WACKER WORLD WIDE MAGAZINE

WWW 02 18

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WACKER

A STRONG HOLD

Find out how Hans R. Bauer has reinvented underwear

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SUSTAINABLE PRODUCTS AND PROCESSES

Dear Reader,

Sustainability is a key element of our Group strategy. At WACKER, we take an integrated approach that includes products and processes alike. We optimize our plants' use of materials and energy to minimize production-related resource consumption. And we develop new, sustainable products with the goal of further reducing our carbon footprint.

For example, WACKER POLYMERS now offers its customers the option of purchasing VAE copolymers that are produced using bio-acetic acid from renewable raw materials – or, more specifically, from scrap wood. For all polymer products based on renewable raw materials, the division has established its own product line: VINNECO®.

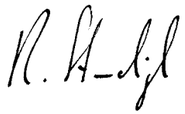
In the field of silicones, the consumer goods industry, in particular, is increasingly demanding resource-efficient upstream products. With BELSIL® eco, WACKER SILICONES now offers a brand of silicone fluids for cosmetic and hair-care applications that is based on biomethanol produced exclusively from straw or grass cuttings.

Products from renewable resources are a relatively new development for us. WACKER has always worked toward resource- and energy-efficient production processes. Our closed production loops are our great strength. We reuse byproducts as starting materials for other products. And we optimize the energy- and resource-efficiency of our facilities through our own groupwide productivity program: the WACKER Operating System (WOS).

Further, our strategic position as the world's largest producer of vinyl-acetate-based copolymers and the second largest for silicones also ensures that production is highly efficient. WACKER POLYMERS is the only VAE manufacturer to both produce and then dry dispersions at its sites. This tandem approach reduces transport and logistics costs, and avoids freight traffic.

These intelligent solutions are geared to sustainable growth. In this way, sustainability is becoming a strategic success factor – and increasingly a competitive advantage for both us and our customers.

I hope you enjoy reading this issue.



Dr. Rudolf Staudigl
President and CEO of Wacker Chemie AG

Dr. Rudolf Staudigl, President and CEO of Wacker Chemie AG

"Our closed production loops are our great strength. We reuse byproducts as starting materials for other products."

CONTENTS

WWW 2.18

Here you'll find all of this issue's articles at a glance.

18

TEXTILE INDUSTRY

GREATER WEARABILITY THANKS TO SILICONE

NTT is a company based in Balingen, southern Germany, which develops and trials textile-manufacturing technologies. These are then licensed out to major international brand names. NTT's latest brainwave is a sports bra that works like a suspension bridge and does not require any steel underwire.

Starting on page 18

52

34

26

42

NEWS

APPLICATIONS

SOLUTIONS

PORTRAIT

WWW 2.18 ▸ GLOBAL ▸ **WACKER WORLDWIDE**

WACKER WORLDWIDE

WACKER has production sites, application technology centers, subsidiaries and sales offices on every continent. Here is a selection of news and interesting topics from the Group's four business divisions.

1 CHARLESTON

This year, as part of the Manufacturing Day training initiative, WACKER invited students from Bradley Central High, Cleveland High and Tennessee Tech to its Charleston site to give them insights into the occupations available there and talk to them about career opportunities. After a site tour, the students were asked to take on tasks and come up with ideas following their visit. In late October, they returned to the site and presented their results. On Manufacturing Day, thousands of processing-industry companies from all over the USA promote themselves as attractive employers.

2 MUNICH

For the twelfth time, Dr. Peter-Alexander Wacker (center), WACKER Supervisory Board chairman, presented "Die Arche" (The Ark) in Munich with a donation of €100,000 this summer. Based in Munich's northern district of Moosach, this charity has been helping socially disadvantaged children and young people since 2006 by providing a warm meal for lunch, helping with homework and arranging extracurricular activities and school holiday programs. Initially, all this took place in construction trailers, but in spring 2018, the Ark moved into a "real" house. WACKER has been a partner to the organization from the start and supports it primarily with financial donations. In addition, a team of WACKER volunteers donates a large buffet of cakes for the summer party every year.

3 HELSINKI

The final phase for registering existing substances under the EU's REACH program for chemicals concluded in late May 2018. WACKER had registered a total of 245 substances with the European Chemicals Agency (ECHA) in Helsinki by the closing date. Manufacturers and importers had to submit a dossier to ECHA on the manufacture, use and safety of each substance produced in volumes of 1 to 100 metric tons per year. The Group took the opportunity to register substances not only for Wacker Chemie AG, but also for non-EU subsidiaries: 22 registration dossiers were submitted for Wacker Chemical Corporation (USA), six for WACKER Greater China, three for WACKER Norway and one for Wacker Metroark Chemicals (India).

4 SINGAPORE

The first WACKER Square Room opened in this Southeast Asian city-state in summer 2018. Not only its modern furnishings and large graffito on the wall set it apart from the Group's other showrooms or conference and training rooms. The technical equipment is particularly impressive. Visitors can combine real application examples with augmented and mixed reality, as is the case with the graffito, which can be wiped away in three dimensions using the WACKER Square app. With Microsoft HoloLens, users can see interactive 3D projections in their immediate environment, for example the use of WACKER products in the automotive sector. You can have a look at the WACKER Square Room here: **www.youtube.com/watch?v=JqEmv7lmlUQ**

5 SHENZHEN

The Chinese government is surging ahead with the expansion of electromobility. The metropolis of Shenzhen, for example, has electrified its entire local public transport bus fleet over the past eight years and, with more than 16,000 vehicles, today boasts the world's largest fleet of this kind. And in general, China is breaking all of the records for electric buses at the moment. According to a current Bloomberg New Energy Finance report, 99 percent of the world's 385,000 or so fully electrified buses are on the road in China. Shenzhen is planning to take it a step further and fully electrify all of the taxis in this southeastern Chinese megacity. WACKER offers numerous silicone products that are ideal for electromobility applications.

GROUP UPDATE

3D PRINTING LAB FOR SILICONES OPENS IN THE US

ACEO® makes production of printed parts with complex geometries possible

WACKER is expanding its ACEO® 3D silicone printing services with a new printing lab in Ann Arbor (Michigan, US). This is the first ACEO® facility of its kind outside of Germany. The new lab is equipped with two high-performance 3D printers. Silicone elastomers with a broad range of different Shore A hardnesses and in varying colors can be printed there, as well as media-resistant FVMQ grades. The ACEO® 3D technology enables innovative product designs and complex geometries. Even cost-efficient production of small series and replacement parts is possible.

WACKER plans to globally expand this technology. “The printing lab in Ann Arbor is the first milestone,” emphasized Dr. Bernd Pachaly, head of the ACEO® project at WACKER. “North America is the largest and most dynamic market for 3D printing. With our new lab, we will be able to convince our business partners in the region of the compelling possibilities of 3D printing with liquid silicone rubber.”

While ACEO® will continue to produce and deliver printed components from its head office in Burghausen, Germany, the new lab in Ann Arbor will concentrate mainly on advising customers and on project work. “Right from the start, the primary focus will be on the development of silicone-based products for key industry segments such as medical technology, healthcare, transportation, aerospace and electronics,” announced Pachaly.

Ian Moore, vice president of WACKER SILICONES at Wacker Chemical Corporation in the USA, further emphasized that “our R&D center for silicones is focused on developing advanced and forward-looking industrial solutions that support regional trends and can be quickly brought to market.”

ACEO®

is the first industrial-scale technology for 3D printing of liquid silicone rubber. This unique drop-on-demand method enables unprecedented product designs and complex geometries, while fully retaining the outstanding properties of silicones, such as temperature and UV resistance or biocompatibility. 3D silicone components can be used in a wide range of applications and in several key industries, such as the automotive, aerospace, healthcare and supply sectors, as well as in mechanical engineering.

The unique ACEO® drop-on-demand method can be used to faithfully replicate human organs using silicone – such as this anatomical heart-valve model.

Filling up cartridges with silicone sealant at WACKER’s new site in Jincheon, South Korea.

NEW SILICONE SITE OPENS IN SOUTH KOREA

In Jincheon, WACKER produces sealants and specialty silicones for the electronics industry

In late April, WACKER opened a new production site for silicone elastomers in South Korea. The plant is located around 100 kilometers southeast of Seoul at Jincheon, where the Group has already been producing silicone sealants since 2010 and specialty silicones for the electronics industry since 2012. Some €15 million has been invested in the move to the new production site.

“The opening of our new plant is a milestone for us and sends a signal to our customers that we want to continue growing in Asia and in South Korea especially,” said WACKER Executive Board member Dr. Christian Hartel at the opening ceremony. “We generate around 40 percent of our sales in Asia. Our operations in South Korea play a key role here.” With the new production site, the Group hopes to strengthen and expand its position in the region over the long term. “Due to the strong growth in demand for our silicones, production was increasingly being stretched to its limits,” explained Executive Board member Auguste Willems. As it was not possible to expand the facilities on the existing premises, WACKER decided to move sites. “Our new plant in Jincheon is four times as big as the old one and therefore provides enough space for future capacity expansion,” he stressed.

The centerpiece of the new site is a 13,000-square-meter production building. Both silicone sealants for the construction industry and silicone rubber compounds for electronic applications are manufactured in separate facilities there. The production lines have been equipped with cutting-edge manufacturing technology that enables fully automatic and therefore highly efficient production processes. Hyperpure silicones are also produced and packaged in a dedicated cleanroom – a service that is becoming increasingly important for the electronics industry in particular.

“Jincheon offers us the space and technical facilities we need to continue meeting the rising demand for silicones in the region long term. That applies both to our sealants and to our high-performance silicones, which our customers use to produce automotive displays or use in other demanding electronic applications,” emphasized Willems.

ALPHA-DEXTRIN FOR EGG-FREE BAKED GOODS

CAVAMAX® W6 offers vegan alternative to the use of eggs

At the IFT (Institute of Food Technologists) Annual Meeting & Food Expo 2018 in Chicago, WACKER presented its alpha-dextrin CAVAMAX® W6, the innovative solution for reduced-egg or egg-free baked goods. It has an emulsifying and stabilizing effect in a wide range of bakery products and ensures that layer and sponge cakes, waffles, muffins or brioches are as light and fluffy as baked goods made with egg.

For a variety of reasons, ever more consumers quite deliberately demand products that contain no animal-sourced ingredients, while still requiring that their texture and flavor meet high standards. A purely vegan product, CAVAMAX® W6 is low in calories and cholesterol- and fat-free. As a fermentation product of starch – for example from corn or potatoes – CAVAMAX® W6 is made from renewable raw materials.

In addition, the use of alpha-dextrin achieves cost reductions of up to 40 percent compared to egg-containing products, as the availability and price of eggs are subject to significant seasonal fluctuations.

CAVAMAX® W6 is a water-soluble powder that is easy to handle and process. Since the dough's leavening properties and viscosity are not impacted, baked goods containing alpha-dextrin can be produced using existing equipment.

CAVAMAX® provides baked goods with volume, elasticity, and optimum moisture content – important properties, which are usually impaired when eggs are omitted.

WACKER AT TRADESHOWS

CHINA IMPORT INTERNATIONAL EXPO
Shanghai, China
November 5 – 10, 2018
english.mofcom.gov.cn/article/zt_englishimport

COMPAMED
Düsseldorf, Germany
November 12 – 15, 2018
www.compamed-tradefair.com

Formnext
Frankfurt, Germany
November 13 – 16, 2018
www.mesago.de/en/formnext/

India Rubber Expo
Mumbai, India
January 17 – 19, 2019
www.indiarubberexpo.in

JEC
Paris, France
March 12 – 14, 2019
www.jeccomposites.com/

EUROPEAN COATINGS SHOW
Nuremberg, Germany
March 19 – 21, 2019
www.european-coatings-show.com

CYSTINE PRODUCTION STARTED IN SPAIN

Fermentation process allows manufacture from non-animal raw materials

WACKER BIOSOLUTIONS, the Group's life sciences division, has begun producing fermentation-generated cystine at its new site in León, Spain. Over the past eighteen months, the division has extensively modernized part of the 800-cubic-meter fermentation capacity acquired there at the end of 2016. In addition, it has built a production line for cystine. Capital spending for the site totals some €30 million. WACKER employs more than 40 people in León.

"With our investment in the León site, we are well equipped to strengthen our position as the global market and technology leader for fermentation-generated cystine," explained Dr. Gerhard Schmid, head of WACKER BIOSOLUTIONS. "The modernized fermentation plants and the new cystine production plant enable us to reliably meet our customers' growing demand for cysteine and cystine, and to commercialize new fermentation-generated products."

Cystine and cysteine, the amino acid produced from it, are widely used in the pharmaceutical, cosmetics and food sectors to not only manufacture flavorings and make doughs in baked goods easier to process, but also as free-radical scavengers in cosmetic products or expectorants in cough medicines. WACKER is the first company in the world to produce cystine by fermentation in a patented biotech process. Due to their entirely plant-based and inorganic raw materials, WACKER cystine and cysteine are purely vegetarian. This makes them ideal for safe use in food and pharmaceutical products. In 2008, WACKER was awarded the Federation of German Industries (BDI) Environmental Prize for its innovative production of cysteine.

Production equipment for fermentation-generated cystine at the León site.

A cleanroom for producing biologics at WACKER's Jena site. Bacteria in the fermenters help produce active proteins for medications used, for example, to treat cancer and multiple sclerosis.

WACKER INVESTS IN JENA BIOTECH SITE

Expansion of production plants and successful inspection by Brazilian health authority ANVISA in Jena

In Jena, WACKER has expanded its production facilities for biopharmaceuticals – also known as biologics – to include new equipment. "In recent years, we have been continuously expanding our contract manufacturing capacity for biopharmaceuticals in Jena. The new, modern production equipment has further enhanced the site, making our company fit for the future," explained Dr. Guido Seidel, managing director of Operations at the wholly-owned WACKER subsidiary Wacker Biotech GmbH. The company invested €2.5 million in, among other things, a fully automated fermentation plant including a new bioreactor with a capacity of 350 liters, a new separator for efficiently isolating cells and a new GMP cell-bank suite. The suite enables independent cell-bank production and expands storage capacity for customer cell banks.

Furthermore, analytical capacities were expanded with a new microbiology laboratory and equipment for process and product characterization. A modern eDMS system now enables the automatic handling of GMP documentation. As a result, Wacker Biotech's Jena site is fully equipped to supply the fast-growing market for biologics. Future-oriented therapeutic agents now make up 25 percent of the global pharmaceuticals market.

Another positive signal for the Jena site came with a visit from the Brazilian health authority ANVISA. After an inspection of the production facility in April 2018, the ANVISA team confirmed that the Jena site complies with the Good Manufacturing Practice (GMP) principles and standards for the production of high-quality active ingredients. The inspection by ANVISA was arranged because one of WACKER's customers intends to market its cancer medication in Brazil (requiring a pre-approval inspection). Wacker Biotech has been producing the active ingredient using a new, efficient, recombinant method since 2016. The European Medicines Agency (EMA) already gave its approval in February 2016.

"With the successful ANVISA inspection, we now have further confirmation from a respected authority that we are able to provide our customers with outstanding products and efficient production processes," stressed Dr. Susanne Leonhartsberger, managing director of Wacker Biotech GmbH. "This positive assessment makes Wacker Biotech an expert and certified partner for all customers who want to sell their products on the Brazilian market."

For further details, visit the following website: **https://www.wacker.com/biologics**

WWW 2.18 ▸ NEWS ▸ **UPDATES**

NEW ADDITION-CURING SOLID SILICONE RUBBER GRADES

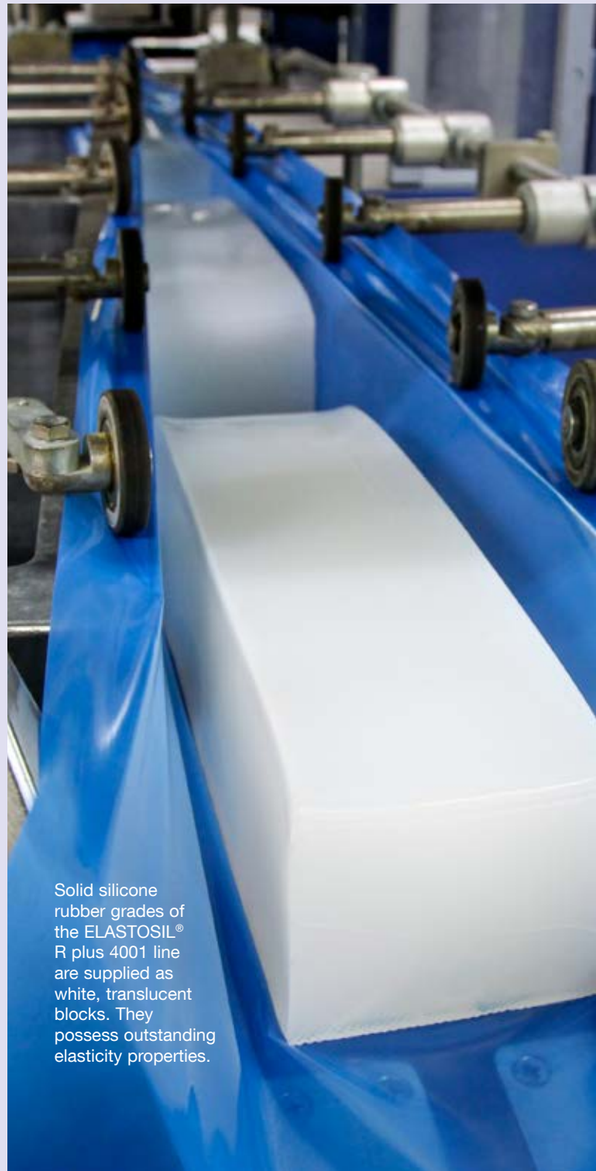
At the German Rubber Conference DKT, WACKER showcased solid silicone rubber grades that are particularly soft or hard, or heat-resistant. Their application range is correspondingly versatile.

With its solid silicone rubber line, WACKER already offers highly versatile grades of varying elasticity and hardness. This summer's German Rubber Conference DKT in Nuremberg was the first time WACKER introduced products at the upper and lower end of the Shore A hardness scale, respectively.

ELASTOSIL® R plus 4001 is an addition-curing solid silicone rubber with two outstanding features: ease of processing and excellent elasticity. ELASTOSIL® R plus 4001 cures up to 50 percent faster than comparable peroxide-curing rubbers, which facilitates short processing times and high production throughputs. Cured products made with ELASTOSIL® R plus 4001 are also elastic, considerably deformable and retain their mechanical properties for many years. Postcured molded parts are ideally suited to manufacturing membranes and seals for a number of industries and uses, including sensitive applications for the food sector. With a Shore A hardness of 20, ELASTOSIL® R plus 4001/20 complements the existing range of extremely soft and low-modulus silicone rubbers. Products cured from ELASTOSIL® R plus 4001/20 can be stretched to twelve times their original length without cracking or losing their mechanical properties.

The second grade is from exactly the opposite end of the hardness range. ELASTOSIL® R plus 4001/90 has a Shore A hardness of 90, which is similar to that of a thermoset. Yet this solid silicone rubber has an elongation at break of 140 percent, making it comparatively elastic, flexible and ductile. Since the cured products are suitable for sensitive applications, ELASTOSIL® R plus 4001/90 can also be used in the food sector.

ELASTOSIL® R plus 4350/55 is a silicone rubber for formulating heat-resistant, addition-curing silicone elastomers. This silicone grade reveals its properties to optimum effect in combination with heat stabilizers and it can be easily extruded. ELASTOSIL® R plus 4350/55 can be used to make extremely heat-resistant tubing and sealing profiles. They withstand temperatures of up to 300 °C without being damaged, even for several days. Cured rubber grades made from ELASTOSIL® R plus 4350/55 are ideal for manufacturing heat-resistant profile gaskets, such as for oven and stove doors or for engine-compartment parts. Postcured grades comply with the requirements of the German Federal Institute for Risk Assessment (BfR) and the US Food and Drug Administration (FDA) for food contact.



Solid silicone rubber grades of the ELASTOSIL® R plus 4001 line are supplied as white, translucent blocks. They possess outstanding elasticity properties.

Transfer station for acetic acid at the Burghausen site. The raw material certified by the biomass-balance method is required for the manufacture of vinyl-acetate-based polymers.

VAE BINDERS BASED ON RENEWABLE RESOURCES

WACKER has biomass-balance method certified by TÜV SÜD

WACKER is the world's first manufacturer capable of using renewable resources to produce commercial quantities not only of dispersions based on vinyl acetate-ethylene copolymer (VAE), but also of further products based on vinyl acetate – all known by the VINNAPAS® brand. To do so, the company uses acetic acid generated as a byproduct in the woodworking industry.

The wood used to make the bio-acetic acid originates from sustainably managed forests that are PEFC® certified like this one.

TÜV SÜD, the international technical inspectorate and certification body, has certified WACKER's biomass-balance method as meeting its international CMS 71 standard. Independent certification assures customers that WACKER has replaced the required quantities of fossil resources with an equivalent amount of renewables for its biomass-balanced products right at the start of production. WACKER markets this innovative product class under its new VINNECO® line, encompassing all its polymer products based on renewables.

"More and more customers in construction, paints, adhesives, textiles and the paper industry value the use of renewable raw materials," said Dr. Christoph Riemer, head of the Consumer & Industrial Polymers business unit at WACKER POLYMERS. "We can now meet that wish with our vinyl acetate-ethylene copolymers. Because sustainability begins early for us," he added, "with the raw materials." In the case of WACKER's new polymer class, the acetic acid comes from the woodworking industry.

The wood originates from sustainably managed forests that are PEFC® certified. The bio-based acetic acid meets WACKER's quality standards and is characterized by very high purity, very good color compatibility and very low water content. As a result, the bio-acetic acid's chemical and physical behavior is identical with that of conventional, fossil acetic acid. What's more, mixing both types of acetic acid does not affect the end product's properties.

All of these aspects favor the biomass-balance method that WACKER uses to calculate how much VAE dispersion was produced from renewable and, thus, non-fossil raw materials. The recently issued certificates verify that WACKER's mass-balance method for VAE production meets the criteria of TÜV SÜD's CMS 71 standard on the traceability of renewable resources. "We can now offer customers of VAE dispersions something comparable to the green electricity that consumers get from utilities," said Dr. Markus Busold, strategic marketing director at Consumer & Industrial Polymers. "When customers order binders based on renewables, WACKER ensures that the required amount of bio-acetic acid has entered the production loop. And that kind of acetic acid comes solely from certified producers."

Production of plasma devices for accelerating wound healing at Coldplasmatech. The large silicone dressing can be seen in the center.

COLDPLASMATECH RECEIVES GERMAN INNOVATION PRIZE

Startup processes medical silicones from WACKER

Coldplasmatech, a company based in Greifswald, northeastern Germany, that works with WACKER's SILPURAN® range of silicones for medical applications, has won the 2018 German Innovation Prize in the startups category. The competition is an initiative set up by Accenture, Daimler, EnBW and "Wirtschaftswoche" magazine. It is sponsored by the Federal Ministry for Economic Affairs and Energy.

Coldplasmatech has developed an innovative wound treatment process using cold plasma. It has long been widely known that cold plasma can sterilize wounds and promote healing. Even multi-resistant bacteria that fail to respond to antibiotics are destroyed on contact with the electrically charged gas.

To date, applications involved devices the size of a thick ball point pen that were only suitable for small wounds. Coldplasmatech researchers from Greifswald have now developed devices that work with large silicone dressings and are suitable for treating equally large wounds (bedsores occurring in bedridden patients).

We reported on Coldplasmatech's development work in our 1/15 issue of WWW.

WACKER Executive Board member Dr. Christian Hartel (right) and Dr. Christoph Kowitz, head of Corporate R&D (left), congratulate the winners of this year's Alexander Wacker Innovation Award Dr. Volker Stanjek (2nd from left) and Dr. Lars Zander (2nd from right).

WACKER CONFERS INNOVATION AWARD FOR DEVELOPMENT OF ALPHA-SILANE TECHNOLOGY

Combination of hard phenyl silicone resins and elastic hybrid polymers makes novel binders possible

WACKER has conferred the Alexander Wacker Innovation Award on Dr. Lars Zander and Dr. Volker Stanjek, employees at the WACKER SILICONES business division, in recognition of their work on the development of new binders. The chemists found a way to combine hard phenyl silicone resins with elastic hybrid polymers so as to manufacture products with enhanced property profiles. Such binders are suited to the formulation of high-performance, extremely strong adhesives and sealants, wood varnishes and coating materials. The €10,000 innovation award was conferred in early October at the WACKER Group's 46th research symposium in Burghausen.

Stanjek was part of a trio that won the coveted research award back in 2008 for their work on alpha-silanes. "Through his work on developing alpha-silane technology, Dr. Stanjek laid the chemical groundwork for the innovation that we are honoring today," said WACKER Executive Board member Dr. Christian Hartel at the award ceremony. "This illustrates the innovation potential which this technology has to offer." WACKER has been producing silane-terminated polymers based on alpha-silane technology under the GENIOSIL® STP-E brand name since 2005. These hybrid polymers, which cure rapidly in air by virtue of their reactive silyl groups, are chiefly used in highly elastic adhesives and sealants, such as wood-flooring adhesives.

Alexander Wacker (1846-1922), founder of Wacker Chemie AG, after whom the innovation award is named.

Now, Zander and Stanjek went a step further. They modified extremely elastic hybrid polymers with relatively hard phenyl silicone resins to develop elastic binders that possess high mechanical strength – a combination that cannot otherwise be achieved with either silicones or hybrid polymers.

Different silicone resins can be used to vary properties such as hardness, elasticity and tensile strength to match new application areas. The new binders are thus suited not only to the formulation of extremely strong adhesives, but also to the production of joint mortars, crack-filling compounds, paints, tile adhesives and wear-resistant coatings for concrete floors. "The new technology that Zander and Stanjek developed allows us to offer binders that stand up perfectly well to polyurethane- and epoxy-based systems when it comes to hardness and tensile strength – they have a lot of advantages, too," emphasized Hartel.

The products have more to offer than very good mechanical properties. Unlike many competitor products, they are also free of isocyanates and heavy-metal catalysts. "The sustainability of products is becoming increasingly important. That makes this product group very attractive to customers," stressed Hartel.

> "This new technology allows us to offer binders that stand up perfectly well to polyurethane- and epoxy-based systems when it comes to hardness and tensile strength – they have a lot of advantages, too."
>
> **Dr. Christian Hartel,** member of the Executive Board of Wacker Chemie AG

ENHANCED WEARABILITY

The evolution of traditional underwear is far from complete – German textile engineer Hans R. Bauer demonstrates how to redesign a conventional product using modern technology, new materials and a highly innovative mindset.

WWW 2.18 ▸ INNOVATIONS ▸ **TEXTILE INDUSTRY**

Inside NTT's production center: Hans R. Bauer checks how the dispensing equipment applied the silicone that is used to trace the contours of a bra prototype.

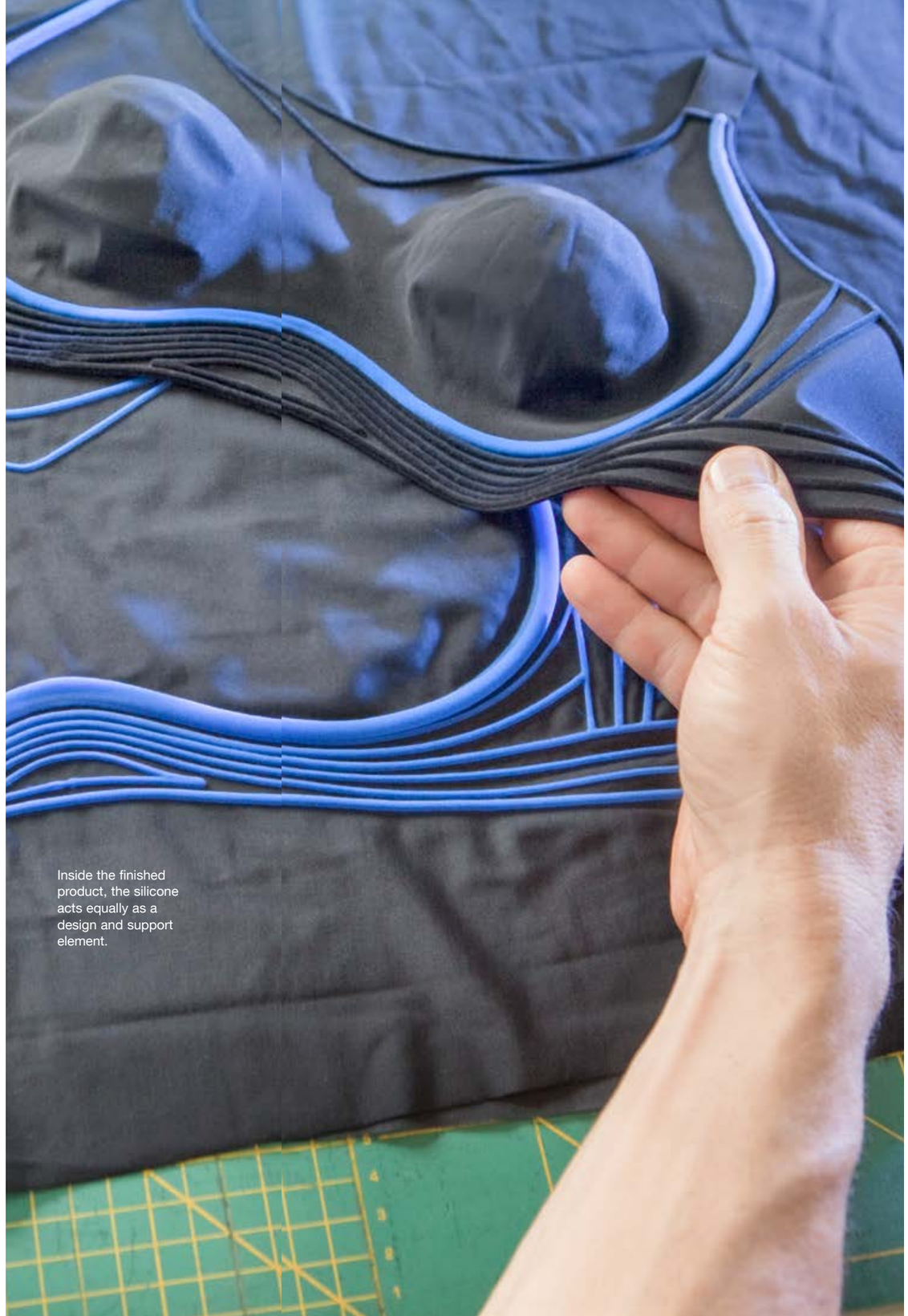
Together with his employees, Hans R. Bauer (right) checks the finished bras, which were made almost seamlessly using a production process he developed.

The dispensing machine's nozzle sweeps over the black-gray synthetic fabric msade of Lycra and polyamide fibers in long, flowing movements and traces the outlines of a garment with a colorless liquid silicone rubber. A red laser cross marks the beginning and end. The latest technology is being used here in Balingen in the Swabian Alb region of southern Germany to create a conventional, albeit new-look item of clothing: a sports bra.

Once the bra straps have themselves been reinforced with three vertical silicone strips, the equipment takes a short break, heats up the 3D print head and then moves toward the bra cups. At the curve of the cup, the dispenser squeezes a reinforcing polymer – an elastic polyamide – into the silicone bed.

MAXIMUM WEARABILITY

"By replacing the traditional metal underwire of a sports bra with silicone and polyamide, we are creating unrivaled wearability," says Hans R. Bauer, managing director and founder of New Textile Technologies (NTT). NTT refers to this patented, wire-free technology as SensWire. According to Bauer, the traditional metal underwire has been the subject of some debate in terms of health over recent years. It is true that the German Cancer Information Service (DKFZ) has given the all-clear – a correlation between wearing a bra (with or without an underwire) and the onset of cancer cannot be proved. Yet many women are looking for softer alternatives to the rigid metal underwire – and the structural design developed by Bauer makes these alternatives possible.



Inside the finished product, the silicone acts equally as a design and support element.

An elastic material such as silicone – possibly reinforced with another synthetic material such as polyamide at critical points like the bra cups – molds much better to the human body, thereby preventing painful pressure marks.

LIKE A SUSPENSION BRIDGE

Bauer likens the bra-manufacturing technique that he developed to the structural principle of suspension bridges such as the Golden Gate Bridge. The bra straps work like pylons – the towering static bridge piers to which flexible support cables are fastened. In a bra, the long, vertical strips of silicone coating applied to the straps act as the support cables, which hold the actual weight of the breast. These silicone coatings are reinforced by another synthetic material (polyamide) at the bottom of the two cups.

Once the bra has been completely reinforced with silicone, a member of staff takes it out of the dispenser. Detailed silicone patterns that are created by NTT's own textile designers and which cannot be produced by the dispensing machine are added on site by means of screen printing.

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Polyamide flocks are manually spread over the as-yet uncured silicone to match it to the coloring and feel of the rest of the garment.

The dosing unit presses polyamide into the silicone support lines to increase their hold.

The next step is so-called flocking. An electrostatic metering device that is reminiscent of a pepper shaker is used to apply black-gray polyamide flocks – just like in powder coating – to the lines of silicone while they are still damp. This approach is required by the design, but it also necessary so as to suppress the natural tackiness of unflocked silicone. Such tackiness may well be desirable, however, on the inner surface of textiles to ensure that the garment hugs the body.

Optically, the bra is now perfect. It is then placed into the drying unit, where it is heated to 145 degrees Celsius for ten minutes to allow the silicone to cure.

Yet as is so often the case, there is more to this design than meets the eye. Developed by NTT experts, SensElast 3D technology for the seamless production of clothing ensures that the sports bras made in this way are extremely comfortable to wear.

"Underwear produced by this technique feels like a second skin," says Bauer. At this year's ISPO – the world's biggest tradeshow for sports articles – in Munich, the Balingen-based company received the "Health & Fitness – Sports Bra" award for its SensWire and SensElast 3D technologies.

SEAMLESS TUBULAR FABRICS

The seamless production of textiles – known in the industry as tubular fabrics – is one of the core skills of NTT, which Bauer founded in 1999. "I've always had the urge to invent something," recounts Bauer, who is a trained textile machine mechanic. He previously worked as a technical manager in his father-in-law's knitting factory. And it was in this capacity that Bauer, who holds several patents, learned the many skills that he later brought to his own company: expertise in stitching and materials, the development and installation of machinery, the specification of customer requirements, textile design and much more. Thanks to the production processes he developed, Bauer, in a manner of speaking, reinvented the manufacture of ready-to-wear textiles twice.

Hans R. Bauer holding the model of a sports bra that he designed. His innovative, seamless design won him the international sports industry's ISPO Award.

Although NTT's portfolio includes the production of individual series, the company's core business is prototyping. Bauer and his 25 employees – including several textile engineers from the nearby Albstadt-Sigmaringen University of Applied Sciences – develop innovative technologies and processes, which leading manufacturers then use in their production. "We employ laser cutting, ultrasonic welding, dispensing and screen printing with silicone – not everyone can do that. Over the last 15 years, we've gained expertise in the manufacture of smart textiles," emphasizes Bauer.

GLOBAL ROLLOUT

NTT's official licensees include, for example, MAS in Sri Lanka – one of the world's biggest contract manufacturers of underwear, sportswear and other textiles that employs some 100,000 people and supplies almost all major clothing brands worldwide. What's more, NTT has been operating its own production plant in Croatia since 2016, where it makes the products developed in Balingen.

Due to high personnel costs, virtually no clothing or sports-goods manufacturer produces standard articles in large series in Europe anymore, but Bauer hopes that the highly automated technology he developed will make the manufacture of high-quality clothes interesting there again. A bra consists of around 40 parts. With Bauer's technology, the entire basic assembly runs on one line. Bauer and his textile engineers are currently working on a machine that acts both as a dispenser and can handle silicone screen printing with its highly multifaceted design possibilities – "a kind of jack-of-all-trades."

Now NTT's head of development and owner, Bauer first came across silicone as a material some 20 years ago when a large German textile

In partnership with Antelope, a Frankfurt-based startup, Hans R. Bauer developed an electro-stimulation suit coated with a specialty silicone from WACKER that is filled with carbon black – and is thus conductive. During a workout, a slight voltage is applied to the suit, thereby stimulating muscle growth.

> “The future of Germany's textile sector lies in high-end products such as the electro-compression suit we helped to develop.”
>
> **Hans R. Bauer,** owner and managing director, NTT

manufacturer was looking for ways to improve its high-quality bodysuits. The problem, explained Bauer, was that this kind of underwear was primarily targeted at older customers, which meant the product had to meet specific requirements. The bodysuits needed to have integrated supports for assisting the connective tissue. These kinds of supports tighten up and shape the body. The product that Bauer developed showed that silicone could be used in such bodysuits without the need for a visible and uncomfortable seam.

FUNCTIONAL AND COMFORTABLE

To combine functionality with wearability, NTT uses a two-component liquid silicone rubber (LSR) from WACKER. The material is slightly pigmentable and exhibits good mechanical properties. Moreover, the liquid silicones used require only short curing times – a key property in the textile industry, since it relies on fast throughput.

After curing on exposure to heat, the silicone is bonded to the synthetic fiber fabric underneath it. The product is lent properties that provide support and it remains elastic, in both cases without additional bonding.

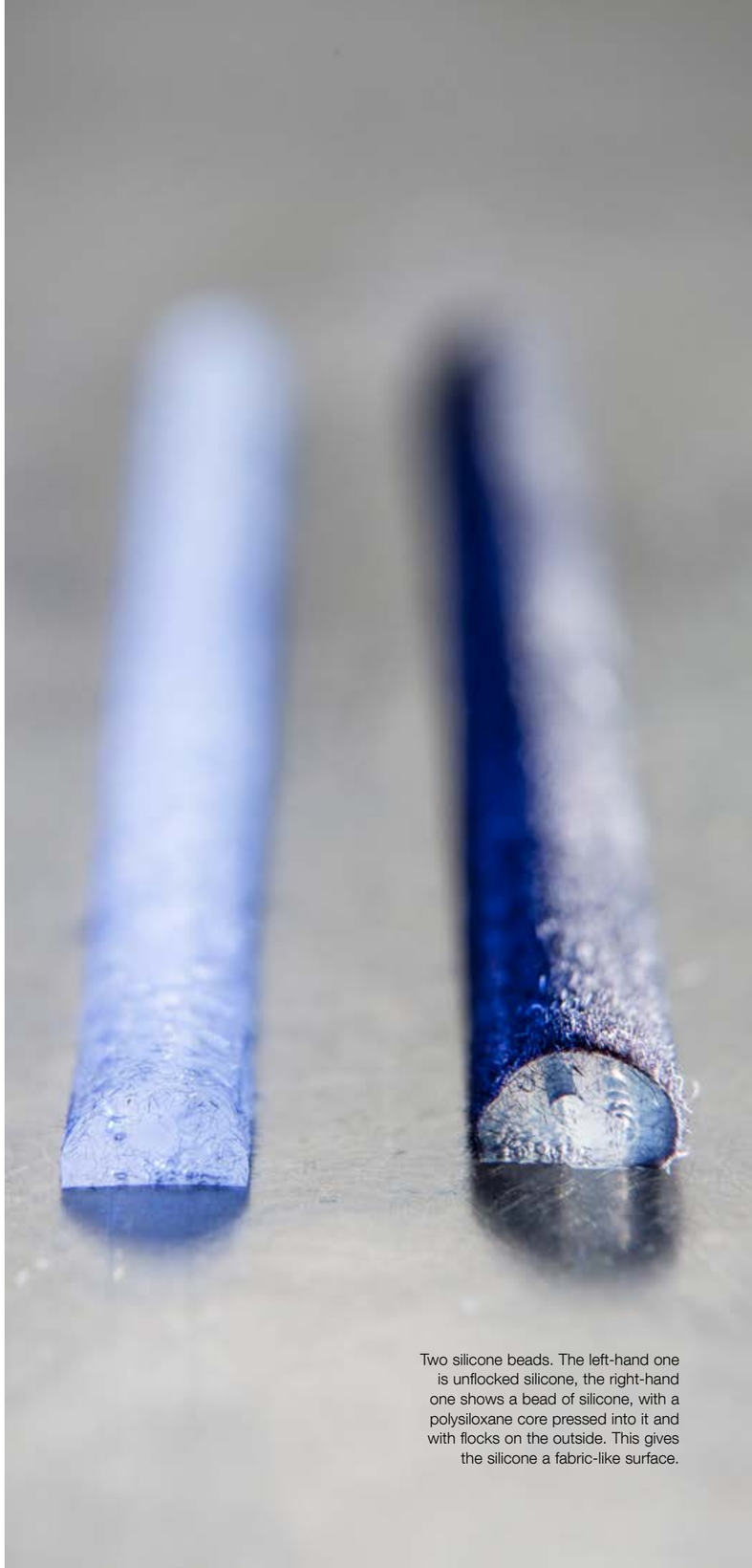
SILICONE PREVENTS SLIPPAGE

This unusual property profile makes the range of applications truly diverse. For instance, a silicone coating can replace the elastic strips that had previously been glued or sewn into women’s hold-up or thigh-high stockings and men’s underpants. The silicone layer on the rim of the pants or stockings ensures that the textile fits sufficiently tightly on the body and does not slide off. The silicone can also be left exposed on the textile’s inner waistband to act as an anti-slip coating that reinforces the hold.

In the early years, Bauer and his employees also experimented with other materials, such as polyurethane, as support materials for underwear and sportswear. However, he quickly came to the conclusion: “There is nothing quite like silicone on the entire market.”

AN ELECTRIFYING TRAINING SESSION

Silicone rubber compounds even make considerably more ambitious applications possible. On behalf of Antelope, a Frankfurt-based startup, for example, NTT produces a compression sports suit with integrated electrical muscle stimulation (EMS). During a workout, a slight voltage that is supposed to stimulate muscle growth and, at the same time, shorten recovery time is applied to the suit. It is possible to apply a voltage, because the inside of this sports suit is coated with silver and a specialty silicone from WACKER that is filled with carbon black – and is thus conductive. Bauer believes that the future of the German textile industry lies in these kinds of high-end, possibly custom-made, products. “The evolution of traditional underwear is far from complete,” he says. ■



Two silicone beads. The left-hand one is unflocked silicone, the right-hand one shows a bead of silicone, with a polysiloxane core pressed into it and with flocks on the outside. This gives the silicone a fabric-like surface.

ADVANTAGES IN A VACUUM

In the world of insulation technology, vacuum insulation panels (VIPs) are the top of the line – especially when filled with HDK® pyrogenic silica from WACKER. The Vitec company, based in Ilsenburg, Germany, manufactures custom VIPs upon request for use in fire doors, cold-storage rooms or in construction.

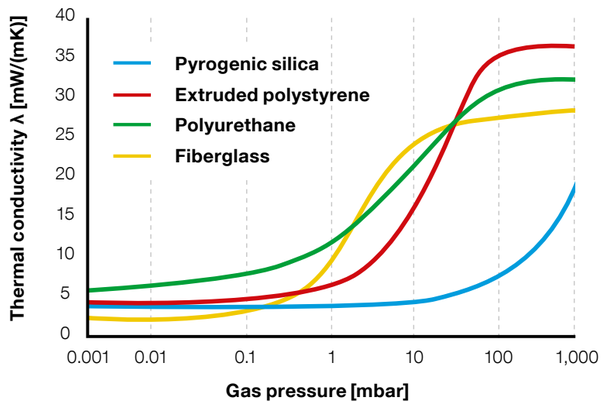
Nothing insulates quite like nothing. Vacuum is what physicists call the absence of material in a given space. As a general rule of thumb, evacuating the residual air within an insulation panel increases its insulating effect by a factor of six or seven.

The underlying principle is quite simple: by preventing the gas molecules of the air from transferring heat, a vacuum can produce extremely low thermal conductivity values of less than 0.004 $W \cdot m^{-1} \cdot K^{-1}$. This allows manufacturers to create insulation panels that, while just two centimeters thick, have the insulating capacity of standard panels 12 to 14 centimeters thick. Applications cover a wide range: VIPs do an equally good job of protecting thermally insulated packaging, refrigeration units, cold-storage rooms, hot-water tanks, fire doors, building exteriors, floors and flat roofs from heat and cold.

MICROPOROUS SILICON DIOXIDE

Suitable filling materials for VIPs include rigid foams, glass fiber and – most of all – HDK® pyrogenic silica. "HDK® is a highly branched, microporous form of silicon dioxide with countless tiny gas pores that make its density very low," explains Dr. Jörg Heinlein, a WACKER chemist in charge of technical support for this product group. The highly branched morphology of pyrogenic silica is extremely effective at suppressing heat transfer, which is what makes it such an outstanding insulator. Other advantages of VIPs that incorporate HDK® are their excellent dimensional stability and long-term performance. Plus, the vacuum in a VIP made with HDK® does not have to be as high as it does with other filling materials.

THERMAL CONDUCTIVITY OF INSULATING MATERIALS



HDK® pyrogenic silica insulates significantly better than comparable insulating materials, even at relatively high gas pressure. At low pressure, it offers the best long-term stability.

Source: ZAE Bayern (Bavarian Center of Applied Energy Research)

Finished vacuum insulation panels at Ilsenburg-based Vitec in Germany, waiting to be packed. Creating a vacuum increases the insulating effect of the processed insulation material by roughly a factor of seven.

IT ALL BEGAN WITH INSULATED DOORS

These properties are all appreciated by the Vitec company, which was spun off from its parent company – Torlit – in 2008. Both companies share the new site in Ilsenburg, Germany. Torlit manufactures insulated doors for warehouses, cold-storage rooms and other areas with enhanced safety requirements; its subsidiary, Vitec, is located next door and produces the vacuum insulation panels that are built into Torlit's insulated doors.

As specialists for fire doors and doors for cold-storage rooms, Torlit engineers are very familiar with the advantages and disadvantages of many insulating materials. The use of mineral wool, for instance, is discouraged in cold-storage areas, because it draws moisture and then loses its insulating properties. Polystyrene, the insulating material used most often in construction applications, needs to be very thick. And the first generation of Torlit fire doors used inorganic foams based on ceramic particles that had been

Standing outside Vitec's HQ in Ilsenburg, Germany (from left): Hannah Ullrich (WACKER sales manager), Joachim Luther (Vitec managing director), Olaf Jansen and Ralf Frohnwieser (Vitec sales team), and Dr. Jörg Heinlein (WACKER technical support).

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formulated with phenolic resins, even though these were found to be quite brittle. After a brief experimental phase, the Torlit engineers ultimately decided about ten years ago to make their doors almost exclusively with vacuum insulation panels filled with HDK® from WACKER.

The use of vacuum insulation panels has allowed Torlit to reduce the thickness of their door insulation from 110 millimeters to 20.

An employee prepares an insulation panel so that it can be packed in protective film and then have a vacuum applied to it.

Joachim Luther, the managing director of both Torlit and its offshoot Vitec GmbH, put forward another key argument for using HDK® as the core material for VIPs: "The rule of thumb is that if something insulates well, it burns well too." But, he explained, silicas are non-flammable, which makes them ideal for fire doors. "Thanks to silica, we've been able to make our doors thinner – and lighter too – while at the same time making them better insulators and improving fire safety," says Luther, summarizing the advantages.

FLUSH FITTING

Fire doors and doors for cold-storage rooms are generally customized and produced on demand. The built-in vacuum insulation panels are made individually as well so that they fit flush in the doors. That means that Torlit relies on a very fast, flexible supply of VIPs.

"We deliver fire doors of all sizes within two to three weeks, which wasn't convenient as regards the time it takes VIP manufacturers to deliver – they often need six to eight weeks," says Luther. "To produce and deliver our doors faster, we absolutely had to make the VIPs ourselves."

The principle underlying VIP manufacturing is simple: an insulating material of the desired thickness – usually a few centimeters – is inserted into a foil bag. A vacuum is then pulled and the bag heat sealed.

Processing HDK® in VIPs requires specialized engineering expertise, however, which Vitec has acquired over the past ten years. The following are some of the challenges involved:

- Keeping the HDK® dry
- Emptying large volumes of a loose, dust-forming powder from drums, transporting and blending the material, and compressing it into molded panels
- Retaining the good flow properties of HDK® during processing: obtaining molded panels that are as homogeneous as possible means using silica that does not clump or cake

Vitec uses HDK® as a powdered blend containing fibers and other components, one of which is what is known as an opacifier. An opacifier either absorbs or reflects the thermal radiation entering the insulating material from outside, thus reducing the thermal conductivity of the VIP even more.

ADVANTAGES OF HDK®

When used in vacuum insulation panels (VIPs):

- Its microporous structure makes HDK® an outstanding insulator for VIPs, even when the vacuum strength is relatively low
- HDK® delivers excellent long-term insulating properties
- HDK® acts as an extremely robust support element, allowing the VIP to retain its shape despite high external pressure
- HDK® is non-flammable
- VIP cores made of HDK® can be reused

ANTI-MOISTURE BARRIER

Once compacted, the molded panel made from the HDK® blend is placed in a specially designed foil bag. The foil consists of multiple thin layers of polymer and metal, both to ensure the most effective possible barrier to gas and moisture penetration and to maintain the insulating properties of the VIP for as long as possible. The engineers at Vitec anticipate that their vacuum insulation panels will be able to serve their purpose for decades. And this is another reason why HDK® is superior to alternative fillers: glass-fiber cores and polymer foams, for example, age faster than pyrogenic silica, because pressure rises more quickly within these cores, and the insulating properties then deteriorate accordingly.

Certain specialty applications – such as insulation for flat roofs and roof-top patios – require particularly robust panels, and for these the Vitec product line includes VIPs that are encapsulated with an extremely hard, glass-fiber-reinforced plastic. “You can even walk on it at the construction site and nothing will happen,” says Ralf-Geoffrey Frohnwieser, a member of the Vitec sales team.

“Pyrogenic silica is non-flammable, which makes it ideal for fire doors.”

Joachim Luther, Managing Director, Vitec GmbH

If vacuum insulation panels are intended for use on a construction site, Vitec customizes them and automatically supplies the installation plans as well.

For building insulation, the company also offers VIPs with an edging roughly ten millimeters thick and made of traditional insulating material (extruded polystyrene; XPS) so that the panels can still be worked with. “That allows you to compensate for typical construction tolerances,” Frohnwieser explains. It also suppresses heat transfer in the joints between individual VIPs. VIPs for roof and exterior insulation are custom-made and delivered to the builders along with installation plans.

WWW 2.18 ▸ APPLICATIONS ▸ **INSULATING MATERIALS**

An employee fits the the molded panel made from the HDK® blend into a specially designed foil bag and then applies a vacuum to it.

SPECIAL-PURPOSE CONTAINERS FOR USED LITHIUM-ION BATTERIES

In another recent development, Vitec has successfully devised an innovative solution aimed at collection bins for spent lithium-ion batteries. These safety containers are used for collecting spent batteries from electric vehicles, electric bicycles or other relatively large electrical appliances, and then for hauling them to disposal companies. Transporting them is subject to strict government standards, because lithium-ion batteries can potentially ignite spontaneously, leading to fires with temperatures exceeding 1, 000 °C. The containers must be made so that the temperature of their exterior walls will not exceed 100 °C in the event of such a fire. “This project perfectly combined our strengths in metal construction and VIP production, and we worked with our partner to develop a collection bin that would meet all of the customer’s demands just as perfectly,” observes Olaf Jansen, Vitec’s head of sales.

The VIPs are precisely arranged in the container to create an inner chamber with excellent insulating properties. In addition, a metal laminate protects the VIPs from damage that could arise during activities such as loading.

Jansen sees these and similar applications as representing the future of Vitec, which aims to remain flexible and specialized: “We’re not about quantity – our focus is very much on producing and enhancing customized products.”

WWW 2.18 ▸ SOLUTIONS ▸ **OUTDOOR INDUSTRY**

Tent membranes made of siliconized polyamide are bonded together using an adhesive silicone tape. This technique means VAUDE can do without problematical lockstitch seams.

SEAMLESS AND WATERPROOF

Typically, a tent's weakest point is its outer seams, through which water can penetrate into the interior. A new joining technique from outdoor outfitter VAUDE, based on a solid silicone rubber from WACKER, does without needle and thread altogether. The tent is leak-proof even in heavy rain.

“Polyamide fabrics are tear-resistant and the silicone coating further enhances this tear strength. The coating also increases UV resistance – thus extending the polyamide fabric’s service life.”

René Bethmann, Innovation Manager, Materials and Production Technology, VAUDE Sport GmbH & Co. KG

Regardless of whether you’re going hiking or on a cycling or camping trip with your children, anyone spending the night outdoors needs one essential piece of equipment: a waterproof tent. Even the smallest leak can quickly make things uncomfortable. It is not the textile layers, but the tent’s seams that are the weak points.

It is common practice to sew the precut fabrics together with needle and thread. However, the needle perforates the textiles, allowing water to penetrate into the interior via the flat-felled seams. That’s why the seams are sealed. Usually, the manufacturer applies sealing tapes to the seams on the inside of the tent. However, this is not so easy for top-grade tents made of siliconized polyamide fabric. Here, sealing the seams involves a lot of effort for the manufacturer.

VAUDE Sport GmbH & Co. KG, a well-known outdoor outfitter headquartered in Tettnang, southern Germany, recently began marketing a silicone-coated polyamide trekking tent model that uses an adhesive bonding technique without flat-felled seams – meaning it does not require sealing. The siliconized textile layers are bonded with the aid of an adhesive silicone tape. The bond is absolutely waterproof and exceptionally tear-resistant, and can also be repaired.

VVB-Birzer Flächenschutz GmbH, a silicone processor based in the Bavarian town of Pfaffenhofen, makes the adhesive tape. The tape’s base material is a solid silicone rubber of WACKER’s ELASTOSIL® R plus 4001/40 grade.

A camping tent consists of a flysheet (outer tent), an inner tent and a supporting frame of poles. “The double-wall structure achieves better climatic comfort than a single-walled tent,” says René Bethmann, a textile engineer who works at VAUDE as an innovation manager for materials and production technology.

LONGER SERVICE LIFE

Like most tent manufacturers, VAUDE is an outdoor outfitter that generally uses polyamide fabric coated on both sides with silicone when making premium tents. The reason for this is the material’s high mechanical strength, as Bethmann explains: “Polyamide fabrics are tear-resistant and the silicone coating further enhances this tear strength. The coating also increases UV resistance – thus extending the polyamide fabric’s service life.”

By working with siliconized polyamide fabric, tent manufacturers can thus use thin textile layers to produce particularly lightweight tents. This is particularly important for trekking tents, where low weight is key. Sealing the seams, however, is complicated. Unlike the case with less-expensive polyurethane-coated fabrics, where conventional polyurethane seam-sealing tapes can be applied, tent manufacturers have to work with a liquid silicone rubber – and no sealing tape adheres to a silicone surface.

Application of a liquid silicone requires a high level of effort and still involves the traditional sewing of the seams and puncturing of the textile. In addition, the tensile strength

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A silicone coating enhances the tear strength of polyamide fabrics even further.

at the seams has its limits. That's why VAUDE was looking for ways to avoid additional sealing of the seams. The outdoor outfitter turned to WACKER. In turn, WACKER's technical service team established contact with VVB-Birzer.

NO NEED TO SEAL SEAMS

Talks with Christian Birzer of this family-owned business gave VAUDE's product developers the idea of joining the siliconized textile layers with the aid of a suitable adhesive silicone tape rather than sewing them together. They knew that if they succeeded in creating a tear-resistant and completely waterproof bond, seam sealing would be unnecessary.

The three companies started a joint development project. VVB-Birzer tailored its adhesive silicone tape to VAUDE's requirements, particularly to allow the bonding of siliconized polyamide fabric cuttings, while WACKER selected the silicone product optimally suited for the adhesive layer, and VAUDE tested the tape's practical suitability and developed a joining method – which it refers to as siliconized bonding.

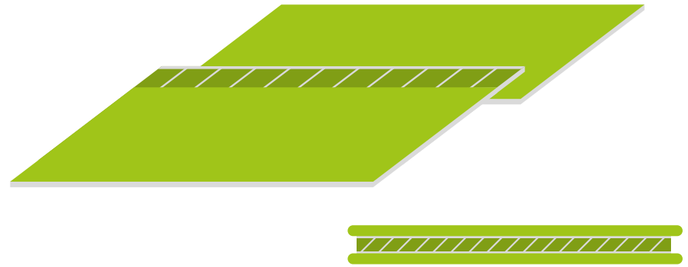
Dr. Christian Anger represented WACKER's technical service in the development project. His investigations yielded ELASTOSIL® R plus 4001/40 – a one-component solid silicone rubber – as the material of choice for the planned application due to its excellent mechanical properties. "An addition-curing solid silicone rubber, this product chemically bonds to a silicone surface and adheres very well after curing. It is therefore ideal for joining siliconized fabrics," he says. "If you try to tear the bonded textiles apart, it is more likely that the fabrics will tear than that the joint will fail."

At high temperatures and under pressure, the product cures very quickly to form a silicone elastomer (see box on page 40). In addition, unlike many other silicone elastomers that stem from peroxide-curing solid silicone rubber, the elastomer yields a safe, odorless end product with very good mechanical properties without the need for several hours of postcuring at 200 °C. This was a further selection criterion, as Dr. Anger notes: "A polyamide fabric would not survive postcuring – as experts refer to the several hours of heat treatment – unscathed."

VVB-Birzer's part in the development project was to transform the uncured solid silicone rubber that WACKER supplies as cuboid blocks into a tape that would be as easy to apply as possible and, after application, result in a bond with good tensile lap-shear strength. "We succeeded in developing a narrow, thin adhesive silicone tape that can be applied to the textile intact," reports Christian Birzer. "The solid silicone rubber is still in its uncured state in this tape."

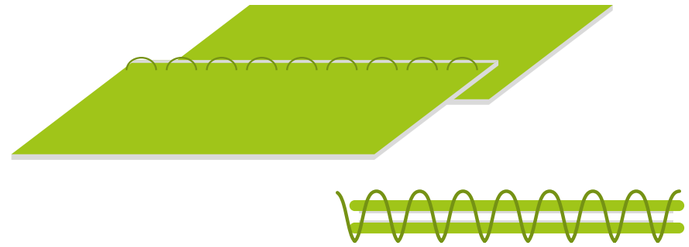
WWW 2.18 ▸ SOLUTIONS ▸ **OUTDOOR INDUSTRY**

SILICONIZED BONDING:



During curing, the adhesive tape made of addition-curing solid silicone rubber bonds chemically with the underlying siliconized polyamide. The joint is twice as tear-resistant as a conventional seam.

CONVENTIONAL LOCKSTITCH SEAM:



With this traditional technique, the two layers of fabric are perforated at the seam, making the material less waterproof and reducing its stability. Seams made in this way have to be sealed from the inside.

The company supplies the adhesive tape as roll stock. It consists of two layers – a continuous tape of the adhesive silicone layer on a plastic carrier film – wound up into approximately 20-centimeter rolls. The film prevents the silicone layers from sticking together and facilitates application to the fabric; it is peeled off during application and discarded.

The tent producer employs a contract manufacturer, who cuts and joins the fabric pieces and is thus also responsible for applying the adhesive silicone tape. "Until recently, the siliconized polyamide fabric pieces had to be bonded with the adhesive silicone tape by hand. But now we have put in place a partially automated joining process," says VAUDE's Bethmann.

“An addition-curing solid silicone rubber, this product chemically bonds to a silicone surface and adheres very well after curing. It is therefore ideal for joining siliconized fabrics.”

Dr. Christian Anger, Head of Technical Marketing, Rubber Solutions, WACKER SILICONES

SILICONE ELASTOMERS

Silicone elastomers are rubber-elastic solids based on polyorganosiloxanes. They are obtained from silicone rubber in a process known as curing (vulcanizing). Here, the polymer chains of the organosilicon macromolecules form a three-dimensional network. Silicone elastomers are characterized by a property profile that makes them indispensable in many industrial applications: extraordinary heat resistance, low-temperature flexibility, chemical inertness and biocompatibility.

Silicone elastomers have a strongly hydrophobic, i.e. water-repellent, surface – water droplets simply roll off. Moreover, they do not absorb water and are very good electrical insulators. A typical characteristic is their high resistance to a large number of physical and chemical influences, which is why, unlike organic rubber compounds, they do not age quickly. As a result, their chemical, physical and technical properties remain virtually constant between around -45 and +200 °C; they can also withstand persistent mechanical stress and continued exposure to oxygen, ozone and UV radiation.

Silicone elastomers absorb short-wave UV radiation, which is particularly high-energy. Used in coatings, they are able to protect substrates that are sensitive to UV radiation – such as textiles that are repeatedly exposed to direct sunlight in their application.

The joining process takes place in two separate steps, so it is discontinuous. In the first step, the silicone tape is applied in sections along the cut edge of the lower textile layer – where the two fabric pieces are to be bonded. The carrier film is then peeled off bit by bit, just as the second fabric piece is placed onto the tape and pressed on. This also proceeds progressively in the direction of the line along which the two textile layers are to be bonded. In this way, the contract manufacturer puts all of the fabric pieces together to make the flysheet. This bond is still temporary, however, as the adhesive tape’s silicone has to be cured.

“Pleasantly surprised”: René Bethmann, innovation manager at VAUDE, holding the tent he helped develop. His tent boasts adhesive silicone seams.

CURING IN A HOT PRESS

Nevertheless, applying pressure makes the fabric pieces hold together well enough to transfer the temporary bond to a hot textile press. This is where the second process step takes place: heat setting. The curing process bonds the silicone tape with the textiles’ silicone surfaces so that they become practically inseparable. Only after this process step does the adhesive bond obtain its end properties.

Laboratory, wind-tunnel and outdoor tests confirm that the adhesive bond is extremely durable: a flysheet produced using siliconized bonding is robust and has a long service life. Here, the properties typical of silicones come into play alongside the high adhesive strength. This adhesive technique makes the joint between the fabric layers absolutely waterproof, permanently preventing rainwater from penetrating the tent via the bonded joints – and making it unnecessary to seal the bonds. The bond is twice as tear-resistant as a conventional flat-felled seam and is also comparatively easy to repair. If, contrary to expectations, a joint should open up years later, the tent manufacturer can re-bond the affected fabric pieces.

With its siliconized bonding process, VAUDE is entering uncharted territory in the outdoor outfitter sector. “All previous attempts to bond siliconized textiles failed,” explains Bethmann, “which is why our expectations were relatively low when we started the development project. But we were pleasantly surprised.” It would not have been possible without the excellent collaboration between the three participating companies, as the textile specialist emphasizes: “Whenever we had a question or problem relating to joining with adhesive silicone tapes, VVB-Birzer was able to give us constructive answers or offer solutions, and WACKER’s technical service team was always on hand with its expertise.”

FLEXIBLE ON SOLID GROUND

A mixture of cement and modified polymer dispersion provides effective stabilization for the subgrade courses underneath roads. This technology is not only of interest for gravel paths, but also extends the service life of asphalted roads.

WWW 2.18 ▸ SOLUTIONS ▸ **ROAD CONSTRUCTION**

The Federal Ministry of Transport estimates the total length of the German road network at 830,000 kilometers. Of this, more than two thirds – roughly 600,000 kilometers – are local roads. The task of maintaining the roads falls first and foremost to local authorities and places a financial burden on cities and local authorities, especially as many roads are showing their age and in need of rehabilitation. This situation is exacerbated by freeze-thaw cycles in winter and increasing traffic volumes on road networks.

Many local roads that link up inhabited areas, forest roads/tracks and farm tracks date from the 1950s and 1960s when there were fewer and, more important, much lighter cars, forestry and agricultural equipment on the roads than is the case today. The problem is that the heavier the vehicle, the more the road suffers: doubling the axle load multiplies the risk of damage by a factor of 16. With ever-burgeoning traffic volumes, many roads are unable to cope and will need extensive rehabilitation sooner or later.

COST-EFFECTIVE SOLUTION

The cost of maintaining and rehabilitating roads is now in the millions of euros. The KfW Municipal Panel 2018, the largest regular survey of German treasurers in urban municipalities, rural municipalities and district communities with over 2,000 inhabitants, estimates that it will take €38.6 billion to repair the municipal road and transport infrastructure. “Given the tight budgetary situation, local authorities are looking for cost-effective ways to rehabilitate their roads and to keep ongoing

4,000 metric tons

of rubble per kilometer are generated when a 5-meter-wide road with a 50-centimeter base course is excavated.

In the hamlet of Hebertsfelden in Bavaria, a farm track leading to a farm was treated with a subgrade stabilizer. The test section shows that a structure strengthened in this way can withstand high loads undamaged.

maintenance costs under control over the long term," says Nikolaus Bucksch from WACKER POLYMERS' Strategic Marketing department.

A team of experts from STRABAG (a leading German road-construction company), WACKER POLYMERS and the New Zealand-based company Gravel Lock is currently developing an innovative technology that could considerably simplify the rehabilitation of Germany's country roads, thereby allowing local authorities to save money. The idea is, instead of excavating the subgrade and replacing it with new material, to recycle the entire road substructure.

PROTECTS EQUALLY AGAINST FROST

The solution here is the use of a soil stabilizer containing polymer-modified cement that stabilizes the subgrade while making it resistant to mechanical loads and frost. "Gravel Lock NZ Ltd., a New Zealand-based company has developed a soil stabilizer, Flexi-C-Ment, based on our ETONIS® polymer dispersion with proprietary additives and is achieving fantastic results with it globally," says Bucksch. "This technology could also help a lot of municipalities in Germany to slash their road maintenance costs."

A standard road has several courses underneath its surface, namely the subgrade, subbase, and base. The purpose of the subbase is to transfer loads into the ground without damaging the structure. The base acts as a wearing course. Finally, the subgrade is responsible for the stability of the tracks and roads and needs to be properly executed.

When a road is rehabilitated, all the courses, including the subgrade, must be excavated and rebuilt. "That calls for large quantities of fresh aggregate and gravel," says Bucksch. "Because the fresh material has to be delivered to the construction site and then stored there temporarily, every rehabilitation is hugely expensive." And then there is the cost of disposing of the excavated material. "Every kilometer of a five-meter wide road with a 50-centimeter base course that is excavated generates some 4,000 metric tons of rubble," explains Albert Glotz from STRABAG, one of the leading road-building companies in Germany. "A 14-ton truck would have to make 300 trips to remove all that material."

What is more, the regulations governing the disposal of excavated material have been tightened up substantially in recent years. Under the German Waste Disposal Act (KrWG) and the waste laws enacted by the individual federal states, contaminated excavated material,

GRAVEL LOCK NZ AND TRISON

New Zealand-based road building company Gravel Lock NZ Ltd. has chiefly made a name for itself as a manufacturer of construction chemicals marketed under the name Flexi-C-Ment which contains ETONIS® polymers enhanced with proprietary additives. Flexi-C-Ment is primarily used for subbase and subgrade stabilizing of unpaved gravel roads and tracks. Gravel Lock NZ also supplies a range of dust-suppression and erosion-control products modified with ETONIS® polymers.

In Germany, Austria, Switzerland and the Middle East, the polymer dispersion is marketed under the name Subgrade Stabilizer (USG) by Trison GmbH, based in Hauzenberg near Passau, Bavaria. Trison is licensed by Gravel Lock NZ to market and distribute the polymer dispersion in these regions.

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The polymer dispersion modified with additives can be applied to sand and gravel roads alike. This increases the flexibility of the subgrade, enabling it to withstand mechanical loads more effectively.

Preparation of a test surface at WACKER's Burghausen plant. A special-purpose vehicle belonging to the STRABAG road-construction company digs up the road surface before polymer binders are added to the soil.

e.g. bituminous, broken-up road material, often has to be disposed of in backfill pits or landfills only. "Suitable landfills are rare and often some distance from the roadworks. It is not unheard of for such material to have to be transported more than a hundred kilometers to the nearest landfill," adds Glotz. Nor does it help that rising landfill fees are also making disposal more expensive. In fact, transport and landfill costs are now among the biggest cost factors in road rehabilitation and rank second only to pure material and labor costs.

A way out of this cost spiral might be afforded by WACKER's polymer technology. The Group's vinyl acetate and ethylene-based (VAE) polymeric binders are widely employed throughout the building materials industry. Aqueous polymer dispersions or dispersible polymer powders from WACKER are added to cement mixtures, such as tile adhesives, plasters/renders and waterproofing membranes.

MORE FLEXIBILITY NEEDED

VAE polymers also have the right properties for formulating soil stabilizers. These products essentially consist of cement and additives. Mixing cement with gravel, sand and water produces concrete, which is a high-strength building material but is also brittle and prone to cracking.

Adding a polymer dispersion increases the overall flexibility of the stabilized subgrade. As a result, the stabilized subgrade is better able to withstand mechanical stress. "The flexibility removes the brittleness from the stabilized layer, a fact which is reflected in much-improved flexural strength," explains Bucksch. "The rehabilitated road will thus last longer and maintenance costs will be lower over the long term. Its service life can be three times that of a conventionally built road."

WACKER, working closely with Gravel Lock New Zealand, has already achieved good results with specialty polymer dispersions based on vinyl acetate-ethylene from the ETONIS® range.

"Treating a road with a soil stabilizer can triple its service life."

Nikolaus Bucksch, Marketing Manager, WACKER POLYMERS

These plasticizer-free dispersions are readily compatible with various kinds of soil. Specialist distributors, such as Trison GmbH in Passau, Lower Bavaria, can offer suitable formulations – for example its USG subgrade stabilizer.

"Our vinyl acetate-ethylene copolymer is chemically designed to spread itself evenly throughout the cement matrix. Computer tomography and electron micrographs have confirmed that this does happen," explains Dr. Abdulmajid Hashemzadeh, a WACKER chemist who optimized the dispersion for use with soil stabilizers. He added that the conferred flexibility stemmed from the long polymer molecules which adhere firmly, but not rigidly, to the cement matrix. "Imagine the polymer molecules as being like a serving of cooked spaghetti, in which the long strands are intertwined with each other. If you tug at them, they behave like a continuous three-dimensional network," he says.

In order for the copolymer to confer its flexibilizing action, it has to be evenly distributed throughout the cured cement. Any gaps in distribution within the cement matrix would cause the stabilized soil to be inflexible and would act as rupture points. "We specifically selected the polymer for its compatibility with cement and the components of most soils and for its ability to confer flexibility equally in hot and cold environments," says Hashemzadeh.

"We have tested a great many polymeric binders in our time and have usually been very disappointed with the outcome," says Andreas Fuchs from TPA Gesellschaft für Qualitätssicherung und Innovation, STRABAG's competence center for quality assurance and materials technology. The engineer carried out studies on the first ETONIS® test sections built in Bavaria in 2017. "The polymer dispersion from WACKER was highly effective even in low doses." Fuchs believes there is no reason why the dispersion should not be used outdoors. Studies show that ETONIS® does not dissolve in water or give rise to contamination.

Road rehabilitation is much easier when a polymer-modified subgrade stabilizer is used. The first step is to tear up the asphalt or gravel layer, crush it and then level it out roughly.

Test specimens being prepared for the analysis of mechanical strength at STRABAG's test center.

Cement and polymer dispersion are then incorporated evenly into the subgrade before being compacted and leveled with a roller.

Several options are available when it comes to the surface layer. Gravel courses are flooded with a diluted polymer dispersion to stabilize the wearing course, protect against abrasion and suppress dust formation. Alternatively, it may be covered with a layer of asphalt. Not only is this much thinner than usual at just four centimeters, but it also bestows a particularly long service life on the road and finishes the surface to the standard that motorists are accustomed to in Germany.

ROAD CAN BE RE-OPENED A DAY LATER

Bucksch explained that the new polymer technology offered a number of benefits for local authorities. Roads can be rehabilitated faster than before, and a well-rehearsed team can finish up to 6,000 square meters a day, including preparatory work. One of the main benefits of polymer road construction is that the road can be re-opened a day later. "This even applies if a layer of asphalt is also put down."

The technology has a great deal going for it in in ecological terms too. Recycling in-situ road material in its entirety saves on sand, gravel and precious landfill space. And it has a sustainability bonus: it eliminates numerous truck journeys and cuts fuel consumption and carbon emissions on site.

But its cost efficiency has the greatest impact. Comparison shows that road rehabilitation costs can be slashed by as much as three-quarters without compromising on quality when ETONIS® is used. In 2017, for example, USG subgrade stabilizer was used to rehabilitate a 500-meter-long and 3-meter-wide private access road leading to a farm in Hebertsfelden, a community in Lower Bavaria. The cost of the roadworks totaled some €25,000. "It would have cost a multiple of that to rehabilitate the road by the conventional method," says Bucksch.

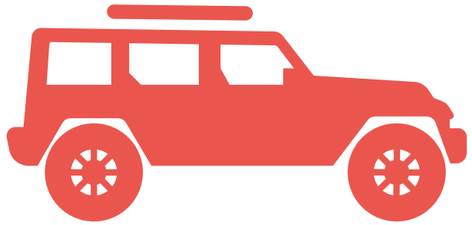
The new technology is perfect for rehabilitating and building new secondary roads, forestry roads/tracks and farm tracks, as well as asphalt roads that do not carry much heavy traffic. It is also a cost-effective way to build temporary roads, such as those for diverting traffic during major roadworks.

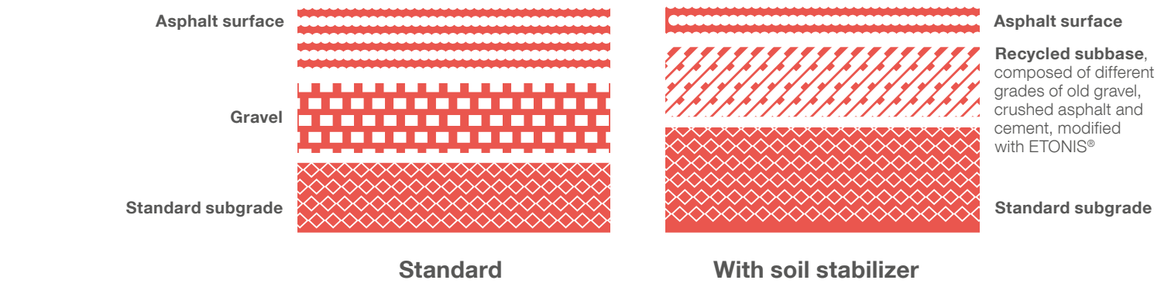
FOCUSING ON SHOULDERS

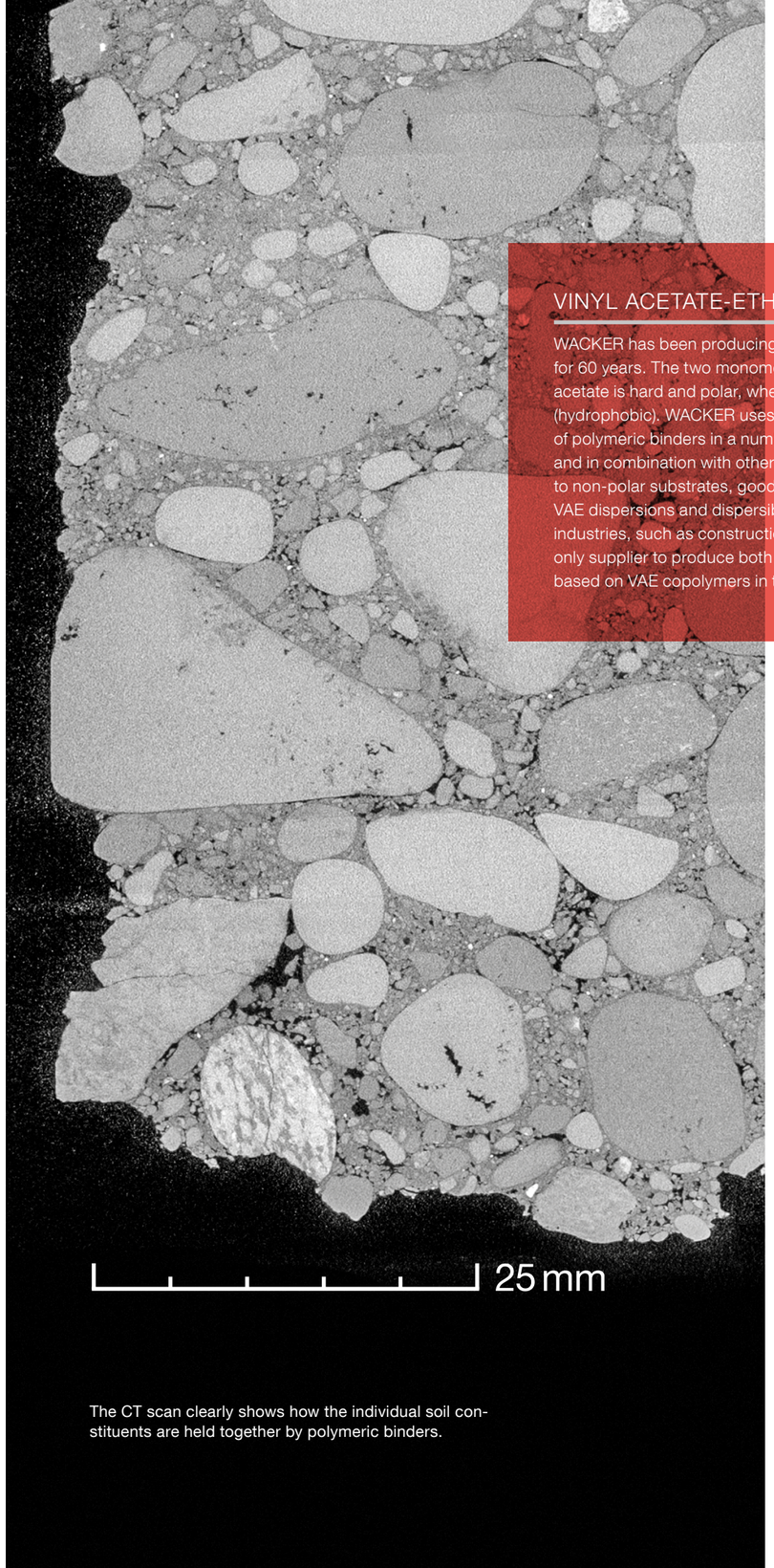
Harald Kneidinger, the owner of Trison, sees a further application area for the new technology in the stabilization of loose shoulders (emergency stopping lanes). These are often washed away by heavy rain and are therefore especially

CROSS-SECTION OF A ROAD

Addition of a soil stabilizer that comprises a modified polymer dispersion and cement increases the flexibility of the subgrade, enabling it to withstand loads for longer. This means that a thinner layer of asphalt is possible. What's more, the old road surface can be dug up, crushed and re-used at the site of the roadworks.







The CT scan clearly shows how the individual soil constituents are held together by polymeric binders.

VINYL ACETATE-ETHYLENE COPOLYMERS

WACKER has been producing vinyl acetate-ethylene (VAE) copolymers for 60 years. The two monomers complement each other perfectly: vinyl acetate is hard and polar, whereas ethylene is soft and water-repellent (hydrophobic). WACKER uses these building blocks to produce a variety of polymeric binders in a number of different polymerization processes and in combination with other monomers. These have excellent adhesion to non-polar substrates, good film-forming properties and high flexibility. VAE dispersions and dispersible polymer powders are employed in many industries, such as construction, paints, and adhesives. WACKER is the only supplier to produce both dispersions and dispersible polymer powders based on VAE copolymers in the Americas, Europe and Asia.

This soil sample shows clearly the compacted subgrade in which the various grades of gravel are held together by cement and a polymeric dispersion as a binder.

The flexural strength of a soil sample being tested at STRABAG's "TPA" quality-assurance laboratory.

"The polymer dispersion can be used to realize totally new building methods. In that sense, the technology is revolutionary."

Andreas Fuchs, test engineer, TPA Gesellschaft für Qualitätssicherung und Innovation

vulnerable. Damage also occurs when heavy vehicles swerve onto the gravel course to avoid other traffic. Rehabilitation then becomes a time-consuming, costly affair. "Stabilizing the shoulders with cement and our product would save the public sector millions of euros in rehabilitation costs every year," he says.

The new technique has now been used to rehabilitate three test sections in Bavaria. They are the access road in Hebertsfelden, a truck parking lot, and a road inside WACKER's Burghausen site, and all have been stabilized with ETONIS®. The previously unstabilized parking lot had to be regularly repaired because the trucks kept making potholes as they made their various maneuvers. Since the parking lot was treated with soil stabilizer, repairs are a thing of the past.

The other test sections, too, have shown that they are fit for everyday use. "The test section in Hebertsfelden, in particular, is in very good condition," says Glotz. Here, the road builders were not obstructed in any way in terms of space as they deployed their large-scale machinery. The STRABAG expert is also pleased with the test sections at the WACKER site, where the work was obstructed by a large number of ground installations. "Despite the conditions there, these sections are also in a surprisingly good state of repair."

WACKER intends to monitor the condition of the sections on a regular basis into the future. "We want to prove that the load-bearing capacity will be retained at a high level over the long term," says WACKER's Hashemzadeh. Considerable experience with test sections has already been gained in New Zealand, Australia and India over the past several years. New Zealand-based Gravel Lock has treated over 100 kilometers of road with polymer dispersions in different climate zones in these countries. The first roads were built eight years ago and are still in perfect condition.

Two test sections in the United Arab Emirates show that even loose sand with a high content of round grains can be stabilized. A few months ago, in the Hamriyah Free Zone in the Sharjah Emirate, an area frequented by heavy trucks and a section of road were treated with USG subgrade stabilizer. Instead of using expensive gravel, the road contractor opted for local desert sand. This material, which is actually unsuitable for soil stabilization, was stabilized with ETONIS® polymer dispersions.

ROADS IN GREAT CONDITION

"The roads are in great condition. The technology has proven itself even in the most challenging conditions," says WACKER's Bucksch, who sees the project as further confirmation that the soil-stabilization process can be used nearly anywhere. "The new technology can also make road construction easier and cheaper in regions where there are desert sands."

TPA test engineer Andreas Fuchs agrees. He sees the new technology as a major addition to the arsenal of methods available to road builders. "The polymer dispersion can be used to realize totally new building methods. In that sense, the technology is revolutionary."

WWW 2.18 ▸ SOLUTIONS ▸ **SHOE INDUSTRY**

FITTING THE MOLD PERFECTLY

Bonding instead of stitching – Spanish startup Simplicity Works is using this approach to simplify shoe production, to make it more efficient and to conserve raw materials. The approach requires the patented, 3D-bonding silicone mold technology to perform in such a way as to withstand the high demands of the new production process.

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AMF safety footwear
made using
3D bonding technology

> “3D bonding makes lean, efficient production processes possible and therefore offers manufacturers a very quick payoff.“
>
> **Adrián Hernández**, founder and CEO, Simplicity Works

On average, every person on Earth wears out three pairs of shoes a year, or some 23 billion in total. Undisputed leader among producer countries is China. Its roughly 13 billion pairs put it miles ahead of India (more than two billion), Vietnam and Indonesia (around one billion each). These top rankings are not just down to these nations’ large populations, though, as a look at their footwear exports reveals that they are world leaders in that area as well. It is a fact that the established industrial nations in the West produce very few shoes nowadays.

The primary reason for this is that labor is cheaper in East and Southeast Asia than elsewhere in the world. And it takes a great deal of manual labor to protect our feet, with each shoe requiring as many as 60 working steps. Back in 2009, an idea about how to change this took shape inside Adrián Hernández’s head. The Spaniard would use an injection process to join three-dimensional parts together.

FAMILY OF SHOEMAKERS FROM VENEZUELA

“The idea came to me as I was driving,” he recalls. He had already been very familiar with many aspects of shoe manufacture for some time, having managed production shops, and been involved in product design and marketing. In fact, there was nothing accidental about his choice of career. After growing up in a family of shoemakers in Venezuela and working in the shoe industry in various countries for 25 years, he finally settled in the province of Alicante on the Costa Blanca, the heart of the Spanish footwear industry.

Surprisingly, there are still some regions of Europe – mostly in Italy and Spain – where shoemakers have thrived in the face of Asian dominance. But it is a tough business, as the years 2000 to 2005 illustrate, when some 300 footwear companies in Alicante province went out of business, and 7,000 jobs were lost. Now, though, the industry there is in the ascendancy again, pinning its hopes on the three pillars of quality, special sales strategies, and design. Every year, Spain exports shoes worth more than two billion euros, with seventy percent originating from precisely the province of Alicante.

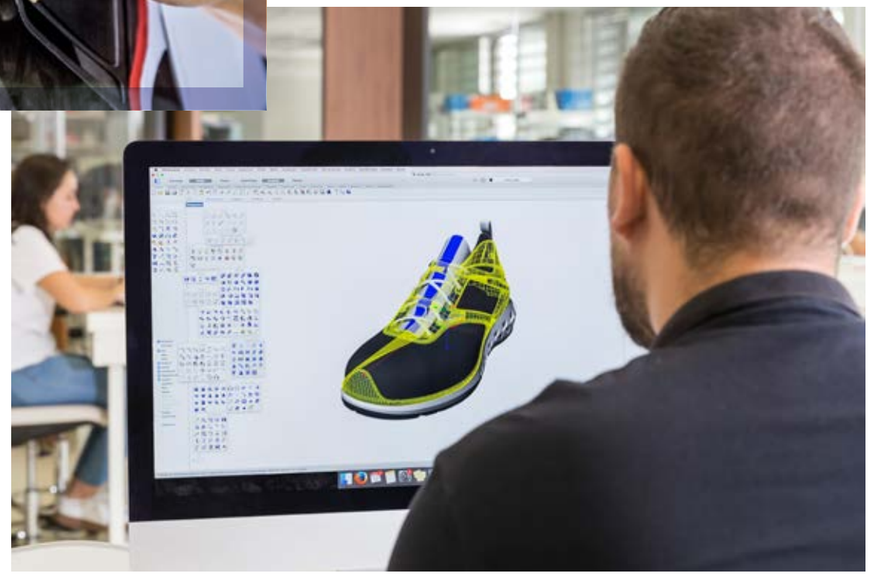
In 2011, Adrián Hernández made the acquaintance of Christopher Banus, a chemical engineer from the USA, who holds numerous US patents. He told Banus about the idea that he had kept on developing over the previous two years. Banus, in business for over 40 years, loved it.

Together they founded Simplicity Works, setting up shop – naturally – in Elche, the footwear stronghold of Alicante province.

The company then set about transforming its concept into a marketable technology. On the way, it experienced the usual difficulties faced by startups. Although the small team was keen to protect its concept and loath to attract the attention of potential rivals too soon, all startups are dependent on sharing knowledge and the resources of companies along the entire value chain. So, it was not until this year that Simplicity Works publicly unveiled the first shoes to be made by its own 3D bonding process.

APPEAL EXTENDS TO OTHER SECTORS

The Spanish company holds more than 16 patents relating to different aspects of this technology and its application in various sectors such as footwear, seats, apparel, accessories, furniture, etc.



Designing shoes at Simplicity Works: the Spanish company devises an entire process that licensees can then implement on a large scale.

Simplicity Works intends to license out its process to replace the traditional stitching together of shoe uppers. The company has created a technological transfer model for its 3D bonding process in which, by signing a contract, other manufacturers are allowed to implement the technology in their own factories in exchange for paying royalties for every pair produced. “This model soon pays off for manufacturers because of the cost reductions made possible by leaner, more efficient processes,” Adrián Hernández says.

3D bonding works like this: a worker inserts the various pieces of the uppers into a shoe-shaped mold so that they can be joined together. The pieces are held firmly in place by a vacuum, but there are still gaps between them. The worker then places the shoe last over the pieces and closes the mold. The vacuum pump responsible for the vacuum is now switched off because the pieces are fixed in position between the mold and the last.

WWW 2.18 ▸ SOLUTIONS ▸ **SHOE INDUSTRY**

The individual sections of a shoe are bonded in a single work step. What’s more, this approach minimizes the scrap material produced during cutting.

READY IN JUST TWO MINUTES

After that, everything happens quickly: a special polyurethane-based adhesive is injected into the mold, which channels it into the gaps. “Two minutes later, the separate pieces have been joined and the shoe upper is complete,” says Fernando Nicolás García, innovation manager at Simplicity Works. In a similar manner, the injected polyurethane creates the shoe sole in the form of a three-dimensional skeleton.

The polyurethane forms an adhesive seam as well. This protrudes slightly above the shoe upper, connects the pieces together and ultimately forms the ankle part. The cured adhesive is therefore not only located between the joined upper pieces, but also covers their edges like a protective layer. This is a major advantage over a conventional seam in that the polyurethane material prevents water from penetrating through the seams into the shoe when it rains. In addition, the adhesive seam acts as a design feature.

A further advantage of 3D bonding is that it saves a substantial amount of upper material. In conventional shoemaking, the pieces of material have to overlap so that they can be stitched.

The principle behind the new technology may appear simple. But the devil is in the details, as usual. In fact, in this case, it is in a material that does not even end up in the finished shoe. The problem area is the mold which gives the shoe its shape. If it were made entirely of metal, for example, the polyurethane adhesive would bond so strongly to it that the shoe upper could not be removed afterward.

INNER MOLD PLUS METAL

In its search for a solution, Simplicity Works came across silicone rubber. This material

WWW 2.18 ▸ SOLUTIONS ▸ **SHOE INDUSTRY**

"What was needed was a particularly durable silicone rubber that also has a high tear strength."

Hans-Rudolf Pfeffer, Technical Marketing Manager, Industrial Solutions, WACKER SILICONES

Shoe last

Various pieces of the uppers to be joined (leather, fabric, plastic) are then fitted on the last and reinforced by a metal mold.

A polyurethane adhesive is injected into the form and joins the individual sections.

The finished shoe after being removed from the last: at the same time, the polyurethane forms the shoe's plastic sole.

is well known in moldmaking circles within industry and the skilled trades. The idea which the Spaniards came up with was that the silicone rubber would form an inner mold that would then be surrounded and reinforced by a metal mold. However, initial tests by Simplicity Works proved unsatisfactory.

So, last year, the Spanish technicians approached WACKER. Their problem was that the silicone mold stopped working properly as soon as a few shoes had been produced because the shoe material was sticking too firmly to the mold. "My hunch was that the silicone rubber did not have sufficient chemical resistance to the polyurethane adhesive," recalls Hans-Rudolf Pfeffer, who heads an applications laboratory for moldmaking at WACKER in Burghausen.

Another headache for Simplicity Works was that the silicone mold would often tear. "What we needed, therefore, was a silicone rubber that was both particularly resistant to the polyurethane used and that also had a high tear resistance," says Pfeffer.

Simplicity Works employees demonstrating how the silicone material provided by WACKER is poured to create the patented 3D bonding silicone mold.

TIME-TESTED IN MOLDMAKING

He suggested that the Spanish company try out two variants of ELASTOSIL® M silicone rubber that possessed these properties and had already proven themselves in other industrial applications – for example, as materials for molding polyurethane shower trays. These two-component silicone elastomers are pourable and addition-curing, and vulcanize at room temperature. This makes them easy to process. They have been successfully used in moldmaking for decades.

It transpired that one of the ELASTOSIL® variants was indeed highly suitable. A mold made of this material can be used to produce more than 60 shoes before it needs replacing. It might be possible to push this number even higher in the future, e.g. by using release agents. Preliminary trials to this effect have proved successful.

A Simplicity Works employee removes the last from the finished shoe.

In the meantime, Simplicity Works has managed to convince AMF, a Portuguese manufacturer of safety shoes, to adopt the process. AMF has already unveiled its first 3D-bonded shoe at a tradeshow and will be commencing production soon. "We are also working with major European and US manufacturers, but these development projects are still in their infancy," says Fernando Nicolás García of Simplicity Works.

LESS EXPENSIVE TO PRODUCE

The Spanish startup estimates that a pair of 3D-bonded shoes can be produced up to four euros more cheaply in the USA than in the traditional way somewhere in Southeast Asia. Contributing to this positive bottom line are low labor costs, 10 to 40 percent less material consumption and lower energy, storage and transport costs. No wonder that the CEO and founder of Simplicity Works, Adrián Hernández, believes: "Our technology has the potential to bring Europe's footwear industry back home."

WE ARE WACKER | THOMAS SEITZ

“MY DISABILITY DOESN’T POSE AN OBSTACLE”

The Bavarian state’s “Inclusion in Bavaria – We Work Together” award honors employers committed to inclusion of people with disabilities. One person who has benefited is Thomas Seitz, a chemical laboratory technician with total hearing loss at WACKER POLYMERS.

People who encounter Thomas Seitz at the plant in Burghausen don’t notice his disability right away. His eyes are alert, his movement is physically unrestricted and he openly approaches other people. But Thomas Seitz is actually 100% deaf. He is late-deafened (i.e. has late-onset deafness), meaning he was not deaf at birth, but rather first started going deaf from the age of six. Around 150,000 people in Germany have this hearing disability. Seitz calls his late deafness a “fortunate” circumstance because he was able to hear and learn to speak his native language up until starting elementary school. As a small child he could also hear ambient sounds like birdsong and the sound of the elements.

“That’s a big advantage I have over people who were born deaf. I’m also very good at lip-reading and can express myself relatively well verbally,” he explains. Since he became completely deaf, a hearing aid has been his constant companion.

MUNICH SCHOOL FOR THE DEAF

After obtaining his intermediate school-leaving certificate at Munich’s School for the Deaf, he wondered: “What profession can I actually train for with my disability?” A typical office job was out of the question. How was he supposed to maintain customer relationships without using the phone? Speaking on the phone – something people with full hearing take for granted – is something Thomas Seitz has never done in his life!

He undertook a two-year training course at the Institute for Agricultural Education in Landsberg am Lech to become an agricultural technical assistant. It was at this institute that

At his workplace in a pilot plant, Thomas Seitz dismantles and cleans the dryer’s spray head, which he then further cleans out with a compressed-air hose. Beforehand, he took a sample from the spray test.

Thomas Seitz at the muffle furnace for determining ash content: since the furnace reaches temperatures of up to 1,000 degrees Celsius, the lab assistant must cover his entire body and wear extra-long, heat-resistant protective gloves.

he conducted special tests on dairy products and raw materials, as well as packaging that comes into contact with milk. In 1991, he joined WACKER as a chemical laboratory technician.

His responsibilities at WACKER POLYMERS include analyzing dispersible polymer powders and redispersions. He carries out spray tests in the pilot plant. “I enjoy my job because my work varies in the lab and in the pilot plant and I am always on the move. My disability doesn’t pose an obstacle,” he emphasizes. Filling out forms on the computer is not a problem for him. Special analytics software is very helpful.

FLASHING LIGHT INSTEAD OF A LOUDSPEAKER

The only special equipment at his workplace is the flashing light in the pilot plant that acts as a visual alarm. The hearing aid Thomas Seitz always wears amplifies the warning signal from the speakers, while his colleagues have to explain the content of the announcement to him.

WACKER has always employed a sign language interpreter for its annual general employee meeting for the disabled. For some years, this freelance interpreter has also been coming to internal informational events and safety days. Because he can lipread very well, he hardly has a problem understanding his colleagues. Some were willing to learn simple signs such as fingerspelling. Instead of a phone receiver, people pick up a notepad – writing something down is always a good option.

Surrounded by understanding colleagues and supervisors, Thomas Seitz feels fully accepted as an equal among staff at WACKER. He just does not like to be called “deaf and dumb.” “This is a common, outdated expression. We have a language, sign language, which enables us to communicate with each other and those with full hearing, he stresses.

INCLUSION AT WACKER

For years, WACKER has employed a higher number of people with severe disabilities and those of equivalent status than required under German law. At the end of 2017, 900 people with severe disabilities (persons with degree of disability of 50 or more) or with similar impairments (persons with degree of disability of less than 50 but at least 30 and a certificate of recognition for equal status from the Federal Employment Agency). That constituted 8.7% of WACKER’s total employment rate in Germany. The law in Germany requires only 5%, which equates to 511 people. WACKER’s biggest site, in Burghausen, has taken on eleven trainees with disabilities in the past ten years.

WACKER IN FIGURES

R&D has traditionally been one of WACKER’s top priorities. The Group has a central research unit in Munich as well as product-related development facilities run by its business divisions and at some 20 application-technology centers located in the major sales regions of Europe, North and South America, and Asia. Additionally, process-oriented development is conducted at Corporate Engineering. WACKER collaborates with universities and research institutions around the world and finances a Chair for silicon chemistry at the Technical University of Munich.

728 Employees were working in WACKER’s R&D departments in 2017.

€153.1 million was invested in R&D by WACKER in 2017.

3.1% of Group sales is invested in R&D.

272 R&D Projects are currently underway across the Group

140 final thesis projects and internships with students at over 50 international universities were sponsored by WACKER.

88 Inventions were filed as patent applications by WACKER in 2017. The Group’s portfolio currently includes 3,800 active patents and 1,700 patent applications.

SAFE AND SOUND

Historical buildings sometimes still contain cabling from the pioneering age of electrification. Easy to recognize by their lead or textile jacket, these cables hark back to a time when the seamless provision of electricity was not yet a matter of course. In early days, the electrical conductors inside the cables were often insulated using paper soaked in oil or wax, thus reducing their sensitivity to moisture and increasing their dielectric strength. Nowadays, the ordinary low-voltage cables concealed in the plaster walls of houses and apartments usually have a PVC jacket – and silicone is increasingly being used in highly sensitive applications such as emergency power generators and fire alarms. The trick is that, even though the silicone rubber burns when ignited, it does not produce loose ash. Instead, it turns into a very hard ceramic layer that continues to provide adequate electrical insulation, even at temperatures of around 1,000 °C. Conductors insulated in this way are ideal for the manufacture of modern safety cables.

WACKER

ELASTOSIL® R 502/75 is a peroxide-curing HTV silicone rubber used to manufacture silicone coatings to insulate cables and conductors, resulting in safety cables that keep functioning in the event of fire. This silicone grade can be easily extruded.