Empa News

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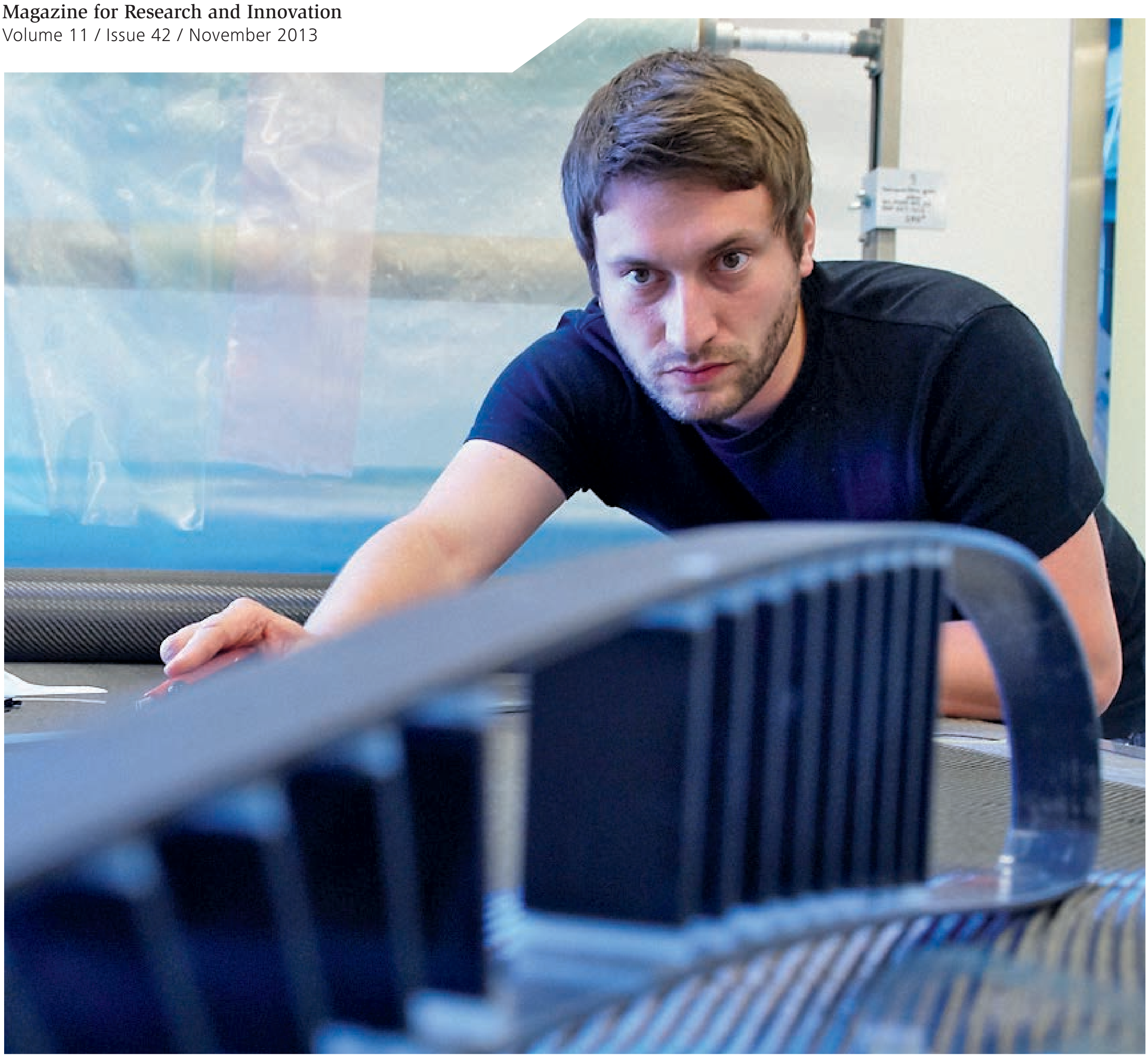

Motion without grease

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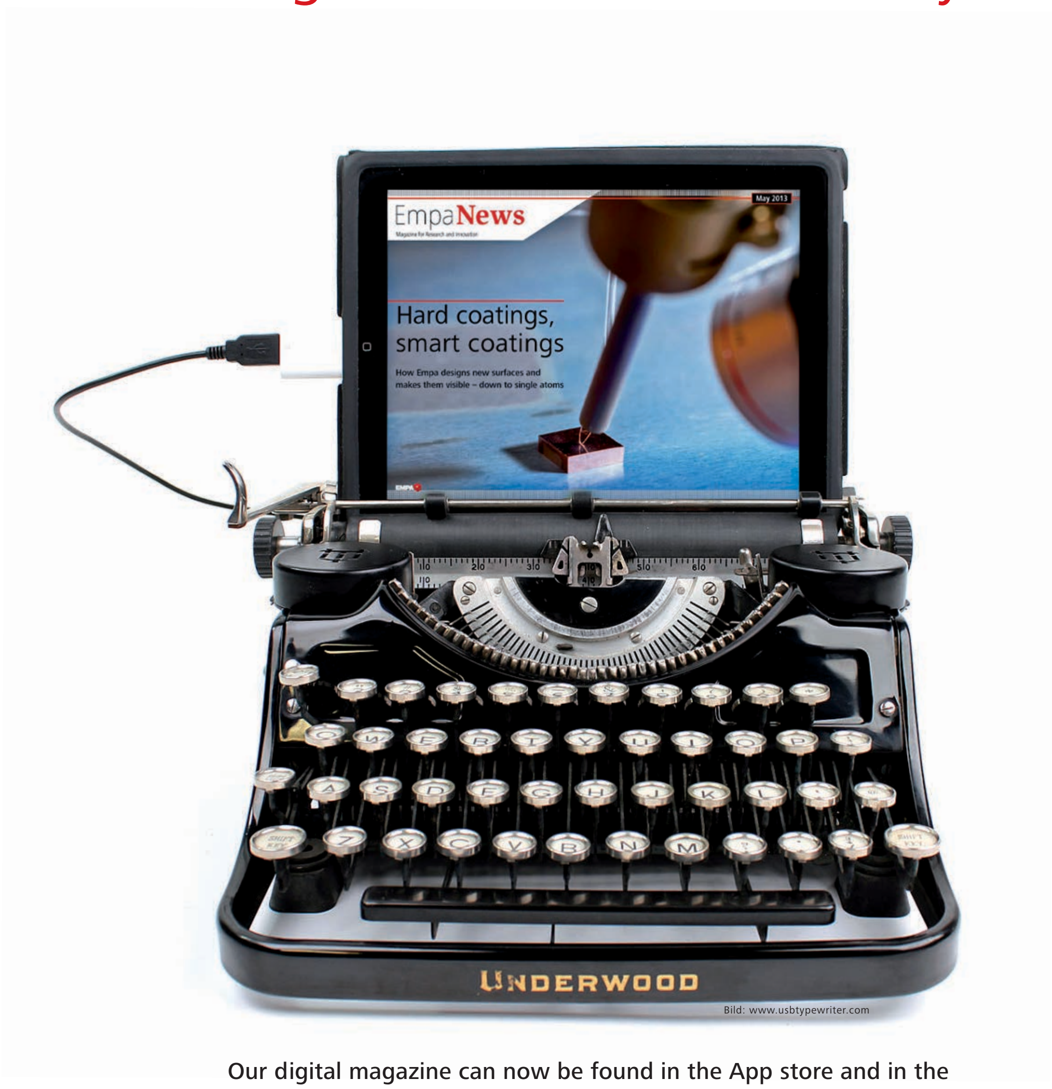

Bild: www.usbtypewriter.com

Our digital magazine can now be found in the App store and in the Google / Android Play Store by searching for "EmpaNews".

(This App runs only on tablets, not on smartphones!)

Available on the App Store

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EmpaNews

TOUCH THE SCIENCE

MICHAEL HAGMANN Head of Communications

Empa goes social

Dear readers

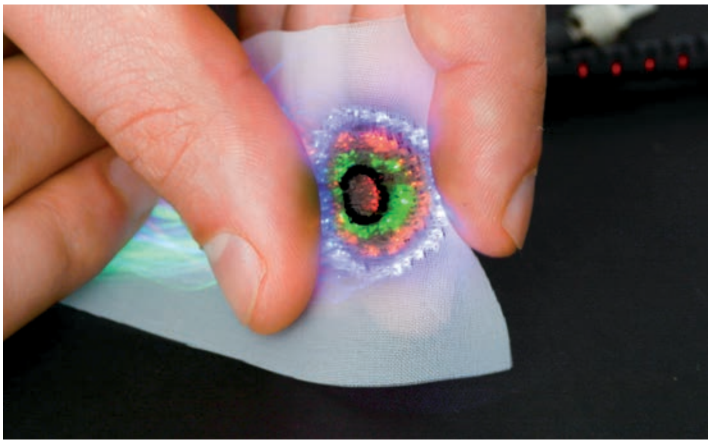
Man is said to be a social creature that likes to network. And Empa is no different, which is why we have boosted our presence on social networks, i.e. Facebook, Twitter, LinkedIn, Xing! and co.

On the Empa pages, you can "like" or "follow" us and comment on (by all means critically, too), share and "re-tweet" our articles. (Our YouTube channel has already been "on air" for some time and recently hit the quarter million-download mark.)

And as these networks also need nurturing, we have also appointed a Social Media Manager, whom I would like to take this opportunity to introduce: Cornelia Zogg. Feel free to contact her with any suggestions, pointers or tips for our social media activities.

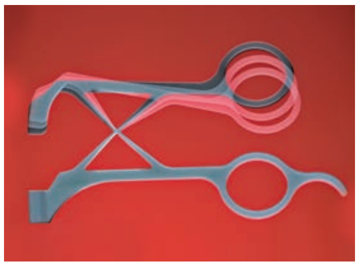
As for the latest issue of EmpaNews – which you can also "share" socially, of course via our App – once again it is jam-packed full of exciting stories, including from the bottom of the ocean or about an Empa spin-off that is looking to make joints and hinges a thing of the past.

Happy reading!



Light sensor stitched from threads – soft, smooth and washable. It measures the blood oxygen level and is used to make a medical "monitoring t-shirt". 16

Tapping into deep-sea oil reserves 04



Joint-free surgical instruments 10

Imprint

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Cover

Solid-state kinematics: Empa-researcher Alexander Hasse checking a compliant aircraft wing, which does not need a single joint. See p. 06. PICTURE: Monika Estermann, Zürich

"Lifejackets" for deep-sea drills

Tapping into new crude oil and natural gas sources is growing increasingly complicated. Although many reservoirs are well-known, they can't be exploited with today's extraction technology. In order to enable oil and gas to be obtained from the deep sea, for instance, Empa is going to team up with industrial partners to develop floating units that are supposed to prevent drill pipes several kilometers in length from breaking.

TEXT: Dominique Bitschnau / PICTURES: Shell, Trelleborg, Empa / ILLUSTRATION: Empa

At present, around 60 percent of the global energy needs is fulfilled by crude oil and natural gas. And the worldwide demand for energy keeps on rising. Obtaining crude oil with conventional extraction techniques, however, has hit a brick wall. Using controversial methods such as "fracking", the oil industry is now trying to use the available reservoirs more effectively. After all, there are still enormous oil reserves; the problem is that the technical means to extract it have been lacking thus far.

Deep-sea oil and gas deposits are attractive, for instance – in other words, around 40 percent of the reservoirs that had been newly discovered between 2005 and 2009. Until now, however, drilling has only been possible to depths of 3,000 meters. Due to the heavy deadweight and stresses while drilling, the steel drill pipes are in dan-ger of breaking apart at greater depths. In order to prevent this, floating units are attached to the drill pipe and the load is considerably taken off the deep-sea drill by the increased buoyancy. The buoyancy module used thus far, a so-called "drill riser", is about as big as a human being and consists of synthetic foam with spherical air pores. "However, this foam has one major drawback: the micro-bubbles implode at great depths because the pressure is too high," explains Empa researcher Jakob Kübler. Using pressure-resistant floating units, he and his team are looking to make it possible to drill at depths of up to 6,000 meters.

>>

Moderately priced buoyancy modules

The goal for Empa and its partners is to replace the current synthetic foams with more resistant ceramic balls. Such balls already exist and are used as buoyancy aids for submarines, for instance. Thanks to its good stability and pressure resistance, a ten-centimeter ball can withstand over 200 tons, the weight of five heavy trucks. The problem is the price: one ball costs around US$ 800 and thousands of them are needed for one deep-sea drilling operation. At these costs, the method is not worthwhile for oil companies. Therefore the british product development contractor Pera Technology and the drilling supplier Molded Forms asked Empa for scientific support. And Jakob Kübler found the task quite interesting: "Developing an optimized ball with as little deadweight as possible and low production costs is a major challenge," he says.

In order to generate a lot of buoyancy, the ball should be as light and bulky as possible, which is why Kübler is looking to produce balls with a thin wall and as little ceramics as possible. The balls should be made of normal, low-priced ceramic powder, which Kübler mixes with water and chemical additives to form a so-called slurry – a mixture with a consistency much like a thin milkshake.

Wanted: the perfect ball

The trick now is to produce a precision ball from this mass that also retains its shape when fired in the oven. After all, only perfectly round balls can bear up against the tremendous pressure in the deep sea. Consequently, simply piecing together two halves to produce the balls is not an option as the ceramic balls need to be produced seamlessly in one go. "We simply can't afford for the buoyancy units to fail while in use," says Kübler. Repair work at such depths would mean enormous costs, breakdowns and environmental pollution. In order to make the balls even more robust, it is planed to cover each of them in an elastomer material, which would enable the impact-sensitive ceramic balls to be transported and installed safely.

The prototypes, so it is planned, could be ultimately tested by a Swedish specialist company, which already manufactures buoyancy units for deep-sea drilling. After the completion of the project, there should be a few hundred balls left over as evidence that they work immaculately and are cheap to produce. //

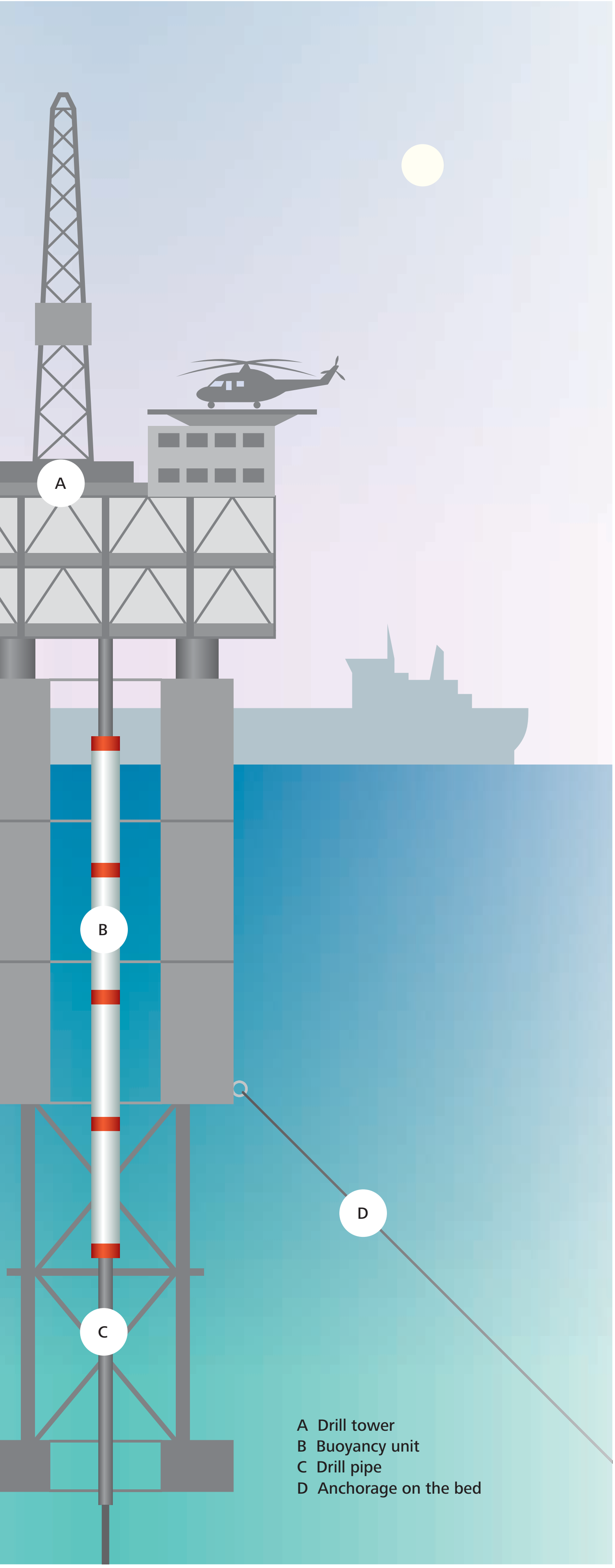
1

2

1
Buoyancy modules piled up before use. The white modules with the orange end caps, so-called "drill risers", are roughly the same size as a person and attached to the drill pipe. Inside, synthetic foam produces the buoyant effect. In order to make it possible to extract oil and gas from great water depths, Empa and its partners want to replace the synthetic foam with special pressure-resistant ceramic balls.

2
Diagram of an oil rig with fitted buoyancy units. Under its own heavy weight, the steel drill pipe risks breaking apart at great depths. In order to reduce the tensile load on the pipe, buoyancy units are attached to it.

3
Ceramics expert Jakob Kübler in his lab in Dübendorf: He produces special ceramics with suitable geometry and defined properties from a semi-liquid substance "with the consistency of a milkshake".



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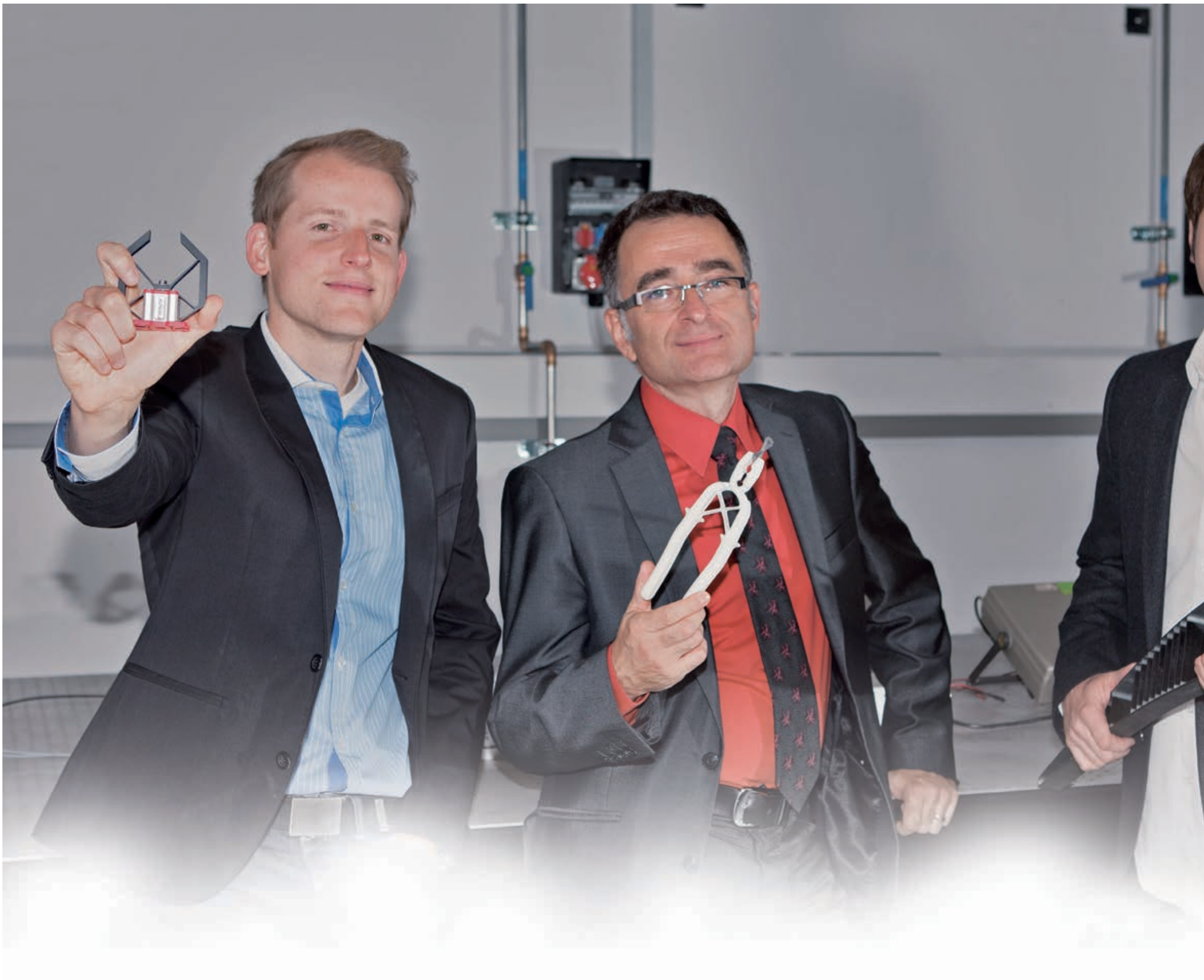
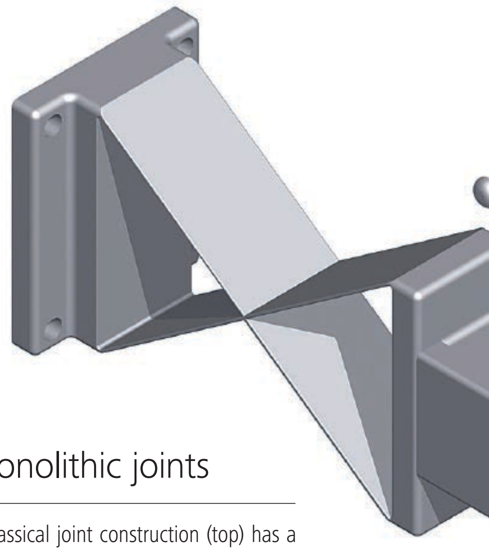


The death knell for joints

Monolitix, a new Empa spin-off, specializes in flexible mechanisms, which are frictionless, wear-free, and lighter, more hygienic and affordable than conventional joint mechanisms. The potential for numerous applications is huge in a vast range of fields. The neo-entrepreneurs are now in the process of conquering the market with their first products.

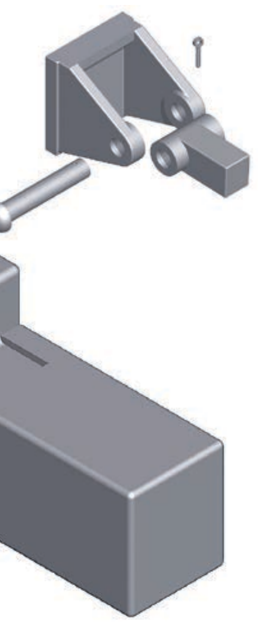
TEXT: Martina Peter / PICTURES: Empa



Monolithic joints

A classical joint construction (top) has a conceivably simple design. A monolithic solution (below) is more complex in design terms but offers numerous advantages during operation.

Empa-researcher and Monolitix head Flavio Campanile (center) and his colleagues René Jähne and Alexander Hasse: Intelligently constructed flexible components may consign joints to the history books.



We are surrounded by jointed objects from dawn till dusk. “We encounter them in thousands of different forms,” explains Flavio Campanile, an aeronautical engineer and Chairman of the Board at the Empa spin-off Monolitix; as a hinge on the kitchen cupboard, from which we grab our coffee caddy in the morning to the toggle switch we use to turn off the bedside lamp before going to sleep. Without joints, everything would be rigid: our cars could not be steered, neither could the brakes on our bikes be applied. However, it took Campanile some time to realize that the optimization of these joints also harbored a lucrative business idea.

The “tweezers” principle

The ETH Zurich lecturer and head of the Empa Center of Solid-State Kinematics and Actuation has been concentrating on so-called compliant systems for over 15 years. The trick: rather than facilitating movements via classical bearings and joints, these elements are deliberately dispensed with in “solid-state mechanisms”. Instead, the material is controlled and deformed reversibly. Metaphorically speaking, instead of a pair of pliers comprising several parts, which typifies the traditional joint principle, Campanile focuses on a pair of tweezers made of a single, elastically ductile component.

“The advantages of monolithic systems are plain to see,” explains Campanile. Mechanisms without joints are frictionless and wear-free and thus do not require any maintenance, which can drastically reduce the running costs of machines and instruments. They are also an asset where high hygiene standards are required, such as in medical technology or the food industry, because they are easier to clean and sterilize. Moreover, the assembly costs for solid-state mechanisms can be slashed or even eliminated completely, which means considerably cheaper production processes.

And finally flexible mechanisms can also perform functions that are unthinkable with conventional systems: aircraft wings, for instance, where the shape – like their role models in nature – can constantly be altered, thus optimizing the use of aerodynamic forces. Rear spoilers for racing cars that generate greater downthrust with the same resistance and thus ensure that the vehicle travels at a higher curve velocity are also conceivable.

At first, Campanile did not recognize the economic potential of these systems, he says. Only when his PhD students looked into the topic did things start to take shape. The first prototypes for medical technology were developed during René Jähne and Alexander Hasse’s dissertations at ETH Zurich. The ideas simply kept on coming thick and fast. The three-man team spent years conducting research at the Mechanics for Modeling and Simulation laboratory of Empa and developed procedures to analyze flexible elements and their deformations, and algorithms for form optimization. Their results were channeled into software modules, databases – and patents. By 2010 the time had come to found a company.

Already with products on the market from the outset

It is not every day a spin-off that already has a product on the market applies to be accepted in Empa’s “business incubator”, says Mario Jenni, head of glaTec, the Empa’s start-up center in Dübendorf. But sure enough, Monolitix had already found its first customer for its robotic grab before the company was actually founded: bakery-product producer HUG uses it to carefully, quickly and hygienically remove small shortbread flan cases from the production line and place them in the packaging.

Like every spin-off at the Empa start-up center, the Monolitix team is also learning to deal with the highly individual challenges on the path towards independence. For Campanile and co. the key is to get new customers interested with their numerous ideas and encourage them to develop novel products together. The head of product development at Monolitix, René Jähne, explains: “As a small firm, it would be too expensive for us to develop and sell complex products for a specific market all by ourselves.” Although they offer a small but high-quality series of grab systems from a catalogue, he expects far more success from actively approaching manufacturers of machine parts, tools and instruments. “This would enable us to get to know the needs of individual partners and their markets better, project by project,” says Jähne. In return, the discussions offer customers an insight into Monolitix’s engineering work. It soon becomes clear that ultimately designing a flexible system can only occur across disciplines and with a lot of knowhow.

There is a demand for the new technology, the founders proudly note, and point out that financially Monolitix is already standing on its own two feet, which is rather unusual for such a young company. According to its business plan, Monolitix should blossom into an SME with around 40 employees within the next five years – a perfectly realistic goal if things continue to develop at this rate. //

Video

Monolitix – a spin-off from Empa

http://youtu.be/4v-GR1avR6Q

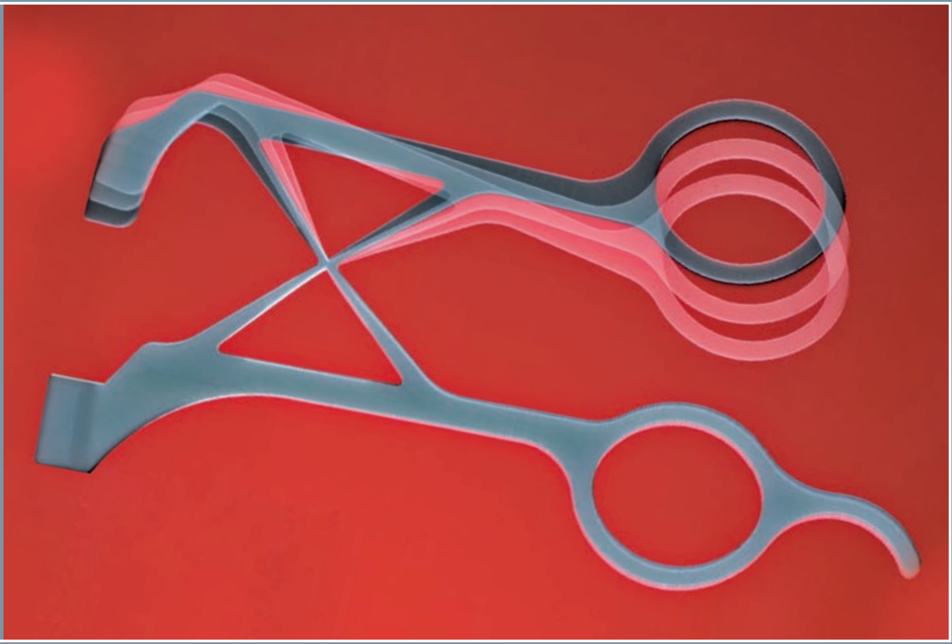
Nomination for the De Vigier development award 2013

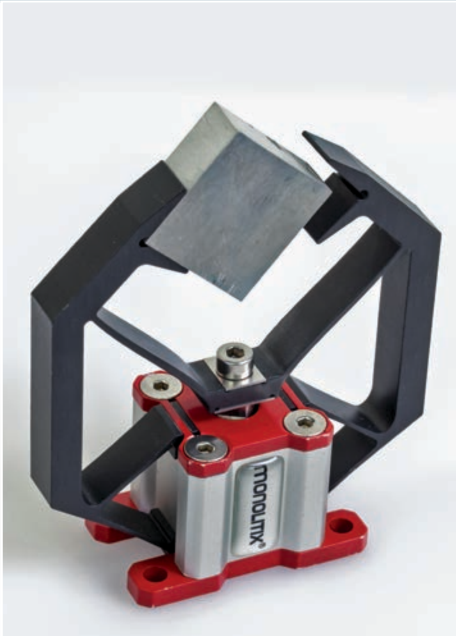
http://youtu.be/lTZqBAGYGKM

01

MEDICAL TECHNOLOGY

Surgical instruments need to be sterile. If they only consist of one piece, bacteria can no longer get into the joints and hinges. And thanks to the drastic reduction in the amount of installation work involved, production costs can also be slashed.





03

MECHANICAL ENGINEERING

Throughout production, processing and conveyor systems, conventional hinge connections provide the necessary movements. The jointless, mechanical systems developed by Monolitix enable major savings to be made on construction, production, assembly and operating costs.

02

AUTOMATION

With its batch-produced jointless grabs, Monolitix provides a maintenance-free alternative to conventional robotic grabs. They are extremely light, frictionless and play-free.

04

CLOCK MECHANICS AND PRECISION ENGINEERING

Conventional clockworks comprise numerous lever mechanisms. By using high-precision, frictionless and maintenance-free compliant structures, Monolitix has successfully demonstrated that clockworks become more efficient while reducing the number of components.

All greased up and nowhere to go!

One-piece compliant components could soon be used in many fields. Read on to find out how and where.

PICTURES: Empa, iStockphoto.

06

POWER GENERATION

Compliant concepts are just the ticket for rotor blades on wind turbines that are difficult to access or roller and slide bearings in solar power stations that are exposed to mud, sand or dust and have to work under extreme conditions.

05

SPORT

In sport, jointless, ductile mechanisms could be used in wing sails for high-tech sailboats (like the ones just used in the America's Cup), front and rear spoilers for Formula-1 racing cars, the soles of sports shoes or flexible wings for gliders.

07

COMFORT

Car seats with compliant "rib structures" offer more comfort for the driver by taking the load off or offering support with pinpoint accuracy. The healthcare bed made of compliant elements by the Empa spin-off compliant concept to prevent bedsores offers patients continual, gentle repositioning.

A second skin

Empa physicist René Rossi conducts research into the clothing of the future. What is it supposed to do? What is feasible? Why are feel-good clothes sometimes deceptive? And how can 1.8 square meters of human skin be used to transfer data?

INTERVIEW: Rainer Klose / PICTURES: Empa

René Rossi in a "tête-à-tête" with a model wearing the clothing developed at Empa. Good clothing should aid the skin's climate regulation, not hamper it.

You have been investigating clothing for over 20 years now. What was your first research project?

The topic of my PhD thesis: the interplay between comfort and protection in protective clothing for firefighters, which I'm still working on to this day. The main problem with firefighter suits is excessive sweating, which can evaporate at high temperatures and cause extremely nasty scalding. This must be avoided.

What does clothing generally need to do from a researcher's perspective?

Ideally, clothing should act as a second skin. The skin is the largest organ in humans and has three main functions: to form a barrier that protects the body's core from external influences; to make contact with our surroundings via mechanical and thermal receptors (the interesting thing here is that we can't perceive moisture directly – the body interprets it from a cold sensation and the haptic feeling of wet skin or clothes); and finally to act as an aid for thermoregulation. If you warm up, like during exercise, the skin alters its thermal conductivity and gives off moisture in the form of sweat. This evaporates and cools the surface. The skin is therefore an adaptive system.

Can the wrong clothing also be harmful?

Yes, it can. You can trick the feel of the skin, create a pleasant sensation and thus go against the body's needs. When I sweat and it's 38 or 39 degrees inside my body, my organism should be cooled down. If I merely place a damp cloth on my neck, I feel better. Locally, the skin produces less sweat, but the body's core doesn't cool. In extreme cases, tricking the senses like that can be dangerous, which is why good clothing needs to aid the skin's adaptive capabilities, not stifle them.

So can you sort of feel good clothing when you buy it?

Unfortunately not. As a designer, for instance, I could make a perfectly insulated winter coat out of thin, metallized film – but no one would buy it. After all, most people "feel" clothes before buying them. This "first touch" is incredibly important: it needs to feel warm if you want to buy a winter sweater and cool for a breathable sports shirt. But that has little to do with the actual function of the clothing. With my fingers, I mainly feel the material's thermal conduction. But heat can also escape through convection – the exchange of air – or thermal radiation. My fingers won't tell me anything about this.

>>

Speaking of functional T-Shirts, nowadays they seem to be the flavor of the month. What can we expect in the textile sector in 20 years' time?

Clearly, one key issue is our ageing population. Our research is aimed, among other things, at enabling the elderly to remain at home on their own for as long as possible, which means they need support. Nowadays, for example, many senior citizens have to take several different kinds of medication and keep those little boxes labeled "morning – noon – night" on the kitchen table. In future, a proportion of this medication could well be administered via the skin thanks to novel textiles, which could administer just what the patient needs.

And how does the system determine what the patient really needs?

Of course, their health status also needs to be monitored via the textile. You don't want to send a senior citizen with a heart condition into hospital for an ECG every day. We'd like to measure the heart rate constantly with a special T-shirt, where the results could be sent straight to the hospital via a data line. The same could work for sleep monitoring: if the patient snores or develops apnea, you could spot it and wake them up with a beeper. Using easy-to-wear textile systems like these, we might be able to improve the quality of life for elderly people considerably – because they would be able to stay at home for as long as possible.

So you're also working on a better future for your own generation then?

(Laughs) You got me! I'm 46 years old now and not averse to doing my bit to give myself the chance of a better life when I'm 80.

If I want to measure bodily functions with a T-shirt, it has to be very tight-fitting and worn for hours on end. Does that mean we can kiss our comfy, baggy woolly jumpers goodbye?

Yes, that's right. That's why researchers also speak of a "second skin". We are already conducting research into body-scanning in order to be able to produce customized shirts. At the same time, we need to understand how the textile behaves if it is in close contact with the skin. We need a new generation of fibers and the corresponding knitting and weaving technologies that make such a "second skin" possible, without it stretching or pinching anywhere.

So it needs to be tight-fitting but mustn't bother us. How is that possible?

It's perfectly feasible – we already manage today. The trick is for the skin's mechanical sensors not to notice the textile at all. Here, it helps that the skin does not keep passing on the irritation. It "gets used" to the feeling of wearing the garment and only transmits the stimulus if something changes in how it fits. If a T-shirt is tight, does not shift and doesn't pinch, eventually you stop feeling it. Such T-shirts already exist in the professional football leagues. The players wear skin-tight functional shirts that absorb the sweat under-

A frontrunner in textile research

The independent Dutch consulting company noéton texrank recently compared European textile research institutes and compiled a list of rankings. Empa took to top spot for application-oriented research institutes – with the remark that not only does it publish the most papers every year by far, but also that they are of particularly high quality. As a result, it is able to keep up with universities that are considerably larger and even outshine some of them. Empa was lauded for its outstanding record. In the overall ranking, it came second, narrowly outperformed only by RWTH Aachen University – a clear indication that the groundbreaking developments achieved at Empa do not go unrecognized on a European level.

> "Good clothing needs to aid the skin's adaptive capabilities, not stifle them."

neath their looser jerseys bearing the sponsors' logos, which provide the visual impact and should no longer have any sweat patches. Business shirts with this technology are already available, too.

How can I keep my body dry and transport moisture away from the skin?

I incorporate capillary gradients, so-called Denier gradients, into the clothing and vary the size of the capillaries in different layers, one on top of the other. As a result, the moisture moves away from the skin. Ideally, textiles combine three unique properties that could revolutionize the medtech industry, just as soon as it discovers them for its purposes: textiles are highly porous, highly flexible and thus very kind to the skin, and have a unique surface-to-mass ratio. You can make very sensitive sensors and build highly efficient medication dispenser systems out of such a material.

And what do I stand to gain from textiles research as a healthy person?

With these three properties – porosity, skin-friendliness and a large surface area – you can also satisfy the next Smartphone generation's appetite for information. Just consider how big the interface with the body is: I can obtain an immense amount of body data from a skin surface area of 1.8 square meters. We'll be hearing a lot more about intelligent textiles over the next few years.

Isn't that wishful thinking?

Not in the slightest. After all, I have also been observing the research activities of my international colleagues – and I see nothing short of a new textile revolution on the horizon. When intelligent sensors and dispenser systems hit the market, they will also have a unique selling proposition (USP). No other material can offer such properties, which is also why I find my research field so fascinating. Renowned institutes such as the VTT in Finland – a sort of Fraunhofer Institute – which gave up textiles research years ago are now getting back in the game to avoid being left behind.

Does that also mean we can save the Swiss textile industry with high tech?

Yes, if it is willing to go beyond its traditional sectors. No textile producer in Switzerland can keep up with the competition from Asia by mass-producing goods. There are only two options: Either you issue licenses in the medium-tech sector and earn your crust solely with knowhow or you branch out into the high-tech sector, for which you can still produce in Europe. You can already see the first signs in the industry that production is shifting from Asia back to Europe, which is precisely what we want to tap into at Empa: our work is highly specialized and we conduct research for a niche market with an extremely high added value. That's where the future lies. //

Video
Hightech protective clothing for fire fighters
http://youtu.be/cqVqw74PvbY

Weight-watcher textiles

Piling on the pounds or shedding them – it all boils down to calorie intake and energy consumption, namely physical activity. Swiss researchers are developing monitoring systems that are integrated in clothing and help overweight people to watch their waistlines.

TEXT: Rainer Klose / PICTURES, ILLUSTRATION: Empa

1
Empa-researcher Lukas Scherer testing the function of a textile light sensor, stitched from threads. Such sensors can be used to measure the oxygen level in the blood.

2
The textile light sensor in action. The sensor is flexible and washable and can be incorporated into a monitoring t-shirt.

3
Prototype of the ECG sensor, which is composed of metal-coated threads.

4
How the monitoring t-shirt works:
a) Six ECG sensors (one on the back, blue) monitor the circulation
b) Flexible fiber-optic threads measure the respiratory volume
c) Light sensors record the oxygen concentration in the arteries and veins.

Obesity is a mass phenomenon. The proportion of overweight people in Switzerland (people with a body mass index of 25 and above) has risen from 30 to 37 percent in the last 15 years. The diseases directly associated with the condition are responsible for healthcare costs of almost 4 billion Swiss Francs a year. And it doesn't look much rosier in the neighboring European countries, either, let alone the USA.

Keeping tabs on the body and its metabolic physiology could help to prevent subsequent diseases such as cardiovascular complaints and provide specific clues as to how the individual can lose weight. Under the research initiative Nano-Tera (www.nano-tera.ch), several Swiss universities and research institutes have teamed up to develop a monitoring system and launch it on the market.

A key element of the project called "Obesense" involves sensors that are attached directly to the skin and provide useful readings without bothering the wearer. This is precisely where Lukas Scherer, a textiles researcher at Empa in St. Gallen and head of the Medical Textiles group, comes in.

Scherer's team brings its expertise for three technically completely different sensors that are supposed to record the patients' body data in everyday life to the table. The analysis, which is calculated in real time, informs the patient around the clock about caloric intake, energy consumption and circulatory values and should (ideally) enable the affected person to change their diet and lose weight.

Silver coated fibers measure ECGs

"Firstly, there's the ECG sensor," explains Scherer, "for which we use an electrically conductive tissue made of silver-coated fibers." The conductive electrode needs to be in close contact with the body and is covered with a hydrating membrane. The reason: it also has to take reliable readings when there is no layer of sweat stuck to the body. While ECGs are very straightforward to measure for sportsmen, it gets more difficult with older

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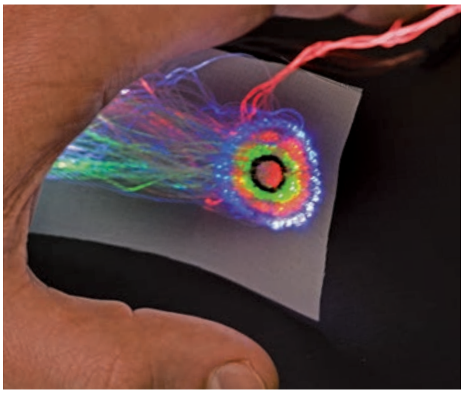

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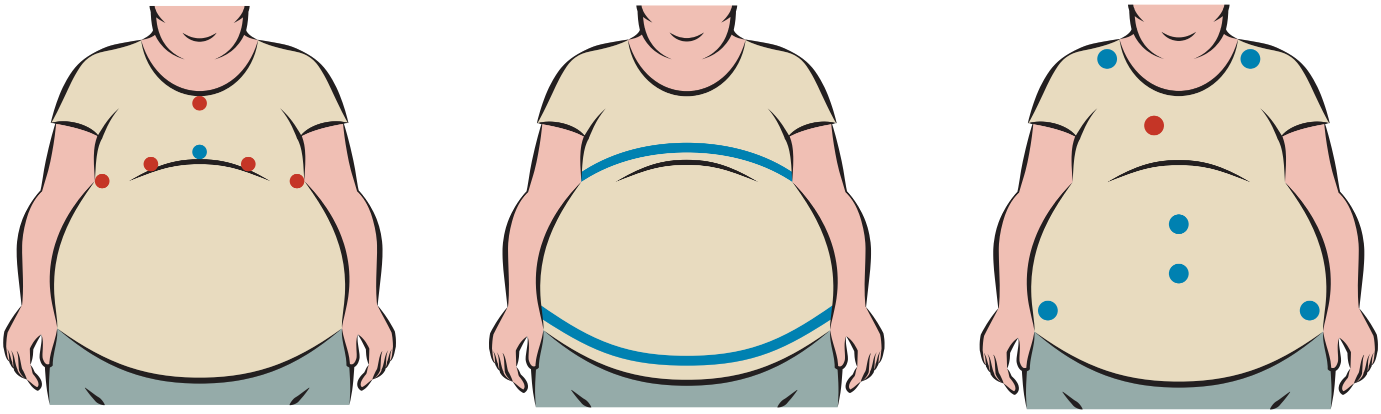


people as they sweat far less. The machine-washable, silver-coated fibers are manufactured using a method developed at Empa and the idea for the "dry" ECG sensor was also conceived here.

The second sensor that Scherer's team is developing should determine the patient's respiratory rate and volume – a critical reading to calculate energy consumption as it takes oxygen to burn calories. The more a person breathes, the more calories they can burn. "We want to use a light-conducting, elastic copolymer that stretches across the patient's stomach in the form of a knitted fabric and is illuminated with an LED," explains the Empa researcher. "When the patient breathes, the elastic fiber gets stretched and alters its optical permeability. Less light reaches the integrated light sensor." Based on this optical motion measurement on the stomach, the respiratory volume – the researchers hope – can be determined with sufficient accuracy. Such a measurement would be a tremendous step forward with regard to monitoring energy consumption around the clock as, until now, this value could only be determined if the patient was wearing a respiratory mask.

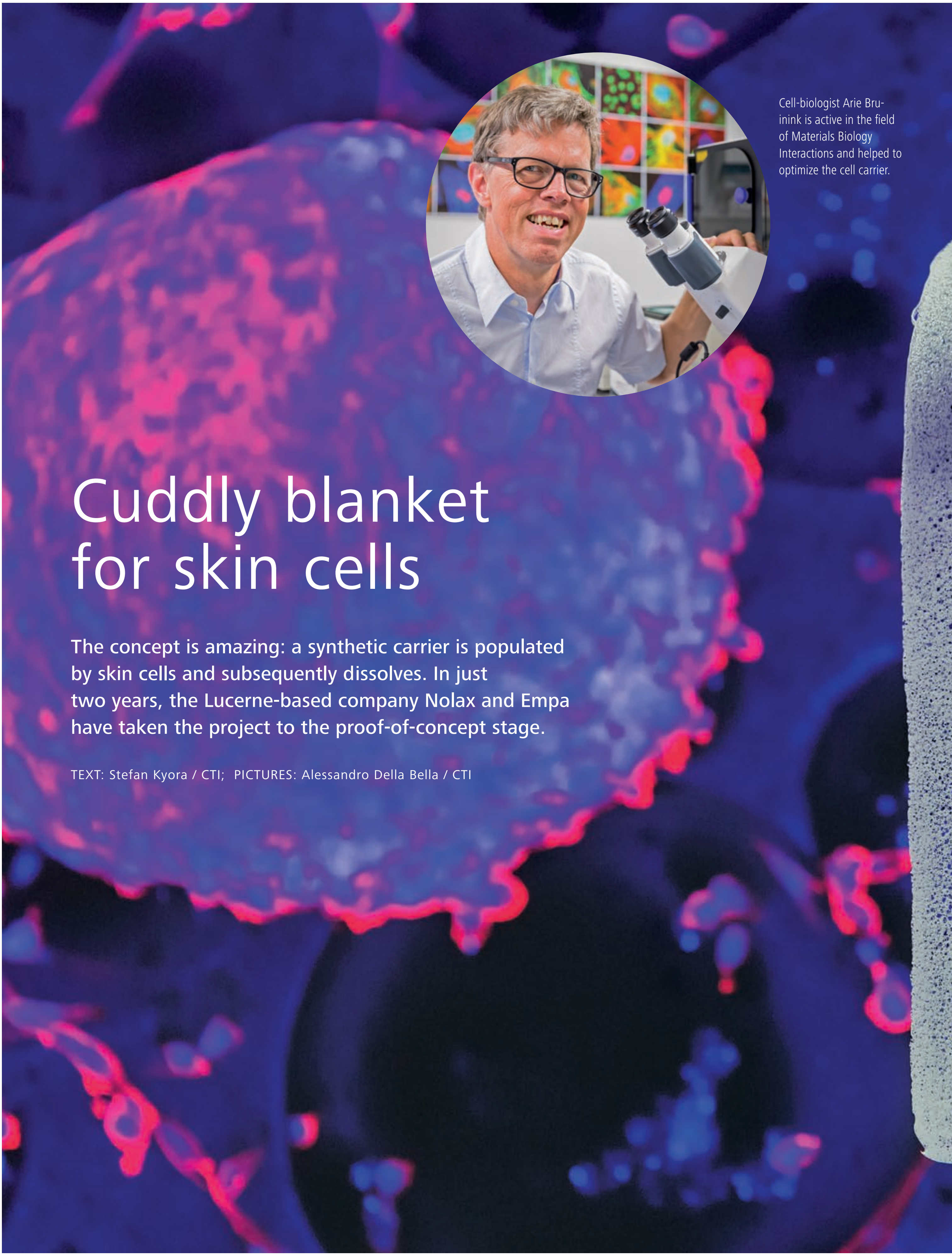
There is another way of measuring oxygen consumption that also requires sensors from the Empa labs. The measurement based on the so-called Fick principle needs three parameters: the blood volume pumped by the heart as well as the oxygen saturation in both arteries and veins.

Woven illuminating sensors for oxygen

Two of these parameters, the heart rate and the oxygen saturation in the arteries, are relatively easy to determine with a pulsoxymeter. Today, this is usually performed with a clip that lights up on the patient's finger, toe or earlobe. In new-born babies, the ball of the foot or the wrist is often illuminated, too. Oxygen-bound hemoglobin absorbs light of a different wavelength to free hemoglobin, which can be used to calculate how much oxygen is bound in the blood.

As the oxygen saturation in the veins differs greatly at many points in the body, it is much more difficult to determine. The sensor shirt the patient is supposed to wear thus needs to have several measurement spots in the infrared range in order to be able to gauge the amount of consumed oxygen with sufficient accuracy. Scherer's team has already developed an illuminating sensor out of woven threads that could be integrated in such a sensor shirt. The analysis of the signals requires special electronics, which is currently being developed at the CSEM (Centre Suisse d'Electronique et Microtechnique) in Neuchâtel.

At the end of the Obesense project, there should be a shirt tailored to suit every patient that hugs the body, is pleasant to wear and easy to wash. It is expected to yield body data on the patient all day long and help them to change their habits without bothering them in day-to-day life. This latter prerequisite is no small feat for Empa's textiles research. Not only does the final product have to be produced with extreme precision; it also needs to be comfortable. Otherwise, it will merely gather dust in the wardrobe. //

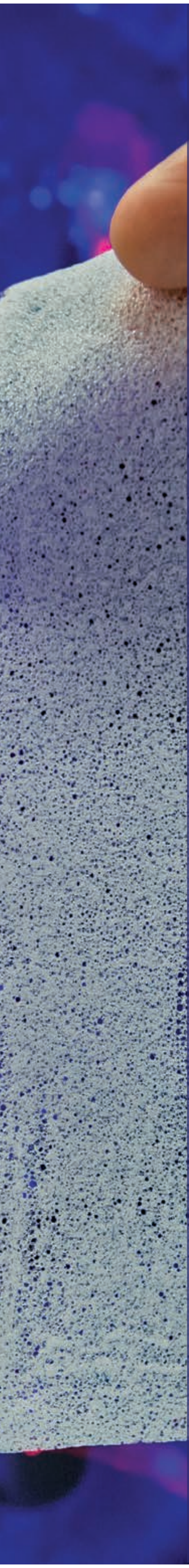


Cell-biologist Arie Bruinink is active in the field of Materials Biology Interactions and helped to optimize the cell carrier.

Cuddly blanket for skin cells

The concept is amazing: a synthetic carrier is populated by skin cells and subsequently dissolves. In just two years, the Lucerne-based company Nolax and Empa have taken the project to the proof-of-concept stage.

TEXT: Stefan Kyora / CTI; PICTURES: Alessandro Della Bella / CTI



Over 50 million people worldwide suffer from chronic wounds. And the number is set to keep on rising. After all, the growing demographic group of elderly people, who are weakened by diseases such as diabetes, is affected the most frequently.

Within the framework of the CTI project Revcel, the Lucerne-based company Nolax and Empa have come a major step closer towards solving the problem. Together, they have developed a synthetic cell carrier or "scaffold" that helps the body to heal wounds. This scaffold – a small, spongy pad made of polyurethane – is applied to the wound. Gradually, it is populated by connective tissue cells while the synthetic material is gradually degraded by the body until all that remains is a newly formed layer of skin.

Although there are already scaffolds on the market, they are made of animal-based products, which makes them expensive and carries the risk of transmitting diseases. There are no such drawbacks with synthetics as support material.

Nolax can look back on decades of experience in the synthetics sector and has had products for medical applications on the market for years. The SME patented its scaffold concept in 2009. "To take it to the proof-of-concept stage, however, we needed a perfect partner," explains Andreas Dobmann from Nolax. And this is where Empa came in. The project was managed by Arie Bruinink, a cell biologist and toxicologist with extensive experience of compatibility testing.

The institute's expertise was now called for. Tests on cell cultures were designed to optimize both material and structure of the scaffold in order to ensure that it was non-toxic, cells populated it and it eventually dissolved completely in the body without any side effects.

Bruinink's speciality: three-dimensional cell clusters

The tests devised by the Empa team were particularly realistic. In a highly complex process, for instance, Bruinink's team produced three-dimensional cell clusters from human cells and observed whether cells from these clusters colonized the scaffold. "This mimics the natural conditions in a wound far more realistically than the standard tests using individual cells," explains Bruinink.

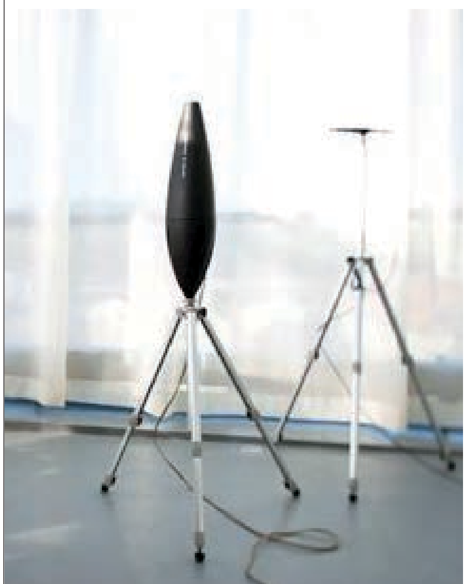
"Based on these results, we continued to adapt the formula and to improve the structure of the scaffold," explains Stephan Häfner, project manager at Nolax. Both teams worked at incredible speed and over one hundred tests were carried out altogether.

Finally, Brigitte von Rechenberg tested the findings on animal models at the Musculoskeletal Research Unit of the Veterinary Hospital Zurich, with convincing results. "Closing wounds with the scaffold worked even better than we had initially hoped," says Bruinink.

Nolax is now setting up a production facility to produce scaffolds for clinical trials. And Andreas Dobmann has high hopes for it: "Besides the treatment of chronic wounds, other fields of application are already emerging." //

Silence is golden

The textile designer Annette Douglas was awarded the «EESC European Award 2013» for her sound absorbing curtains, an award which is conferred by the «European Economic and Social Committee» for design excellence and sustainability. With the help of Empa acousticians and the textiles company Weisbrod-Zürrer, she developed lightweight, translucent, fire-resistant and sound absorbing curtains. The British-Swiss dual national has now received five awards for this product; in 2011 she received one of the «Swiss Design Awards» and in 2012 she was awarded the «Red Dot Award – Best of the Best». These were followed by further awards from Los Angeles and Cologne. For the young entrepreneur, the EESC award is a very special honour. «I am very pleased to have received an EU award for a Swiss project,» comments Douglas. Out of a total of 90 projects, five were singled out, including «Silent Space Collection» from Annette Douglas Textiles ACOUSTICS®.



Acoustic tests using the sound-absorbing curtain were conducted in a typical meeting room at Empa: the reverberation time was measured using a loudspeaker and a microphone.

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