag in the customer lab for indoor powder coatings. "But I've never experienced it like this. I guess I didn't even imagine it like this either. It's really cool." Her colleague Annett Schräpler is enthusiastic: "I'm excited to be participating. In many ways, this is art!" Even if the participants work with this decidedly colourful shade of paint on a daily basis, a total immersion in a white dream world is refreshing.

White goods play a major role at Wörwag. The required powder is produced in a factory in Renningen. But white is not just white. Dr. Peter Moritz is banking on Wörwag strengths. "Our quality sets us apart from others," says the manager, who also threw on

white clothes for the shoot. "If you spill some hot fat onto a white coated surface, in most kitchens, there is a high probability it will leave a yellowish stain on the surface. Our paints are designed to be more resistant."

Symbol of purity

In the white room, market manager Thorsten Bollinger stands beside the washing machine. For five years, the trained industrial mechanic and master craftsman has been responsible for household goods and building equipment—a market that is predominantly white. After all, the colour conveys purity and cleanliness. In addition to kitchen appliances, there are radiators and boilers. "White is not just a consistent long-term trend, it's the easiest solution. Because it is neutral," explains the 48-year-old. In addition, it's a cost saving solution. Colour finishes are more expensive, as the plastic parts in the respective colours have to be manufactured. On the other hand with white you can produce large numbers and just paint them white. Furthermore, →

"The white of white goods is not simply a consistent long-term trend, it's actually the easiest solution."

Thorsten Bollinger





THE HOUSE-KEEPING WON'T
TAKE CARE OF ITSELF

Colleagues from the laboratory for indoor powder coatings Sonja Cramer and Stefan Lutzei are still deciding who will empty the dishwasher. But they are agreed: It has to be emptied before they have breakfast.

→ paint shops need to be converted to multi-colour operation in the case of goods in different colours.

Although white powder coating is a mass product, the demands are high and vary according to the user and product. The paint of a washing machine must be resistant to soapy water, for whereas radiator paint has to be resistant to yellowing. Stove tops and ovens need to withstand hot fat. Premium manufacturers such as Miele also require additional stress testing. For example, we test to see how many times a plastic laundry basket can scrape the machine front below the drum door before you see any marks. Or, how often can the zipper of a pair of jeans scratch the paint while loading? The number of mini-impacts like that add up over a projected working life of fifteen years.

“Larger customers, especially, want a quality provider who can adapt the coat to their needs.”

Regina Neubauer

Testing such requirements are everyday work in our laboratory. “Larger customers, especially, want a quality supplier who is able to adapt the coat to their needs,” says team leader Regina Neubauer. Stefan Lutzei, a lab technician, knows what that means in practice. He and his colleagues regularly receive plastic or metal templates and have to produce a powder coat to match. “Either we develop a completely new shade or modify one for the customer,” says Lutzei. The devil is in the details. Lutzei's colleague Cramer explains: “Among other things, it depends on →



→ the processing done by the customer. We have to modify the powder coatings to match the type of furnace." Electric and gas furnaces may well yield different results. Once you have mastered the method, powder coatings prove to be highly efficient and environmentally friendly.

White-wise by experience

At Wörlag, white goods have a long tradition. BSH (Bosch Siemens Household goods) in Traunreut has depended on Wörlag paint since their early days as Siemens Electrical Appliances AG in the late fifties. Wörlag powder coatings have been used for white parts produced by a BSH supplier since 1980. And since 1998, BSH has been a direct customer. Today Wörlag powder coatings are used in BSH plants in Turkey, Greece, China and Spain.

An important customer is the Liebherr company, which has been using Wörlag products in its plants in Ochsenhausen (Germany) and Lienz (Austria) for 35 years. Wörlag provides the typical Liebherr White with a customized polyester epoxy powder coating. A specially designed powder coat with an extremely robust polyurethane resin

NEW TIDBITS: WHITE PIZZA

Alberto Elliott chuckles as he stands by his randomly assigned position by the white microwave: "Pizza Alberto is ready!" In everyday life, he works in the powder coating production at the Renningen plant and rarely wears white clothes.

"The quality still has to be right even with large quantities. Therefore there are constant checks during production."

Alberto Elliott

surface has contributed to the success of the brand for twelve years. Several thousand tons of powder coating leave the plant each year. White is often produced in large batches of up to 30 tons at a time. "We produce them in a multi-shift operation," explains Alberto Elliott from the powder factory Renningen. "The quality still has to be right even with large quantities. Therefore, there are constant checks during production."

The Wörwag colleagues love white, but are sometimes glad that there are other colours. Cramer: "Developing a red or blue, is of course a welcome change once in a while," Lutzei agrees. He recently used the label of a beer bottle as a reference to develop a green refrigerator. And since the employees of a paint factory must have strong colour preferences by default, the end of the photo session turned into a very colourful affair. Please turn the page. ■

HEATERS IN COOL COLOURS

Dr. Peter Moritz, Managing Director, could hardly wait for the opportunity to immerse himself in the white world. Radiators are almost always white. The one you see under the window was left switched off as it was hot enough under the photographer's spotlights.



Colourful endgame

After eight hours, the Wörwag photo models had had enough of white because the company is also very colourful at times. They pelted each other enthusiastically with water-soluble finger paints. Strict choreographic instructions were given by the photographer Rafael Krötz. The paint fight was the furious finale of an unusual event at the Wörwag warehouse. After a good shower to wash off the warpaint, six tired colleagues headed home. What a day!





It can't get any whiter than this

Summit White Opel
Candy White VW
Alabaster White Daimler
Ibis White Audi
Casablanca White Opel

White is sought after. It's considered a classic among automotive coatings. Developing paints and tints that remain stable in processing involves more than just technology. To those working with white it's primarily a matter of sensitivity.

By Michael Thiem; photos by José Carlos Zarcero



He knows what he is doing: Mateo Dicha fine tunes a white car paint with expertise and sensitivity.

Nobody stops Mateo Dicha. No, not violet! The customer wants white. Nevada White for the gas cap of a Seat. For this purpose, the tint of the car paint has to be readjusted. But the man from the Wörwag colour laboratory in Dosrius, Cata-lonia, almost 40 kilometers (25 miles) north of Barcelona, continues unswerving in his objective.

Buoyed by 35 years of experience in colour development and production, Dicha adds a splash of violet to the white. And another. "There's no such thing as a white white. The tint is decisive," the 53-year-old reveals as he stirs and presents the results. At first glance white, and on closer inspection, Nevada White, which meets the technical requirements. Dicha trusts the measurements. They show: "Yellow is no help in this case. It has to be red-violet." Then he puts the cup aside. "There are a lot more complex colours than white."

White is all the rage, it's classic. All over the world. For decades, almost every third car in Europe has been white or white-metallic. The popularity of the white colour group will last, says Helmuth Dengel, Head of the Development Team for premium and single-colour coatings. Reason: "The colour is emotionally evocative, it's clean, pure, noble and robust."

No effect on the interior temperature

There are also practical aspects. White suits any model, from small cars to luxury sedans. Chipping from stone impact, scratches and other defects are less noticeable. Dengel adds: "Compared to the typical forms of the eighties, white looks better on the beading and edges of today's chassis contours." A white car is cleaned less often. People assume that the interior of a white car is cooler in the sun. Actually it's no cooler than a black car. According to a study by the Touring Club Switzerland (TCS), the paint colour has no effect on how warm it's in the interior. However, the body of a black car will really get hotter faster than a white car body.

Presumably that is why white is so popular in hot countries, including Spain. "Besides black and red, white is our most important colour," says Montse Lopez, who as a sales expert in Dosrius, knows exactly what customers want. Customers include Daimler, VW,

Seat, Nissan and their suppliers of plastic add-on parts. Minor requests for service or adjustment work are handled by the nine employees in Dosrius. When it comes to larger orders or modifications, the experts in Stuttgart are involved.

Colour impressions are subjective

What is important in the development of a white vehicle paint? "White is not just white," says Herbert Kost, Director of Design and Pigments. "Yellowish white looks old, and some find it ugly. If it has a blue tinge and radiates, then most people are won over." And what one person perceives as gray, still appears as white to another. There are no clear criteria of when white is still white. The subjective colour impression is decisive.

Customer demands have increased in recent years. Metallic paints and pearl effects have displaced solid colours, and multi-layer

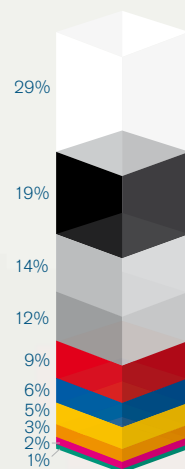
"The colour white is evocative, clean, pure, noble and robust."

Helmuth Dengel



On a white mission: Herbert Kost, Armin Lechner and Helmuth Dengel (from left).

THE
WORLD'S FAVORITE
CAR COLOUR
Almost one third of
all vehicles in 2014 were
painted white
or white-metallic.



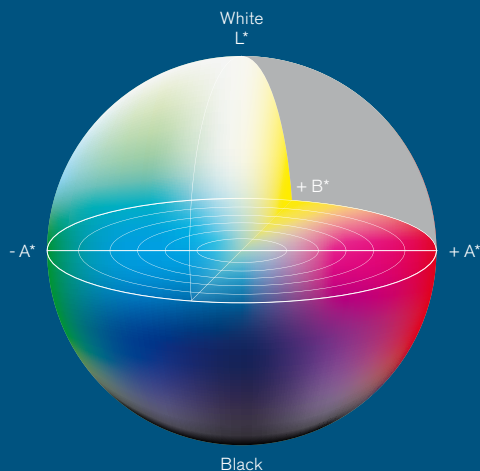
ONE DEVICE, A WORLD OF POSSIBILITIES

Wörwag pulls out all the stops to ensure and optimize quality. The experts in the process engineering, materials engineering and analysis departments have a surface scanner at their disposal. This high-tech testing device measures coated flat surfaces in all of the Wörwag departments. It combines various measuring instruments, like the "BYK-mac-i" (see box to the right). The device can be used in the early phases of colour development to assess colour-shade characteristics and stability in connection with the coating process. A complete battery of measurements includes layer thickness, flow, gloss, and cloudiness. Tests from a range of different coating systems can be compared side by side, for instance. Thanks to the surface scanner, colours can be brought to market faster. Developers can fine-tune various parameters to improve the quality of the surface. The device also helps to monitor customer requirements more precisely.



A BYK-MAC-I FOR ANALYSIS

The "BYK-mac-i" spectrophotometer is used regularly in the development and tinting of colours. It irradiates the surface to be measured with a series of bands of light that cover the entire spectrum, and measures the re-emission from each band. Solid colours are measured at an angle of 45-degrees. Four additional angles are required for special effect paints. Each measurement gives a point which can be situated in the so-called CIELab colour space. These are plotted on three axes: red-green, blue-yellow, and the vertical luminance or simply L-axis with the endpoints white and black. The developer can thus compare the co-ordinates measured with those specified to determine whether the hue is within the accepted tolerance.



THE CIELAB COLOUR SPACE

The International Commission on Illumination CIE (Commission Internationale de l'Eclairage) published the LAB colour model in 1976. Its predecessor dates back to the thirties. It is based on human perception and is independent of the production or reproduction technology used.

* Since 1976, these stars have indicated the CIELab colour model. It's designed to make a distinction between this model and its predecessor, the Lab colour space.

ered structures pose some tricky tasks for developers. After all, it's not just about the right colour, the process reliability in the series is also vital. Spot-repairs directly on cars and new application methods are other aspects that need to be taken into account during the early stages of development.

"The trick is to design the paint so that it can be processed at all."

Helmuth Dengel

One real sticking point is opacity. Unlike other paints, white contains only one pigment, so the name of the game is: add titanium dioxide until you reach opacity. The white pigment portion can be as high as thirty percent. That is a much higher figure than for other paints. But Dengel knows that this means other problems: "If the pigment content is so high, the paint flows quite differently. The trick is to get it to the point where you can even process it at all." Among other things, one must know the proper technique for wetting of the pigment.

Antonio Valverde, who is responsible for colour design and development at Wörwag in Spain, knows that the smallest differences are already decisive. "Sometimes bodywork and plastic parts, which are painted in the same shade of colour, differ optically from each other," says Valverde. "Such disharmonious results are often rejected by the customer, even though we have actually strictly followed their criteria."

Research on behalf of customers

Developing white paints ready for series production is an equation with many unknowns. In a two-year research project on behalf of Daimler AG, Wörwag identified which shade of white can be used on both plastic and metal body parts to produce the maximum brightness with a single application. The answer is Moonstone white. "But if you go to the designer with that proposal, he will reject it because it's too dark," reports Armin →

Cortina white Audi
Pure white Daimler
Calcite Daimler
Alpine White BMW



COLOUR ADDITION
A phenomenon of
the human eye: red plus green
plus blue makes white.

→ Lechner of the development team for Uni- and Premium Colours. "The production department, however, is excited because they can process it and it's stable."

As a compromise, Daimler chose Diamond white for the series. Since the proportion of opaque pigment is extremely high here, special effects and colour pigments cannot be mixed in a single paint layer. They have to be layered successively. Another requirement, which set limits for developers, was a primer-less coating process. A so-called compact or *integrated paint process*, (IPP) has long been standard in the automotive industry. However: "If I drop the primer, the body is missing an important sunscreen, which the white layer will now have to provide as well," says Lechner.

It does not always have to be white. For his own car and leisure gear, Dengel has opted for a contrast. The team leader regularly plays piano and bass guitar in a band. Both are painted matt black. Dengel: "Colour is emotion." And the trend for him on stage is definitely away from white. ■

Pure White VW
Polar White Daimler
Light White BMW Mini

INTERVIEW



"Cream is for
your second
wedding"

Philipp Tingler has been able to help many people. Especially brides. The philosopher and writer clears up some common missteps involving colour. White is definitely not one of his favorite colours. And it does not suit most brides anyway, he says. And mentions other reasons.

By Michael Thiem; illustration by Julia Worbs

“There are many situations when I think white is awful. My favorite colour is medium beige.”

Is white your favorite colour?

Certainly not. There are many situations when I think white is awful.

To be so vehement, you have to actually be quite fond of the colour, don't you?

I do confess, white is rather sophisticated. In fact, it's one of the most difficult colours, although people think the opposite is true.

Are there any white objects that you like?

Oh many. For example, I like white porcelain best, without decoration.

When don't you like white?

Colour theory says: light colours broaden. Therefore, one must be careful with white pants or even skirts, unless you are very slim. A man's wardrobe should only include white t-shirts, dress shirts and dinner jackets for cruises and outdoor occasions. And of course the proverbial white waistcoat to go with tails. Because of rule number one, in particular: no white belts. That is true for all genders and ages. Unless you're younger than ten.

What colour is your car?

In the registration documents it's "metallic blue". I didn't actually pick the colour, it came with the car: A Mercedes R107 from 1980. But the colour is a good fit for the car.

Where do you have white in your home?

On the walls, for example. Then the Kurland porcelain. The Saarinen chairs plus table are also white.

How do you explain to a bride that white is an unflattering colour for her dress.

White expands. Every bride should keep that in mind. Eggshell can already make a big difference. But avoid cream. That's for your second wedding.

What goes through your head when a white car pulls up beside you at the traffic light?

"Not again!" Unless it's a Rolls-Royce Phantom. Then I think: "Hello, Kanye!"

Why is white so popular for cars?

White has the image of being classless. And according to conventional colour psychology it's also deemed to be discreet, sensitive and dutiful. Owners of white cars allegedly wash them more frequently and follow traffic laws. It doesn't seem very cool. But in that vein, many choose white for safety reasons. Bright colours are more visible. I read on the Internet, that if you want to go for the safest colour, buy a mint green car. Well, unfortunately, we no longer live in 1985. Or perhaps fortunately.

What colour suit goes with which vehicle? And why?

Here we could take the three most important rules of wardrobe wisdom and apply them to the road. So that would first mean: ladies and gentlemen over 35 need to be very careful with any shade of colour. This also applies to their choice of car. Brightly coloured cars suit young people. Secondly: forced concoctions that are intended to appear unconventional, are usually embarrassing, just like suits in dayglo colours. The automotive equivalent would be a pastel compact car. Or racing stripes on a French mini-van. Thirdly:

overweight people are well-advised to wear muted colours. This rule, known as the Helmut Kohl principle, can also be directly applied to the automotive world. Larger vehicles look best in darker colours: anthracite, hunting green, marine blue. Light gray would be an extreme option.

What is the role of white in art?

It's important. Besides gold and blue, white is one of the most prominent colours in art history. White symbolizes more than innocence. Ever since the rediscovery of the colourful splendor of ancient temples, which were, mind you, just as brightly painted as their sculptures, white has been associated with the Enlightenment values: Equality, justice and reason. So it's a very virtuous and rational colour.

And finally: What, then, is your favorite colour?

Medium beige.

PHILIPP TINGLER

is a writer, blogger, philosopher and literary critic. Tingler studied economics and philosophy at the University of St. Gallen, the London School of Economics and the University of Zurich. He also worked at the Economic Institute of the Federal Institute of Technology Zurich. He lives in Zurich.
www.philipptingler.com



Terrain test:
Jörg Glocker sells
paint for mountain
bikes and knows
its limits.

PAINT FOR MOUNTAIN BIKES

The thrill and stress of the trail

Cycling as a stress test. Mud, stones and bad weather strain man and machine. You see what the innovative frame paint can withstand on the trail. And for good measure, in the pouring rain.

By Jürgen Löhle; photos by Oliver Roggenbuck



People debate the weather endlessly: it's too cold, too hot, or too dry. Right now it's definitely too wet. In the beer garden of Katzenbacher Hof just outside the gates of Stuttgart, it is merely drizzling to begin with. Seconds later rain is pouring down from lead-gray skies. A fine spray turns to big, fat raindrops, pelting from above or wind-driven from head on. Jörg Glocker seems unperturbed. "There is no bad weather, only bad clothing," quips the 47-year-old Director of Sales Administration at Würwag dryly. Hop on the bike no matter the weather! Admittedly, a competent bicyclist can handle a lot. Getting soaked during the ride is part of the game. But setting off soaking wet? Only if it is absolutely necessary ...

Glocker is still undeterred. You have to set goals and achieve them, that's his motto. Today the goal is to do a terrain paint test. And not even thunder god Thor himself is going to stop him. So slip into the clipless pedals and push off. There is one good thing about constant rain: the forest paths between Katzenbacher Hof, Schloss Solitude and Glemseck are virtually empty. Here and there, put-upon dog-owners peer from under their capes with apathetic canines at their side—that's all the company we'll have on the paths today.

At first, there is a slight descent towards Pfaffenwald. Glocker's heart rate remains calm in keeping with the route. Still no trace of deep holes or knotty roots. Then gently uphill towards the university. For Glocker a chance →



→ to lightly warm up his muscles. After tearing his Achilles tendon twice, the former handball player switched to bike-riding. But not simply to make a quick trip to the bakery on Sundays. He covers about 7,000 kilometers (4,350 miles) a year, overcoming many challenges like the climb to the Stelvio pass or the Albstadter MTB Marathon. “I need challenges like that,” he admits, just as the next one arrives: The gravel track leads steeply downhill towards the highway. If you hit the front-brake too hard here you’ll sail over the handlebars. If you don’t brake, you’ll end up in the hospital. Glocker controls his braking perfectly. After that, the route goes along the lakes to Bärenschlössle. Washed out trails, loose stones, puddles, roots. The handlebars vibrate, raindrops on his glasses cloud his vision, but Glocker focuses intently on avoiding dripping, drooping branches overhead and other obstacles to find the best path. This is when recreational cyclists quit while fighters push on.

The athlete awakes

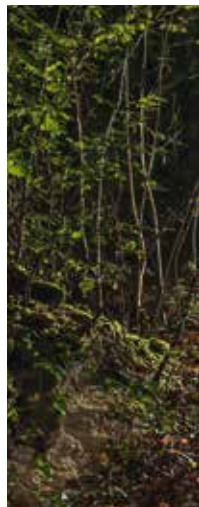
Tenacity—without it, Glocker and his Wörwag colleagues certainly would not be in the market with a complete bike coating solution. For a long time, the Stuttgart-based company sold a leading clear coat for seal-coating the frame. Then a customer asked for a complete solution comprising a primer and base coat to match the acrylic powder clear coat that was already available. Wörwag started development, but it stalled and was almost dropped in 2011 as a result of changing company priorities. “But then,” said Glocker, “we would have done all that work for nothing and the money invested would have been lost.”

Sights set on big targets



Cycling requires perseverance, which proves equally useful in paint development. Besides Jörg Glocker, Riechard van der Zaag (photo) and Thorsten Bollinger also worked on the complete solution for bicycles that has been taking the market by storm since early 2015.

The Dutch sales professional, van der Zaag, got the Dutch Accell Group to on board, and they now use Wörwag products to paint many of their brands, such as Batavus, Haibike and Staiger. The karate practitioner and amateur cyclist is proud that “our coatings have automotive quality”, and is busy trying to convince more brands of Wörwag. A move which Bollinger fully supports. The market manager contributed significantly to the development of the coating system and is pleased that factories in Holland, Hungary and Turkey are all working with it now. Bollinger is now in the process of trying to enlist more well-known brand names as Wörwag customers. A tall order, but Bollinger is also working on his physical fitness in the saddle of his mountain bike to improve his job performance.





"I need
challenges
like that."

Jörg Glocker

Protection under
constant stress:
MTB paint is tough,
defying mud and
stones.



Hitting the limits:
If you love your
bike, you'll wash
it after the ride.



Light at the end
of the rain?
Glocker is almost
there—but not
done yet.

That awoke the athlete in Glocker. Grit your teeth, endure, rise above the setbacks. People like Glocker keep going after the muscles cramps set in at the 28-kilometer (17.4-mile) point and finish the marathon, or keep cycling in heavy rain. They aren't deterred that easily. Wörwag called in some experts, and the paint was developed, tested and approved by the customer. Since early 2015 it has been on the market.

That was tough, sometimes sticky work, like this ascent to Schloss Solitude. Barely visible, Glocker winds his way through the forest. His body is warming up on the inside, while the rain cools the outside. Again and again the tires flick stones against the bike frame. But the paint holds, the protective layer is like the weather—extreme.

More bicycles than cars

Half-time, the turning point. Then it's back via a different route. That's also standard, because breakthroughs tend to come when you try different paths. This is a key to success, especially in development. The approach has also proved successful in bicycle coatings. The prospects are bright: There is only one competitor in the European bicycle market, but a dozen in the car industry. And the number of new bikes being produced far exceeds

the number of new cars. 5,000 tons of paint per year seem doable. The perseverance invested will pay off.

Like Glocker's ride. He is still waiting for a real thrill. Suddenly, it appears—the wall. It is not particularly long, but it's steep. So steep that the rear wheel starts spinning when you stand on the pedals. It must have been a log slide at one time. There is no alternative but to bear it for a while. Glocker is extremely fit, but even his heartbeat leaves the comfort zone as he struggles up the wall. Where minutes before in the Pfaffenwald, there was no cog small enough, the chain now whirs left to the largest sprocket. At the top, even Glocker is panting, and he can feel the strain in his calves. But that is the thrill that every bike athlete seeks. After all, anyone can cruise on flatlands. That's why he's beaming even though he is dripping with sweat.

"My first goal is getting there." From here that shouldn't pose a problem, because the rest of the route is level.

Back at Katzenbacher Hof. Wet, dirty, but successful in defying the rain and the wall. A mere 24 kilometer (15 miles). For someone like Glocker that's nothing. He rides further on Sundays with his wife and children. Oh, and the rain: It stops as soon as he gets home. ■

Promoting sports

For years, the automotive industry has been relying on primers and clear coats from Wörwag for visible carbon parts. Now the Wörwag range also includes a protective coat for sports equipment, which is opening new doors in China.

By Thorsten Schonfeld; illustration by Star Worbs

Surf boards, golf clubs and skis instead of spoilers, mirrors and hoods. Beyond the automotive industry, carbon fiber reinforced plastic (CFRP) is a material that is becoming increasingly popular in high-quality sports equipment because it is extremely light, stable and attractive. And with surfaces of visible woven carbon fibre, the owner can show-off the structural components of the respective device. Since these types of sporting goods are mainly manufactured in China, Wörwag has recently begun offering a primer for this market.

News of good quality spreads. That is why the Action Composites company, one of the world's largest suppliers of carbon parts for the automotive industry, approached Wörwag for a protective coating. The Austrians also produce carbon fiber mirrors for a premium German manufacturer at their plant in Shenzhen, South China. A combination of primer and clear coat protects these parts from UV rays in particular.

The primer, which is, in this case transparent, ensures that the protective lacquer binds properly with the CFRP. In Europe, it is usually an adhesive, water-based, so-called hydroprimer. BMW, for example, uses a Wörwag hydroprimer plus clear coat in the production of the carbon roof of the electric i3 model in their Leipzig plant.

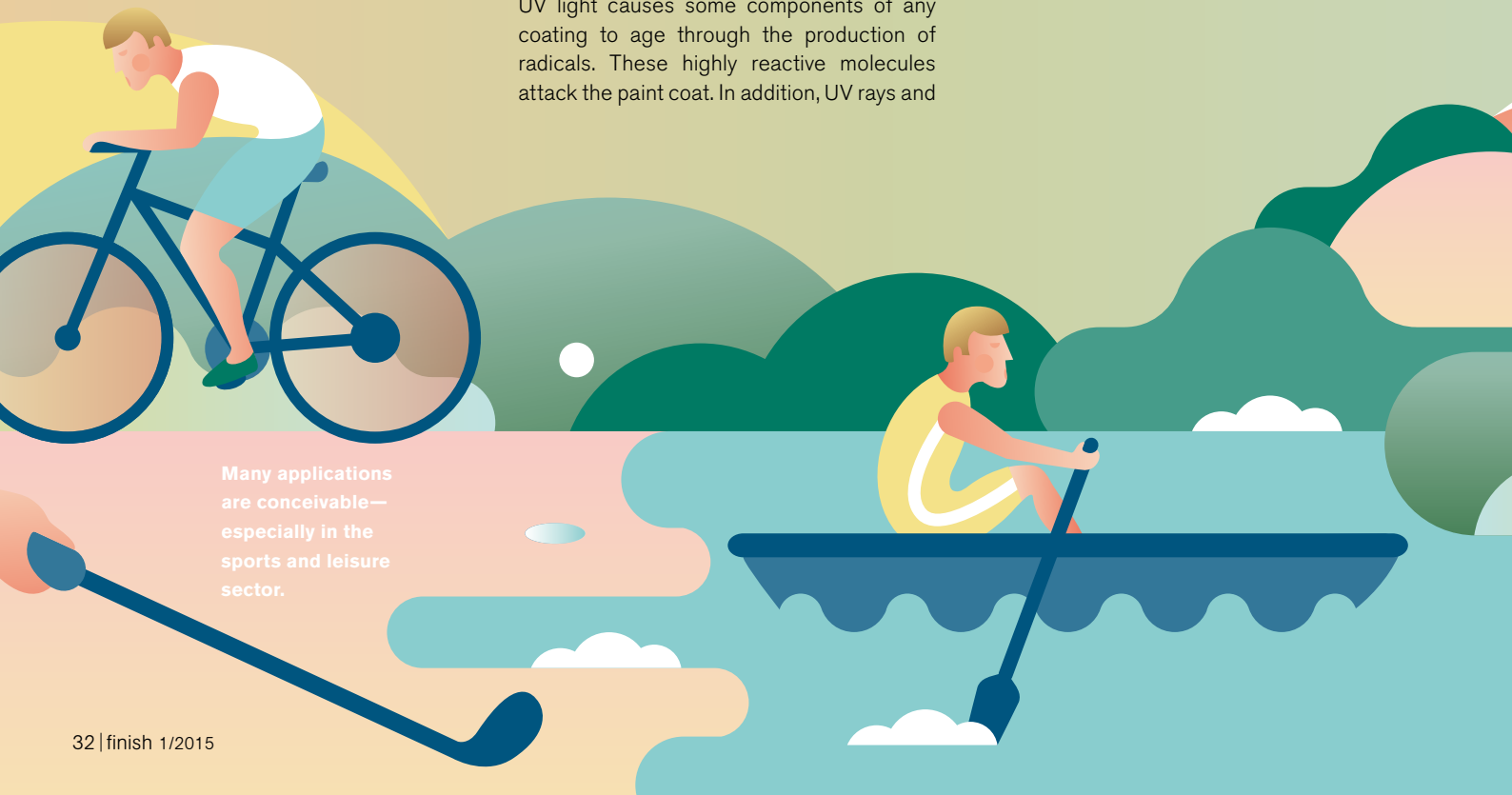
Sunblock and radical scavengers

UV light causes some components of any coating to age through the production of radicals. These highly reactive molecules attack the paint coat. In addition, UV rays and

heat promote radical formation in conjunction with ozone and air humidity. There is also the gradual oxidation caused by atmospheric oxygen. Therefore, in addition to UV absorbers, the new coating specially developed for CFRP surfaces contains free radical scavengers—molecules that neutralize radicals.

However, processing hydroprimers places complicated demands on the production equipment, making it more expensive. "In China, the hydro process is not yet established as a technical standard," explains Georg Bussmann, Director of International Technology Management at Wörwag. It was therefore necessary to find an alternative for the Chinese Action Composites factory that would meet the high quality demands of the customer and the paint specialists.

Many applications are conceivable—especially in the sports and leisure sector.



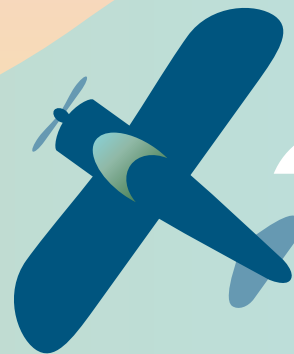


Photo: Laurent Burst



JOANNE WANG has been in charge of sales at the Wörwag factory in Langfang for a good ten years. The academically-trained marketing expert supports industrial users of coatings for carbon fibre reinforced plastics (CFRP) and paint films and develops such products for the Chinese market.

The developers in Stuttgart-Zuffenhausen presented the results in no time: Instead of a hydroprimer, an organically dissolved adhesion promoter is used. This has two advantages for the factory in China. On one hand, there is a greater variability in layer thickness than with the hydro counterpart. On the other hand, work steps are considerably fewer, which reduces the process costs.

From auto parts to sports equipment

The idea to use the CFRP coat in industrial applications besides the car industry was a result of the very positive results achieved with it. Demand was identified at a trade fair in China for manufacturers of high quality sports equipment. Joanne Wang, Sales Manager at Wörwag in Langfang was charged with the marketing. She is also the contact person for Action Composites. "Given the broad spectrum of applications outside of automotive engineering, we are collaborating with an

external marketing company that knows this market," explains Wang. First contacts have been made. Wörwag has one more trick up its sleeve: if the carbon doesn't necessarily have to be visible, for example in sports rowing boats or skis, Stuttgart offers primers with special colour effects. The season has begun. ■





Routing plan:
Waldemar Nesner
has been trucking
goods to Wörwag
customers in France
for ten years.

Road tour de France

The cab is Waldemar Nesner's workplace, kitchen, living room and bedroom. From Monday to Friday, Nesner has six square meters to live in. For ten years he has been trucking Wörwag products to customers in France. In that time, he has covered one million kilometers. A road trip midway between trucker lore and hard labor.

By Michael Thiem; photos by Toby Binder



Evening: Nesner has already parked his truck in position for the night.

“Coffee and smokes, a real trucker’s breakfast. You eat later.”

Waldemar Nesner



The plastic jar of instant coffee is labelled *Jump start*. That would help. After all, it is only five in the morning. Silence pervades La Suzannerie rest area, nearly 30 kilometers (20 miles) north of Le Mans. Wisps of fog waft over the A28 and Nesner’s truck. The cab’s burgundy curtains are still drawn, but the 51-year-old truck driver is already sitting behind the wheel and measuring out the coffee powder. Then he opens a drawer and switches on the electric kettle. Nesner finishes shaving before the steam whistles. He pours the water into a thermos cup, adds six sugar cubes and briefly stirs. Every move is rehearsed. Including reaching for the the cigarettes. “Coffee and smokes, a real trucker’s breakfast” grins Nesner. “You eat later.”

Nesner loves his job. For ten years, he has been travelling through Normandy weekly to deliver Wörwag paints to automotive sup-



Hygiene on the road: Nesner shaves in the driver’s seat, mirror propped up against the steering wheel.



At night, not all trucks look gray: With its yellow painted plastic parts, the cab shines in the dark.



gine at work." It is a 460-hp engine. The maximum load is 24 tons. It takes several minutes before reaching the maximum permitted speed of 80 kilometers (50 miles) an hour when there is a heavy load on board. Nesner switches to cruise control and lets it roll—one man, his truck and the road. "If I sound the two horns on the roof, you'd think a ship was entering the harbor," he grins.

Nesner knows every inch of road

His weekly Tour de France is nearly twelve hundred forty-five miles long. And he always drives it in his yellow truck. The cab paint of his Mercedes Actros reflects the first rays of sunlight that appear on the horizon. Yesterday he already delivered to four customers. Today four more are on the list. Most of the time it is wet paint, sometimes powder coating. Wörwag sent almost 1,400 tons to France last year. 230 of them were driven by Nesner.

Next station: Vire, a town in the region of Lower Normandy. When planning a route, Nesner sticks to the suggestion given by his navigation system, which not only takes into account overhead clearance, but also restrictions for the transport of dangerous goods. Some roads are therefore off-limits, including many country roads and narrow towns. In the meantime, Nesner rarely needs the GPS. He knows every kilometer of the road.

The route goes to Vire via Alençon and Flers. The D 962 country road is hilly, and keeps passing fields of crops and the typical Norman stone houses with their picturesque façades. The next destination is located in a small industrial park. Nesner knows the logistics man there, and it is a quick stop. Ten minutes later, both pallets of liquid paint are unloaded and the journey continues. →

pliers. 100,000 kilometers (62,140 miles) a year. Behind the wheel he feels independent: "I don't have to take my breaks when the siren goes off." Unsurprisingly, *The death instinct* by Jacques Mesrine is one of his favorite books. It is an autobiography by the French public enemy number one of his time, written in a Parisian prison. It describes a life unfettered by the conventions of bourgeois life. Nesner is not a rebel, but pursues his own path. Since 1987, he has worked as a long-haul trucker, the last sixteen years at Schäfer in Bietigheim-Bissingen, a family business that regularly delivers for Wörwag.

The tattoos on his right forearm date back to his time in the navy. Two gold earrings twinkle in his left ear. He traveled the world as a young man. Today, he finds nothing more enjoyable than to drive a 40-ton truck along the highway, to step on the gas and "hear the en-



WOLFGANG FRITZ, at Wörwag since 1997. As Head of Customer Labs, the trained paint lab assistant oversees the coatings for plastic add-on parts for commercial vehicles. "Lightweight designs are in surprising demand for trucks. Cutting weight reduces fuel consumption and increases the payload. This also saves trips."



Nine hours a day on the road:
On behalf of Wörwag, Nesner has already traveled one million kilometers.

Slowing down:
Leisure time after the end of the shift is spent in the parking lot.



Delivery service:
In France, up to nine Wörwag customers await new goods every week.

→ It's 172 kilometer (107 miles) to the Bolleville rest stop. The many miles of road offer plenty of time for reflection. "Usually I am planning the weekend. This Saturday, for example, I'm going to assemble the awning for my trailer." Then he turns on the radio. At the steering wheel he likes to listen to chansons, he says with a laugh. "It's not really my music," admits the man who somewhat resembles and is a fan of actor Tommy Lee Jones. At home, Deep Purple, AC/DC, Iron Maiden and Motör-

"I don't cook,
otherwise I would have
to do dishes."

Waldemar Nesner

head albums occupy his shelves. A particular treasure is the original double album of the British rock band Led Zeppelin that went with the concert film *The Song Remains the Same*.

After two hours on the A84, A13 and A29 through the Calvados metropolis Caen and across the impressive Pont de Normandie, Nesner reaches the Bolleville rest area. After four and a half hours at the wheel, he is required to take a 45 minute rest. After that he can drive an equal period which adds up to a nine-hour shift. Nesner is looking forward to a shower.

Efficiency apartment in a truck

He keeps all the food supplies he needs for a week in the refrigerated storage compartment. Spartan but tasty: farmers bratwurst, tzatziki, palatine liverwurst and pickles. Sometimes he buys a fresh loaf of French



Bigger payload thanks to SMC

The daughter of the transport operator Jörg Schäfauer chose the colour for the paint of Nesner's cab. Wörwag's bright Mercedes-yellow is integral to the image of the freight-forwarding company from Bietigheim-Bissingen. The plastic body parts are not only eye-catching, but also light. The shipper can add the weight saved to the payload.

The secret is a composite material called Sheet Molding Compound (SMC), which is only about one-third of the weight of steel. SMC is composed of a thermosetting reaction resin and glass fibers. It is delivered in sheet form.

In the production of SMC parts, air pockets sometimes arise, which may later outgas and damage the paint surface. To prevent this, Wörwag has developed a special primer coat called barrier primer W321. It forms a solid layer that significantly reduces outgassing from the material.

bread. But usually he has enough brown country bread from his home in Bad Urach, just under an hour's drive from Stuttgart. "I don't do any cooking, otherwise I would have to do dishes afterwards," laughs Nesner. The cold storage compartment also has room for his evening beer.

But that will have to wait. After forty-five minutes he is on the road again taking the A29 towards Abbeville. Final sprint. The last customers receive their products—on time! In ten years, the only long delays were due to a two-day driving ban caused by a snow storm and a road blockade by French farmers.

The night in the bunk

Only a few kilometers are left before he will have to stop driving. At the rest stop in St. Quentin, Nesner scans the parking lot with a trained eye for a spot where his truck will be at a slight angle—to elevate the head of the bed slightly. If that is not possible, he keeps a four-inch high wooden wedge with him. The seven-zone cold foam mattress behind the seat measures 250 times 70 centimeters (three by eight feet). It is where Nesner can decompress. At 6 p.m. he calls his wife Monika. They phone for at least half an hour. They have come to terms with his multi-day tours around Europe. In November, they'll celebrate their silver wedding anniversary.

Slowly the parking area fills up with other trucks. Contact to other truckers is rather rare. Their paths cross, but in this case the path is not the goal. Nesner draws the curtains early and turns on the laptop, he pops in a DVD, and watches another episode of the television series *Vikings*. A welcome distraction as the days on the road don't provide much variety. Towards 10 p.m. the truck lights go off. Seven hours to go until *Jump start*. ■

Betting on Chrome

1001 ideas for school and office: Diana Liebreich got creative with chrome powder.



that show the effect. Samples of all sorts of things. Like the objects that you find lying around in the paint developers' office.

Maxed out possibilities

Wörwag product ideas often originate in a conversation among co-workers. The decade-old predecessor product had few fans left among the developers. Alexander Kiraly from Fiedler's team embraced the challenge enthusiastically. "We wanted to distinguish ourselves from the competition and thought that technically, there's plenty of room for improvement," he recalls. In 2013 they presented the new lacquer to the management. And received a green light. Fiedler: "We have now maxed out the technical possibilities. You can't pack more chrome effect into any coating."

The principle sounds simple: Heap some aluminum pigment into your paint powder, which will float to the surface during baking to produce the mirror finish.

But the devil is in the details. Fiedler illustrates the problem by running his thumb over a playing-card sized sample: "Here's where it gets tricky. You simply can't get rid of the fingerprints." In fact, the harder you try to wipe them off, the worse the streaks become. That is why we need to give the chrome paint a clear protective finish. The new clear coat is thinner and shinier than the old one. It spreads better and is just as effective in resisting dirt.

Using high voltage on sheets

Fiedler demonstrates the difference on a radiator. He sees this as one of the main fields of application for the chrome coat, although the possibilities are virtually unlimited. They range from office equipment such as the hole punch on Fiedler's desk to bicycles, to the interior of luxury cars.

Applying Chrome to school furniture is also a promising idea. "Our chrome paint could spice up the classroom. From our perspective, that's one of the most interesting markets," says Fiedler, who is convinced that the whole development effort will be worth it.

The chief developer leads us through the laboratories. One of them contains a pile of countless cans. "We're experimenting here with around two hundred raw materials," says



MICHAEL FIEDLER has been working at Wörwag since 2000. He studied chemistry in Reutlingen, is an expert in powder coatings, and has been Director of Development since 2010. "I am particularly interested in projects in the automotive industry," reveals the 45-year old. "That's the origin of my enthusiasm for chrome effects."

Fiedler. In order for the paint to give a homogeneous colour impression after application, the ingredients are not mixed in powder form, but first liquefied, melted and rolled into a sheet.

After solidification, the sheet is ground into a powder with a particle size in the double-digit micrometer range.

Fiedler stands at the "shooting gallery", armed with a powder gun. The tip of the nozzle he is using to spray the chrome the chrome coating onto a panel is charged with tens of thousands of volts. The air vibrates, and the paint coats the sheet. During firing the aluminum pigments will rise to the surface.

Fiedler smiles at his reflection, satisfaction all over his face. ■

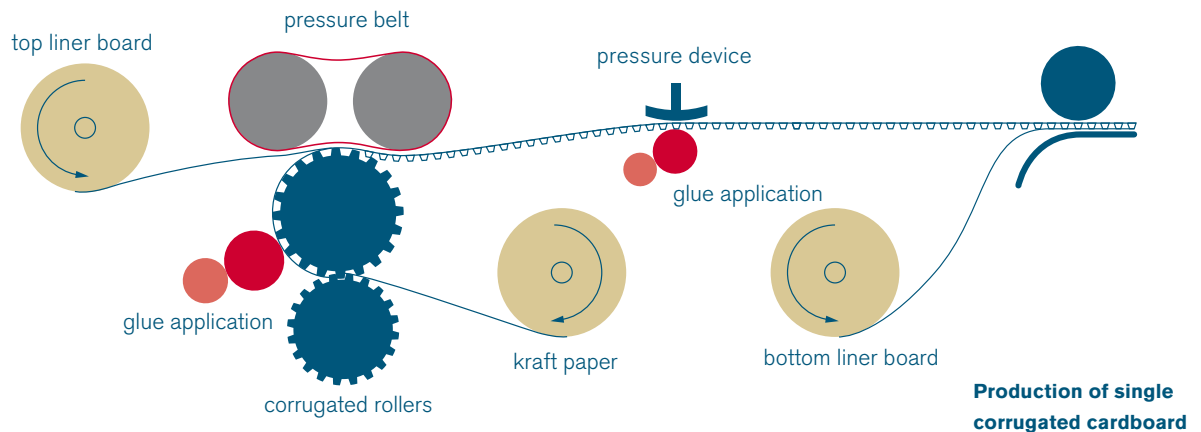
On a wave of success

The business model of BHS Corrugated Maschinen- und Anlagenbau GmbH is anything but a flimsy house of cardboard. Nevertheless, corrugated cardboard is at the very heart of its business. The company, based in Germany's Upper Palatine town of Weiherhammer, is the world's largest supplier of solutions in the corrugated cardboard industry.

By Alexander Günzler



Standard colour: Most of the corrugators made by BHS Corrugated are pearl white.



Simple but effective. A lightweight that protects loads weighing tons. Unobtrusive and ubiquitous. The number one in transport packaging is ambivalent: Corrugated cardboard was invented more than 150 years ago by an American, Oliver Long. Now annual production in Germany alone is more than seven billion square meters (75 billion square feet). The material is used in 70 percent of all freight shipments worldwide. To achieve such numbers requires sophisticated production lines. They are up to 180 meters (590 ft) long, weighing in at 500 tons, and capable of churning out up to 450 linear meters (1476 ft) of corrugated cardboard per minute. Globally speaking, one in two of these giant units comes from the German town of Weiherhammer. The 3900-strong community in the town of Neustadt an der Waldnaab is where the BHS Corrugated Maschinen- und Anlagenbau GmbH headquarters are located. The company, which traces its origins to a ducal hat factory established in 1717, has delivered more than 400 complete systems around the world and thousands of individual machines. Some 1600 employees—half of them in Weiherhammer—generated a record turnover of EUR 320 million in 2014. The magazine “Wirtschaftswoche” ranked BHS Corrugated among Germany’s oldest successful companies, at 24th place.

“In the corrugated paper industry, we are the world’s largest solution provider,” says Christian Engel, who co-manages BHS Corrugated, together with his brother Lars, and Norbert Städele. The brothers share ownership of the business, following in the footsteps of their father Paul, who prompted the company to acquire a stake in its current core business; then took it over in 1993. Much has changed since then. “Twenty years ago we were very manufacturing-heavy,” Christian Engel recalls. “Today, production makes up only 20 percent of sales.” A research and development team with more than 200 employees, as well as sales and service activities worldwide, offer

customers of BHS Corrugated complete support. Since the end of 2014, a new logistics center has optimized and accelerated assembly. By 2017, BHS Corrugated plans to invest a total of EUR 45 million in expanding its headquarters. The company has also been active internationally for decades. It also has production facilities in the Czech Republic, Brazil, the US and China. Although, BHS Corrugated had just five foreign employees in 1993, today there are 800. In Shanghai alone there are 300 of them, and their numbers are growing because particularly in Asia, sales volumes have been taking off lately. “Previously, eighty percent of our machines →

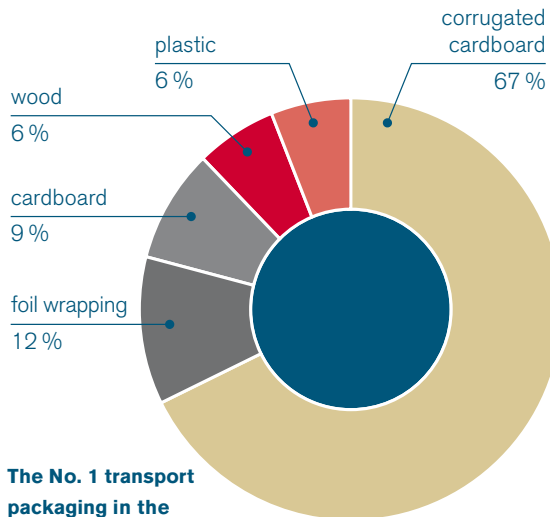
BHS Corrugated

History: Parts of the original plant were built as early as 1717. Since 1960 corrugating machinery has been produced there. The GmbH was founded in 1993

Employees: approx. 1600 worldwide

Revenues in 2014: EUR 320 million

Manufacturing locations: Weiherhammer (Germany, headquarters), Tachov (Czech Republic) Shanghai (China), Curitiba (Brazil), Knoxville (USA)



The No. 1 transport packaging in the world: corrugated cardboard.

→ went to Europe and the USA. Today, nearly forty percent go to the new Asian markets,” explains Lars Engel. Currently, BHS Corrugated supports customers in 22 countries. Service as a vocation—this is the standard the company has set for itself.

Partners for decades

Wörwag and BHS Corrugated are linked by an extremely reliable partnership proven over the past twenty years, says Wörwag sales representative Peter Donhauser. The corrugating machinery is coated exclusively with liquid coatings from Stuttgart-Zuffenhausen. The company’s current annual consumption stands at 120 tons. The machines get a two-coat system of primer and topcoat, supplemented by a protective coating on particularly heavy-wear areas. “That is particularly important in units which come into contact with hot steam or glue,” says paint technician Andreas Bäuerle. As simple as corrugated cardboard is in principle, it is complicated to produce. Raw paper is moistened, heated and then passed between two corrugated or fluted rollers under pressure, which give it its characteristic wavy form. Immediately afterward, a starch-based glue is applied to the wave peaks and a pressure belt presses the cover sheet firmly into place. Not long afterward, the other side gets the same treatment. To make the

corrugated cardboard fold more easily, it is usually creased. Cutting is the final step. The components used in these operations have names like module facer, splicer, dispenser and cross-cutter. BHS Corrugated manufactures them all. That enables the company to configure production equipment to its customers’ requirements. There are more than 1,000 different profiles available for the fluted rollers, of which BHS Corrugated produces some 1300 a year, and about 35 percent of which end up in its competitors’ plants.

New coating shop in in Weiherhammer

Customers have free choice in the way they coat their machines. “The standard colour is pearl white,” says Bäuerle. For quality assurance, BHS Corrugated and Wörwag regularly exchange information about processes and any potential problems. When BHS Corrugated built its own paint shop in Weiherhammer in 2014, the machinery and plant manufacturer also received support from Stuttgart-Zuffenhausen. “The constant technical support is an aspect that we particularly value in our cooperation with Wörwag,” says Markus Gruber from the assembly/production department at BHS Corrugated.

In addition to a responsible approach to the environment, BHS Corrugated takes social responsibility seriously. “Angels for Children”



True giants:
Corrugation systems from BHS Corrugated are up to 180 meters long.

is the family foundation initiated in 2003 by Ingrid Engel, the late mother of the company's current owners. A trip to Laos drove home the lack of opportunity facing the local youth. Since then, the foundation has been supporting the education of Lao children by building schools, paying education or teaching expenses, as well as providing teaching and learning materials. Even in the local town of Weiherhammer, BHS Corrugated has taken up the cause of education. On the premises is a multi-

company training center for some 240 companies from around the region. For many years, BHS Corrugated has also been working with the OTH University of Applied Sciences Amberg-Weiden and Regensburg University. Last but not least, the company has some one hundred apprentices. "Most of them stay with us once they finish their apprenticeships," says Christian Engel. "Ultimately, it's the employees who assure not only our success, but also the success of our customers." ■



PETER DONHAUSER

started at Wörwag 18 years ago. Since then he has been responsible for the sales force in Bavaria in the field of powder and industrial coatings. Above all he enjoys being able to work independently: "I can approach each customer individually." He also appreciates the trusting cooperation with his colleagues in Stuttgart. "We speak the same language."



Photos: BHS Corrugated Maschinen- und Anlagenbau GmbH, Frederik Laux

Thrill seeker

Product: automotive paint

Customer: Audi

Paint: Audi currently offers Wörwag's matte-effect paint for the RS6 and RS7 models in Daytona-Grey matte.

Application area: Audi R8, RS6 and RS7

Paint used since: 2010

Special feature: Even the soccer players of FC Bayern Munich love the effect. 20 players drive Audis with matte-effect paint.

CUSTOMER APPLICATIONS

Parade of stars

Wörwag delivers custom products. Three examples show just how diverse requirements and potential applications can be.







Street sweeper

Product: street sweeper

Customer: Kärcher (Obersontheim)

Application area: floor troughs and cladding for housings

Coating: textured powder coating W790 series

Coating used since: 2003

Coating technology: New powder plant enables different pretreatment steps for the components. Electrostatic powder coating processing with recovery and individual cycle times for powder curing

Special feature: particularly resistant to scratches; long life

Custodian

Product: door closing systems

Customer: GEZE GmbH (Leonberg)

Paint: Wöropur W single-coat paint W960

Application area: Building equipment, door closers, door and window systems, building technology

Paint used since: 2005

Special feature: The paint is applied both manually and by electrostatic high-rotation atomising. The 2K Hydro-PUR single-coat paint is quick-drying.



ESSAY

Yellow

By Elmar Brümmer—magazine journalist, who now knows why
“The yolk of the egg” is a German idiom for the very best

There is intrinsic value in yellow. There is virtually nothing negative associated with the colour, which is not particularly surprising, when you are talking about the colour of the sun. It warms the body and soul, and awakens the spirit. Moreover, yellow produces measurable muscle energy—it is a genuine stimulant.

It is the brightest and most cheerful of all colours and it strengthens the nervous system. And gets inside your head: thinking is easier, speech skills and memory get a boost. Besides stimulating the appetite, yellow turns on the imagination. New ideas result in actions, limits fall, freedom calls.

Yellow moves. And how! Now wonder the colour “Speed Yellow” is very popular in motor racing. The postal service chose it for painting their carriages long ago. In the Tour de France, the best racer is given the yellow jersey. The famous yellow of the New York taxicabs is supposed to suggest speed. But anyone who is stuck in a traffic jam in Manhattan will know that rather than tempo, yellow stands for serenity.

Yellow as an institution: In ancient China, only the emperor was allowed to wear it. In Thailand it was reserved for the king. After all, it symbolizes fame and fortune. A colour that can do a lot: spread good spirits and warn of danger. Especially in contrast with black—as in wasps.

And the famous “Das Gelbe vom Ei”—the yellow of the egg?
It means the ultimate best, because the yolk is considered most nutritious part of the egg. ■



A strong signal for fans:
Wörwag developed a yellow with rich effects
for the Golf GTI rally at Wörthersee.

LOCATIONS

Wörwag worldwide



Research and
Development



Production



Service



Sales

HEADQUARTERS, STUTTGART (D)



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