



Scratching the surface:
people who develop coating
systems have to know
what surfaces are made of.

SURFACES

The science of sticking to it

Taking care of exteriors is a part of the laboratory's daily routine. The strategists face new challenges repeatedly when new coating systems are in development, as alternative methods are often required to coat new materials or to break new ground in unfamiliar territory. A look below the surfaces.

By Michael Thiem; photos by Rafael Krötz

Titanium

is commonly found in the Earth's crust, but only bound with minerals. This element is only used in cases of highest quality requirements because it is expensive to produce.

Steel

is the most widely used metallic material in the world by far. Around 1.6 billion metric tons are produced annually. The official register of European steel lists approximately 2,500 types.

Iron

is undisputed leader in the rankings of the metals we use, with a weighting of 95%. Its ready availability makes it relatively economical. Iron is the main component in steel.

Aluminum

takes up the geosphere's third-largest mass percentage. It is the most common metal in the Earth's crust. Raw aluminum is of growing importance to the industry.

Carbon

is a primary element in the biosphere. All living tissue consists of organic carbon compounds. Carbon takes up the second-largest share of biomass after oxygen (water). Carbon fibers are an inorganic form. They make compound materials extremely rigid and lightweight.

Plastics

have become indispensable to the industry because of their varied technical characteristics including malleability, toughness, elasticity, fracture strength, and resistance to temperature and chemicals.

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he sample archive cabinet in the first floor hallway is well-filled. There are powder-coated suspension springs, a sawed-up axle support for turntables, naves, and many other components. They are covered with a wide variety of coatings and have stayed behind as silent witnesses to innovative materials research. Now and then Andreas Bäuerle (54) unlocks the door to retrieve forgotten knowledge. The technical customer advisor knows: there are many standards when developing new coating systems, but essentially no standard solutions. That's why it is often worthwhile to look at basic work that has already been done. At the same time, the most important questions never change: "Where is the coating to be applied? What is it supposed to accomplish there?", according to Bäuerle, who—along with his team—is about as close to a Wörwag motto that anyone can get: a deep understanding of surface finishing.

Bäuerle likes to cite the DIY store example: "If it were easy to paint a random surface, then anyone could buy paint off the shelf, spray it on, and that would be it." The coating systems requirements for industrial use today are as multilayered as a new car's list of extras. The coating has to act as protection, look beautiful, and fulfill additional functions on a case-by-case basis. Three criteria that can vary in multiple ways.

"Cars only have a few components anymore that are not coated in some form," says Bäuerle. That even applies to the engine. The old gray cast-iron block from which a colorful array of cables dangled has given way to visually pleasing aggregates with plastic covers sporting company logos. Even the back windows and headlight diffusers are being coated more and more often.

In general, the demands on the design become higher with each generation of cars.

The manufacturers have long since even developed color philosophies for brake disks and brake calipers. The requirements demanded of the color systems are constantly changing because new materials are continually being put to use or known materials are assigned new tasks. The development of a shade has evolved into a total work of art that sometimes entails exploiting all method and product spectrum options. "We often have to develop three or four systems for one shade," says Bäuerle. "We check on the possibilities we already have to solve the problem. If we find that we need new techniques, then it gets really exciting."

Ultraviolet coating makes a lot possible

Wörwag's innovative UV coating allows an electronic component made of aluminum and copper to be coated in a single work step. A prospective customer asked Bäuerle about it during a trade fair and was amazed when he shot back with the reply: "Yes, we can."

The combination of materials was new to Wörwag as well. "Two metals, which can have an intense reaction if they create a galvanic cell under damp conditions, come together in this electronic component," says Bäuerle. A prime example for the need to enable the innovative application of conventional materials using a coating solution. Even geometrically complex areas can be covered with the UV coating. The German construction machinery manufacturer Bomag, Wörwag, and the paint line producer Sturm joined forces to build a paint line that is able to coat and cure road roller drum casings in 16 minutes, thanks to the UV technology. A lamp with a diameter of 80 centimeters (31.5 in) and 400 watts output per square centimeter (0.155 sq in) was built in order to irradiate more inaccessible spots. There are many people behind success stories like this one. Andy Bender from technical customer support at the Düsseldorf-based



Surface experts: Silvie Mohr and Andreas Bäuerle understand the role substrate materials play in coatings development.

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company Henkel can verify this: "It is essential that the coating manufacturer work together with the surface's previous processor." The consumer goods giant's laboratories are testing new methods of preparing the substrates for powder coating as closely as possible to actual conditions as well as the re-coatability of seam sealants. That's the reason the experts in Zuffenhausen like to draw on the Düsseldorf company's expertise. Bender trains and advises Wörwag employees in the chemical treatment before the coating application. And so coating specialist, customer, and facility builder have grown together to form a highly effective team over the years. This "ground control" operation is especially challenged by the search for locking screws. Customers are also welcome to access this expertise. Wörwag offers seminars in Germany covering many coating and pretreatment topics several times a year (woerwag.de/seminars).

Sticking point: pretreatment

Plastic surfaces are especially tricky. Although empirical data is available for the individual substrate groups, there is no way around testing the respective substrate type for specification fulfillment with the pertinent coating, as paint adhesion is influenced by numerous factors. The adhesion of the coating itself can be manipulated by means of binding agents or solvents, and by pigments as well as the type and amount of filler. However, the type of plastic used and the pretreatment also have a considerable influence on the adhesion. "While you simply clean sheet steel before coating it, the modern thermoplastic polyolefins require additional treatment for the coating to adhere well," explains Silvie Mohr, Head of Materials Engineering at Wörwag. That primarily includes flame treatment and pretreating with plasma. The coating will then endure. "Stick-to-itiveness" is a virtue. ■