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inno · Innovative Technologies - New Applications

Enabling the future of small tools

Dr. Gregory Eberle
Dr. Claus Dold

Cutting tools or turned parts in the millimeter and micrometre range are often mechanically processed either by grinding or by turning. However, when the workpiece exhibits a high aspect ratio (i.e. the length is significantly larger than the diameter), complications during processing can occur owing to processing forces and vibrations. The fabrication of said parts using laser-based methods together with ultrashort pulses leads to negligible thermal influences and opens up new geometrical and material possibilities. For this reason, geometries in the micrometer range with high geometrical requirements can be realized.

The company EWAG, located in Etziken Switzerland, offers the Laser Line Ultra, which is a machining center used to process a wide variety of materials, with a particular focus on ultrahard materials such as PCD (polycrystalline diamond) and PcBN (polycrystalline cubic boron nitride). Additionally, the machine's repertoire includes cutting edge preparation, post-sharpening as well as the fabrication of chip breakers and cylindrical margins.

Figure 1: The EWAG LASER LINE ULTRA. A laser-based machining centre equipped with 5 CNC and 3 optical axes enabling it to process practically all materials and geometries without significant thermal input. Source: EWAG

Complex microgeometries

Owing to its 8-axis kinematic concept and the use of an industrial laser source emitting pulses in the picosecond time regime, complex microgeometries can be made using the Laser Line Ultra. In a first example, a tungsten carbide drill bit with a tip made of solid PCD is shown. All features of the drill bit shown in Figure 2 are laser processed from a solid cylinder.

EWAG has developed an in-house CAM module which enables the fabrication of drill bits in the diameter range from $0.5 \leq d \leq 3$ mm by using a simple parameterised programming environment. In order to fabricate such tools, one only needs to input geometrical parameters, thereby eliminating the need for CAD data or other programming languages (e.g. G-Code programming). When one compares the manufacturing of cutting tools using ultrashort laser pulses to grinding or erosion, a principle advantage is the ability to process materials independent of its mechanical and electrical properties. ➲

Figure 2 a: Image of an unprocessed blank. Source: EWAG

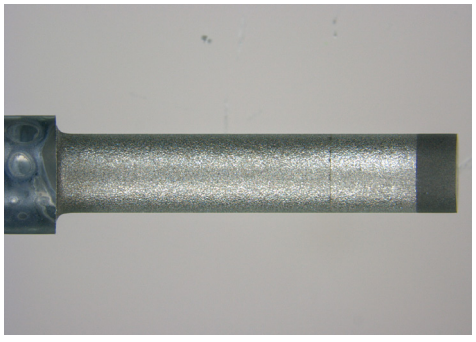


Figure 2 b: View of the circumference. Source: EWAG

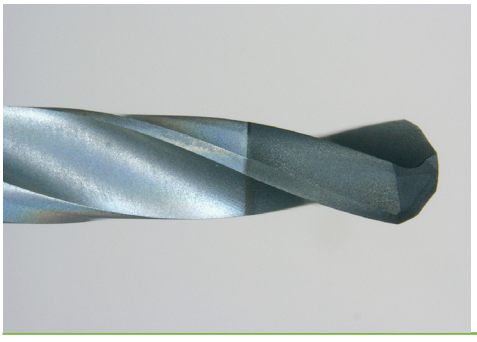
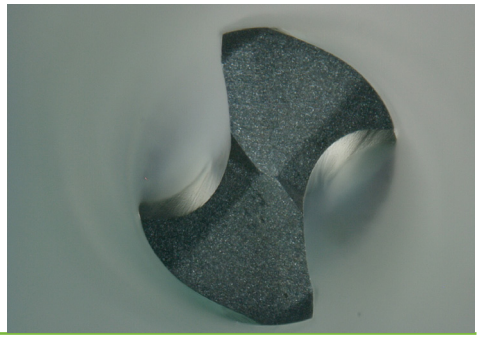


Figure 2 c: The PCD tip of a laser processed drill bit with a diameter of d = 0.7 mm. Source: EWAG



| Focus: Micro and Nano Industry in Switzerland|

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Editorial

Focus: Micro and Nano Industry in Switzerland

Welcome to the annual international issue of »inno«. This year, our international issue is dedicated to the micro and nano industry in Switzerland.

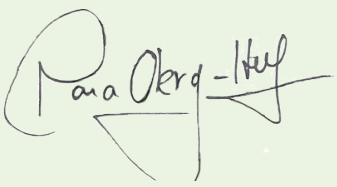
Switzerland has been one of the world's top players in the field of microtechnology since the very beginning of the technology. The existing know-how is based on the precision engineering tradition of the high-precision watch industry. Another important aspect is the active research landscape in Switzerland, which intensively and efficiently promotes key technologies.

In this issue, IVAM members from Switzerland like EWAG, GlencaTec, IMT Masken und Teilungen, Cicor or Sensirion introduce their companies and products, as well as their innovative applications. IMT Masken und Teilungen for example informs on page seven about the best ways to select the best material for a new generation of in vitro diagnostics. The Sensirion AG has brought a siloxane-resistant sensor onto the market that helps to provide fresh air and can be used in future automotive or smart home applications. You will find this article on page eight.

On page five, the 24IP Law Group informs about intellectual property rights in Switzerland, especially in comparison with current EU standards.

Due to the fact that digitalization still is one of the hottest topics for high-tech companies, the Swiss initiative digital-switzerland reports on its activities to push forward Switzerlands competitiveness on page four.

I wish you a pleasant reading!
Best regards



Mona
Okroy-Hellweg

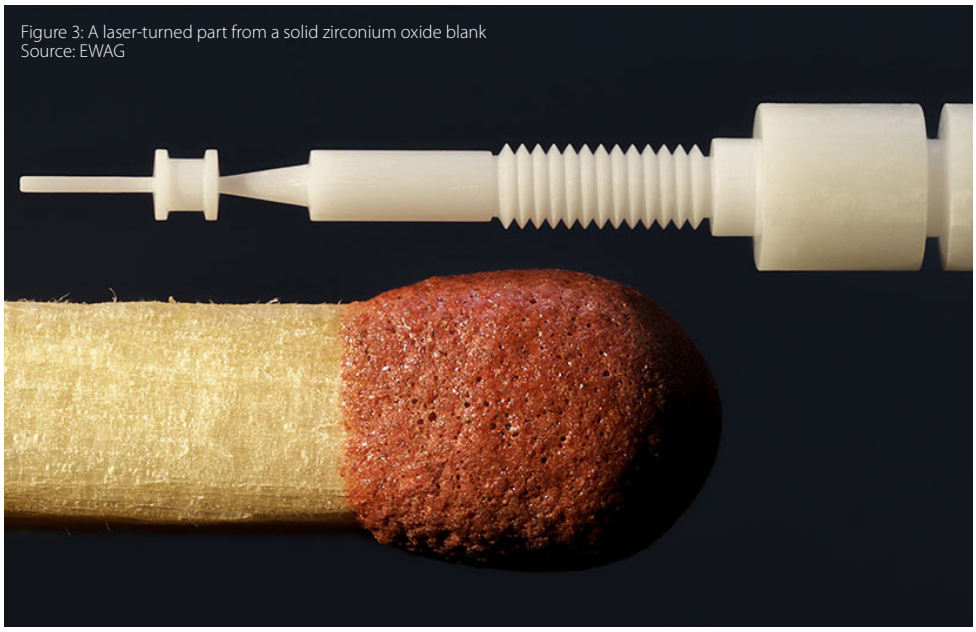


Figure 3: A laser-turned part from a solid zirconium oxide blank
Source: EWAG

The Laser Line Ultra is particularly suited to process helical tools composed of PCD, PcBN and other ultrahard materials. Compared to conventional manufacturing methods, helical tools particularly with a diameter less than or equal to one millimetre can be processed faster and exhibit a far superior surface quality. Additionally, high aspect ratios or very fine tip thinning geometries within only a few micrometers are possible.

Laser Turning

In a second example shown in Figure 3, a rotationally symmetric workpiece is processed by means of laser turning. The workpiece is fabricated from a solid cylindrical blank composed of zirconium oxide (ZrO_2).

This workpiece illustrates the possibilities of laser processing using laser pulses in the picosecond time regime including features such as: fine surface quality, lack of significant thermal input or deformation, high geometrical accuracy as well as high geometrical flexibility. Concave geometries in the order of magnitude of the laser beam radius (approximately 13 µm) can also be generated with ease. Such geometries are possible in nearly all materials owing to ultrashort laser pulses. To fabricate laser-turned parts, all that is necessary are cylindrical blanks and the turning profile, e.g. in form of a DXF file. Additional tooling such as a profile-grinding wheel or other special toolings are not necessary. This leads to immediate availability of the laser machine since the machine never needs to be constantly reconfigured depending on the type of processing application.

Outlook

The laser-based manufacturing using laser pulses in the picosecond time regime is an ideal method to process geometries and materials which are otherwise difficult using conventional methods. In this sense, new functionalities and dimensions with high geometrical flexibility and surface quality can be fabricated which up to now has often been considered unthinkable.

EWAG AG, Etziken, CH
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Imprint

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Intellectual property rights in Switzerland

Dr. Robert Harrison

It may be a small country in the middle of Europe, but by many measurement, Switzerland is one of the most innovative. It files more patents per head of population than any other country in Europe and also spends a significant proportion of its Gross Domestic Product (GDP) on research and development. But it's not a member of the European Union and so does not benefit from EU-wide protection of intellectual property. This brief article will outline the ways and means to ensure that innovation is protected in the country.

Patents

Switzerland was one of the original member countries of the European Patent Office which means that any patent application filed at the European Patent Office will include initial protection in Switzerland without the payment of an extra fee. After grant the patent needs to be validated in Switzerland and a local "address for service" in the country needs to be notified to the Swiss Office for intellectual property. Even if the patent application was originally in English, there is no need for it to be translated into one of the country's four official languages. Patents can be licenced just for Switzerland alone, because Switzerland is not part of the EU's single market, so that there is no "exhaustion" of patent rights when the product is first sold in another EU member state. In practice, however, the integrated nature of the Swiss economy with the rest of Europe means that fee licences are unlikely to be interested in a licence only to this one country. Switzerland will not be participating in the proposed Unitary Patent covering most European Union member countries.

Trade Marks

The so-called European trade mark does not include protection in Switzerland as the country is not a member of the EU. Swiss companies can file their trade mark applications with the office in Berne and these will be registered within a few weeks. Within six months after filing, it is possible for a Swiss company to extend their registration through the system for international registration of trade marks administered by the World Intellectual Property Organisation (WIPO) based in Geneva. This is a simple process and enables swift protection to be gained in a single application for many countries throughout the world, including the EU and the USA.

Source: Fotolia.com, WrightStudio

Non-Swiss companies seeking trade mark protection in the country have two options. They can either register a domestic Swiss trade mark through a trade mark agent having an office in Switzerland, or they can also file an international registration based on a registration in their home country

Registered Designs

Similar to the trade mark, registered designs in the European Union do not cover Switzerland and need to be filed separately in that country. There is an international design registration, which also covers Switzerland, but a number of major countries does not participate in this system.

Conclusions

Registering intellectual property in Switzerland is easy and the conditions for validity are almost identical with those in the EU. However, the registration process needs to be carried out separately through an office in Switzerland.

24IP Law Group Sonnenberg Fortmann,
Germany, DE
www.24ip.com

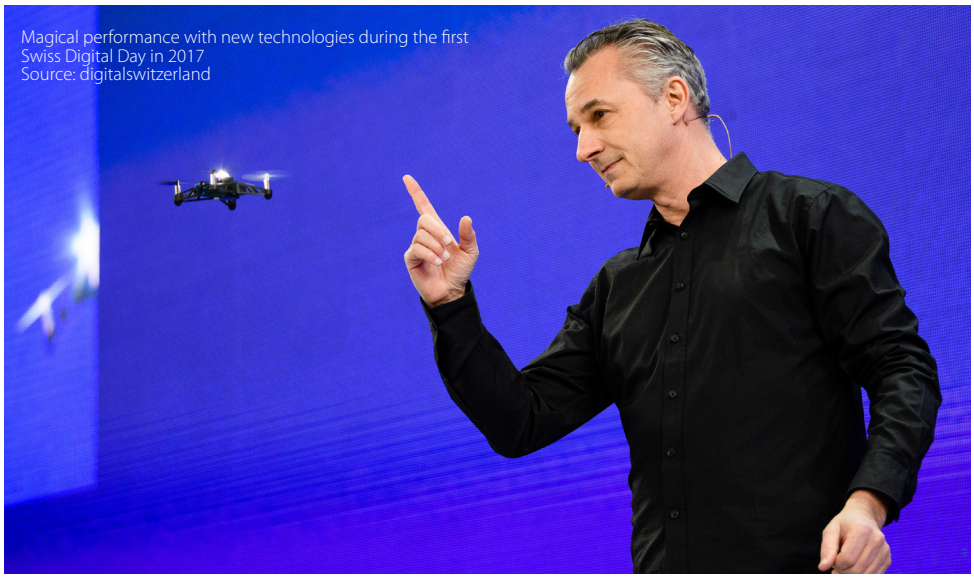
Making Switzerland a leading digital innovation hub

Niniane Paeffgen

Digital transformation has been happening for a while and is now accelerating considerably. As a small country without natural resources, Switzerland has always relied on innovation; it is in the national interest to keep up with today's technology and speed. The initiative digitalswitzerland was born out of the urgency to change and to remain highly competitive.

Interdisciplinary collaboration to bring Switzerland forward

In less than three years, digitalswitzerland has brought together more than 100 companies, organisations, academia and regions, and succeeded in creating a unique cross-sector collaboration between the diverse actors. Over 100 members, with one vision: Making Switzerland a leading digital innovation hub. Worldwide! Since digital transformation is disrupting all industries, digitalswitzerland chose an interdisciplinary approach and so focuses its actions on the following project pillars: politico-economic environment, education & talent, corporate enablement, startup enablement and public dialogue. Additionally, in the coming months, the association aims to increase the international visibility of Switzerland.



Magical performance with new technologies during the first Swiss Digital Day in 2017
Source: digitalswitzerland

digitalswitzerland walks the talk

First and foremost, digitalswitzerland strives towards maximum impact: its initiatives should do nothing less than bring the country forward. To foster more innovation and push for concrete outcomes, digitalswitzerland brought together players from all sectors with different know-how and provided a common platform to push ideas, the „digitalswitzerland challenge": Within the challenge, cross-sector teams place their ideas as bets and have one year to implement their innovative ambitions. Out of this competition resulted, for example, the development of an app, with which it is possible to measure blood pressure directly, and a company registration system using a digitized blockchain process to radically shrink the time it takes to do the necessary administration (2 hours instead of up to several weeks).

Another concrete cross-collaboration project is the so-called startup bootcamps, where startups and established companies come together to exchange and, in the best cases, to start working together towards a proof of concept. The bigger and, in most cases, less agile enterprises benefit from the more dynamic startups, which bring in a fresh and more creative approach to traditional business models.

Lino Guzzella, President of ETH Zurich, Michael Hengartner, President of the University of Zurich and Johann Schneider-Ammann, Federal Council of Switzerland during the first Swiss Digital Day in 2017, Source: digitalswitzerland

New ways of thinking and cross-collaboration to tackle the challenges of digitalization

There exists no panacea that universally solves the challenges governments, business and economies face with regard to digital transformation. Strategies such as waiting until 'the storm is over' or 'let's see what the others are doing' probably won't help either. So digitalswitzerland has taken a pro-active approach and wants to encourage all players to take new paths or try out new ideas. One such idea is the Digital Day, a day dedicated to the general public. Because if the public at large is not on board, transformation won't happen. During the Digital Day, the Swiss can experience what the digital revolution means in concrete terms for everybody. This public dialogue was launched in 2017 and will take place again on October 25, 2018. This time, it will happen in all regions of the country and has a focus on specific topics, such as health, data or mobility. Companies, associations or other players in these sectors will demonstrate how they tackle the challenges of digital transformation and what the implications are for the broader public.

digitalswitzerland, Zürich, CH
www.digitalswitzerland.com

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New solutions resulting from hermetic glass encapsulation

Martin Künzi
Elisa Morales

Glass is a widely used material with a history of more than 3500 years. The use and applications of glass have significantly developed over time. Traditionally implemented in jars or windows, glass has now even the function of an implant body or sensor shell. Taking this approach further, GlencaTec started activities in recent years offering innovative and exciting solutions for glass encapsulation of micro-electronic components.

Protection of sensors and their surroundings

In many industries, different parameters of the production processes need to be monitored and the respective data collected to ensure a safe product output. Small shifts in parameters such as temperature, pH-values or humidity have an impact on the final product. A continuous tracking of influencing factors is essential in order to deliver good products and meet regulatory requirements. How can those circumstances be controlled, if the environment is aggressive and at the same time sensitive to external factors such as the measuring system itself? A hermetically sealed sensor encapsulated in glass offers the ideal solution. The electronic system is isolated and thus protected from harsh environments; it operates as a stand-alone unit and does not interact with the solid, liquid or gaseous conditions around it. The implementation of glass in these cases is therefore an optimal material choice, for its alkali and acid resistance.

Communication, data storage and electrical power supply

Glass serves as a transparent housing to protect electronics and to transmit RF-signals out of the hermetically sealed unit. This allows combining visual systems, for example optical sensors or cameras, with RF technology to get a wireless connectivity. In addition to the RF technology's communication function, it also acts as an autonomous power supply unit. Meaning there is no need for batteries.

Nowadays, transponders are mainly implemented in the food and consumer industries bearing data for identification. Products can therefore be tracked and identified along the whole supply chain up to the shelf in the supermarket, in order to ensure a great customer experience. Other utilizations include the veterinary market, where most of the implanted tags in cats or dogs are encapsulated in glass. These are concrete examples of the immense possibilities, the combination of optical and RF-transparency bears for the future. The applications will augment in sophistication and thus increase the complexity of the requirements.

Medical device applications

RFID tags for human application are already reality. RF technology has a huge potential when it comes to certified medical devices. Transponders are able to bear a person's vital information, for example the blood group, which in case of emergency could be a life-saver. The possible applications go even further and may help with patients suffering from Alzheimer disease. Such implementations require a biocompatible material combined with optical transparency and miniaturization, which stresses the importance of glass in the medical industry.

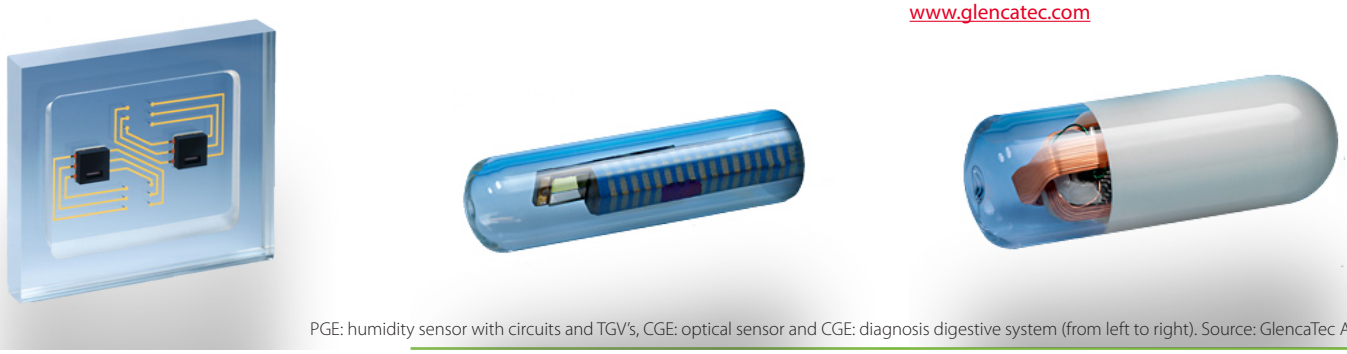
In the case of an implantable pressure sensor, the device is placed in the area of the heart and it measures the vital system without any external wires. The thin wall acts as a membrane and transfers the body pressure into a movement. This allows the modification of the electric signal, whereupon the pressure can be defined. The data then passes through the hermetic glass body for analysis by means of an RF-signal, as mentioned above.

Solution provider with material and process benefits

The name speaks for itself: GlencaTec stands for Glass Encapsulation Technologies with the core competences of a full service provider for cylindrical and planar glass packaging. Located close to Bern in Switzerland and certified according to the ISO 13485 standards, GlencaTec offers specialized laser micro-bonding solutions for advanced hermetic glass encapsulation. The cylindrical (CGE) and planar (PGE) glass encapsulation ensure complete and long-term hermeticity, which preserves the integrity of embedded elements for in-body and in-process analytics. The very low temperature impact on the embedded parts during the laser bonding process does not harm the encapsulated components. A CGE unit typically consists of one single tubular glass component formed during the laser melting process with a standard outer diameter from 1 to 10 mm and a wall thickness up to 1.0 mm. A PGE unit is a flat and tailored housing with 2 to 3 glass elements bonded together. The bonding procedure is done by a laser that creates a continuous laser line of about 30µm width in the interface of the parts. The volume of the unit varies from mm^3 to several cm^3 with a wall thickness up to 2mm. Additionally, through glass vias (TGV) can be integrated into the PGE-housing to expand the functionality of the device by keeping hermeticity.

Compared to metallic, ceramic or polymer solutions there is no material that unites optical- and RF-transparency with chemical resistance and long-term stability like glass does. In a nutshell, glass's durability, chemical inertness, transparency and bioinert properties make it an excellent material choice to implement as a sensor or an implant body. GlencaTec is a partner for customized laser-assisted micro-bonding technology for advanced glass encapsulation – for the most diverse applications, today and in the future.

GlencaTec AG, Niederwangen, CH
www.glencatec.com



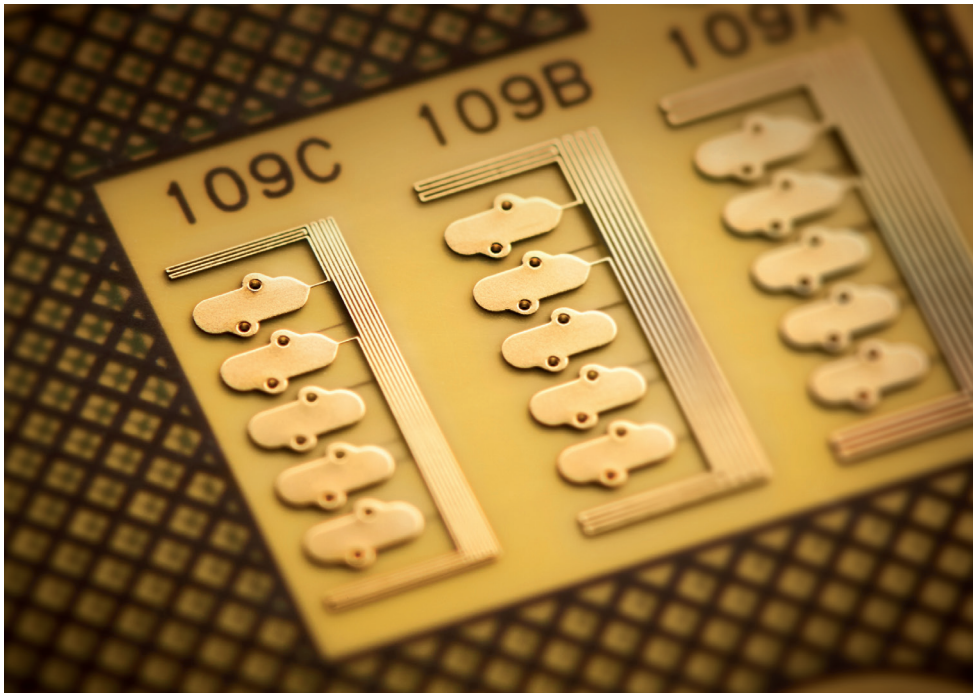
PGE: humidity sensor with circuits and TGV's, CGE: optical sensor and CGE: diagnosis digestive system (from left to right). Source: GlencaTec AG

Technology combinations for innovative products

Cicor is a leading technology partner with a globally unique portfolio of services and products. The latest discoveries combined with many years of experience, state-of-the art technologies together with exceptional expertise make Cicor a solid partner in the development and production of electronics. The Group supplies customized PCB, hybrid and EMS solutions to its customers around the world.

Printed circuit boards (PCB)

The Cicor site in Boudry (Switzerland) is a Swiss PCB manufacturer specializing in the miniaturization. The site develops and produces high-quality rigid, rigid-flex and flex PCB, with extensive knowledge of multilayer, high-density and ultra-high-density boards. The new PCB technology DenciTec includes wire and spacing widths of up to 25 µm, copper thicknesses of 20 +/- 5 µm in all layers, laser via diameter of 35 µm, rings with a diameter of 30 µm at the outer layers and 20 µm in inner layers, copper-filled blind vias with the possibility of via stacking and vias in pads. Even ultra-thin circuits are possible by using a 12.5µm polyamide core material (4-layer flex circuits with less than 120 µm thick), all with the highest reliability.



DenciTec. Source: Cicor

Hybrids and microelectronics

With its sites in Radeberg (Germany), Ulm (Germany) and Wangs (Switzerland), Cicor is a leading manufacturer of microelectronics and thin- and thick-film circuits. Thin-film technology uses semiconductor and microsystem technology processes to produce circuit boards on ceramic or organic materials. The Cicor site in Wangs has invested in a highly flexible, automated coater and developer for the coating and development of wafers and other substrates with photosensitive liquid resists. This system automates the previously manual processes of coating, developing and heating. In addition to the process stability, this investment also frees up personnel capacities that are urgently needed for the processes that cannot be automated. The fully automatic and therefore extremely reproducible edge bead removal will lead to a better layer thickness distribution and thus to an increased yield for the large-volume products in electroplating. The system can process square substrates from 4“ to 6“ edge length, up to 100 substrates can be fed in per run. In addition to spin and spray coating for the application of photoresists, modules for puddle and/or spray development are also available. The resist layers are cured on custom-made hotplates with proximity pins.

The conductor lines in thick-film technology are printed in the screen printing process and then burned in. The use of ceramic as a substrate ensures maximum reliability even under the hardest environmental conditions. The Cicor site in Radeberg has fully automated production lines available for microelectronic assembly, working under clean room conditions. Welding, adhesive bonding, soldering and various wire bonding processes up to the edge of the technology are available as interconnect technologies.

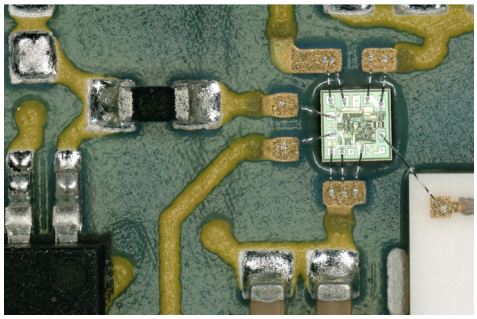
Electronic manufacturing services (EMS)

The production sites in Bronschhofen (Switzerland), Eastern Europe and Asia are service providers for engineering and manufacturing devices and systems. With a wide range of production options in assembly and box building including plastic injection molding, Cicor offers outsourcing solutions from idea to the finished product. The close cooperation between the global Cicor sites and the combination of the various technologies and the exchange of know-how result in new technology applications and opportunities.

For example, Cicor manufactures a customized sensor based on ceramic material, which is designed as a hybrid of three individual substrates. One substrate consists of a thin-film layer in CuNiAu manufactured in Wangs. On the opposite side the substrate is equipped with a thick-film layer in AgPt manufactured in Radeberg. The remaining two of the three ceramic substrates were both processed in Radeberg and use the thick-film technology with printed layers in Au and AgPt. The process chain continues with further technological sub-processes, such as soldering and bonding of the substrates as well as chip and wire bonding. A highly efficient micro-assembly with SMT components and an electrical test of the product finalize the combined achievements.

Cicor Management AG, Bronschhofen, CH
www.cicor.com

Hybrid sensor modul. Source: Cicor



Selecting the best material for the next generation of in vitro diagnostics

Dr. Alexios P. Tzannis

In vitro diagnostics (IVDs) is a term for a broad industry encompassing benchtop or larger bioanalytical instrumentation to point-of-care devices. Microfluidics, or lab-on-a-chip technology, is a powerful tool that sits at the intersection of biotechnology, automation, and functional integration. By using photolithography and other microfabrication techniques to make fluid flow cells, microfluidic devices can shuttle picoliter or smaller volumes into functional regions, enabling everything from synthesis based sequencing (SBS) to organs-on-a-chip.

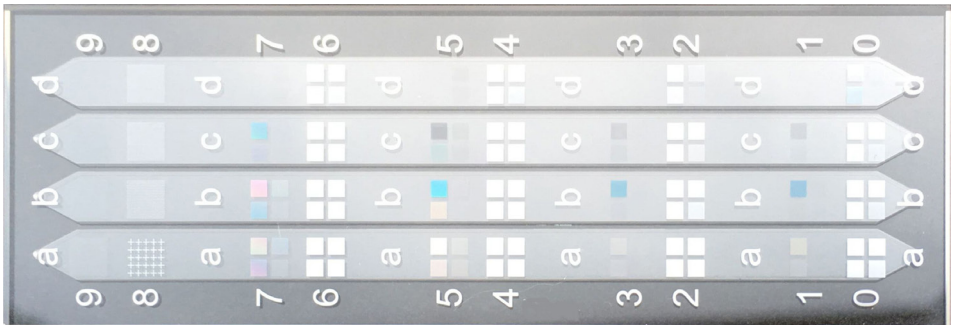
There are challenges with this approach. The viability and functionality of biological material places new burdens on device materials and fabrication requirements that few single foundries can meet. Scalable selective surface modification is becoming key to successful IVD device production.

Overcoming obstacles for IVD devices

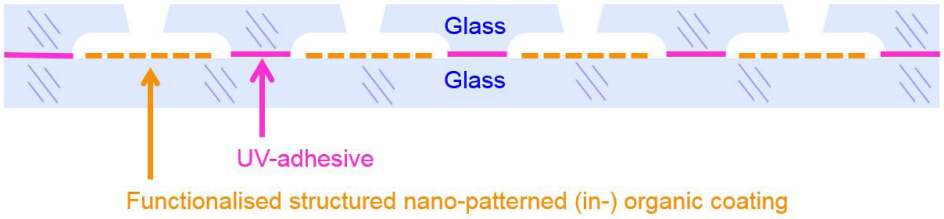
Choosing the best material for a microfluidic flow cell for IVD devices can be the first step in guaranteeing its performance within budget and schedule. Silicon is most useful for high aspect ratios that can be etched using anisotropic chemical etch or reactive ion etch. Thanks to advanced laser microfabrication, high aspect ratio features in glass are more feasible. Glass and silicon are easy to modify with additive methods such as chemical vapor deposition in order to add other materials, metals, and dielectric coatings for additional functionality such as electrodes or waveguides. Silicon oxide layers created on silicon introduce regions that have some glass-like properties. The ability to create three dimensional structures, for example, to create a scaffold for cells, makes silicon a strong choice for some organ-on-a-chip applications. Soft lithography materials such as PDMS, 3D printed materials (hydrogels, biopolymers), are attractive due to their biocompatibility and porosity to metabolic gases. Hybrid materials – glass on silicon, silicon on glass, and plastic on glass, can be constructed to enhance surface properties that are more favorable to the bioassay. Post-fabrication modification using silanization chemistry to create hydrophilic, hydrophobic, or chemically reactive surfaces is best understood for glass. Polymers have their sweet spot where the cost for millions of disposables is hard to beat using glass or silicon. The cyclic polyolefins can give a sufficient optical transparency and auto-fluorescence for many applications.

Applications such as next generation sequencing (NGS), cell selection and organ-on-a-chip technologies all benefit from the ability to pattern nanofeatures in glass microchannels. NGS transduction approaches may have challenging detection requirements

IMT generic NGS flow cell with inorganic nano-patterning with added selective surface functionalization. Source: IMT



Schematic build-up of generic NGS flow cell. Source: IMT



such as measuring single oligonucleotide fluorescence with SBS or electron tunneling through bases as ssDNA traverses nanopores. Additionally, cell encapsulation, droplet digital PCR, sample-to-answer qPCR and digital PCR microfluidic cartridges, encompassing cell enrichment, isolation, lysis, biomolecular sample prep, and PCR amplification/quantitation require partial functionalization and integration of electronic components. The ease of glass surface modification with a variety of materials, coupled to its mechanical, thermal and optical properties, makes glass a material equal to the biological complexity and engineering complexity of many IVD applications. By employing thermally and UV-A-cured adhesives, it is possible to perform room-temperature bonding processes on glass, allowing for bio-molecule encapsulation prior to bonding. The automation of UV-adhesive bond equipment simplifies and reduces costs for manufacture. Finally, glass can be sterilized by a variety of methods, a critical part of IVD manufacturing.

Microfluidics inside

The interface between the microfluidic device and its packaging is a component. The interface between device and its package is decided on a company-by-company and product-by-product basis. Here pick-and-place technologies and other integration processes can facilitate scalable production of complete flow cells, including packaging and sterilization.

Economies of scale

Material selection determines the production scale processing methods that affect design, cost, and quality. Glass is the best material for silane chemistry, room temperature bonding techniques, and coating methods for patterning devices from the prototyping to the manufacturing scale. The ideal IVD foundry offers a one-stop shop for bio-friendly additive manufacturing steps, including multifunctional substrate patterning of customised bio-functionalization, sealing of microfluidic components without damaging the underlying functionalization, singulation and individual packaging of each component. By removing complex manufacturing steps, the IVD device developer can focus on optimising their own proprietary functionalization chemistry.

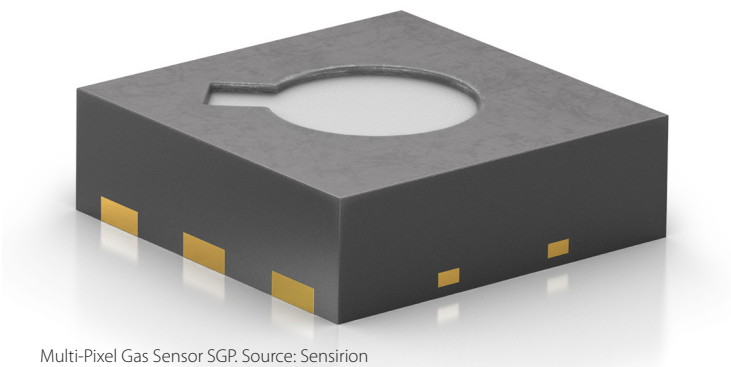
IMT Masken und Teilungen AG, Greifensee, CH
www.imtag.ch

Siloxane-resistant metal-oxide gas sensors

Until now, metal-oxide gas sensors (MOX) have suffered from a short operating life expectancy as their sensitivity and signal strength decline over time. The reason for this are siloxanes that build up on the sensor elements. Sensirion has brought a siloxane-resistant sensor onto the market in the form of the new metal-oxide gas sensor SGP.

Source: Sensirion

Everyone needs some fresh air after eight hours in the office, and not just in the figurative sense, as there is less oxygen available in the air due to people inhaling and exhaling and the VOC content has increased at the same time. VOC (Volatile Organic Compound) is the collective term for organic substances, i.e. substances containing carbon, that vaporize easily (are volatile) or are present as a gas at low temperatures (e.g. room temperature). All living organisms release these organic compounds into the environment. The main cause of the release of volatile organic compounds (VOC) by human beings is the use of solvents and traffic. Sources of VOCs in indoor air include plastics, furniture, carpets and cleaning products. If the concentration of VOCs is too high, it causes poor concentration and signs of fatigue. A good way to prevent this is to use gas sensors to monitor and control the VOC values in the air. However, these sensors often suffer from an inadequate operating life. Sensirion has tackled this problem and has now successfully developed a resistant gas sensor in terms of its long-term stability.


Multi-Pixel Gas Sensor SGP. Source: Sensirion

Disruptive factor - siloxane

Sensirion first mentioned its activities in the field of multi-pixel gas sensors that would combine various sensor elements on one chip at the Mobile World Congress 2015. The corresponding hardware is now ready for use in the form of a chip and packaging, as are the sensor elements, but achieving this has been a long, hard road.

After the initial application tests in the automotive and consumer sectors, which extended far beyond ideal laboratory conditions, Sensirion revealed that the sensors were not working as planned. “At the time, the sensors were not functioning as expected, something was not right,” commented Andrea Orzati, Vice President Sales and Marketing at Sensirion.

The developers, however, were not able to establish exactly what it was. They could only state that sooner or later a decline in sensitivity when measuring volatile organic compounds would occur. As a result of this, the developers tested similar sensors available on the market and found corresponding symptoms, i.e. a degradation of the signal and sensor performance. “So, we were not the only ones on the market who had this problem, but the reason was yet to be established; the problem was still there,” conceded Andrea Orzati. The developers finally identified the cause - siloxanes.

Siloxanes

Siloxanes are chemical compounds where a silicon atom is linked to an adjacent silicon atom via an oxygen atom: Si - O - Si. They are often used in cosmetics, soaps or detergents. Oligomers or organosiloxane polymers are also known as silicones and are used in many areas, including resins and as sealants. A distinction is made between linear (for example, L3, L4, L5) and cyclical (for example D4, D5 and D6) siloxanes. The EU classifies these substances as largely harmless to people; however, the cyclical D4 siloxane is banned in the EU.

Contamination by siloxanes

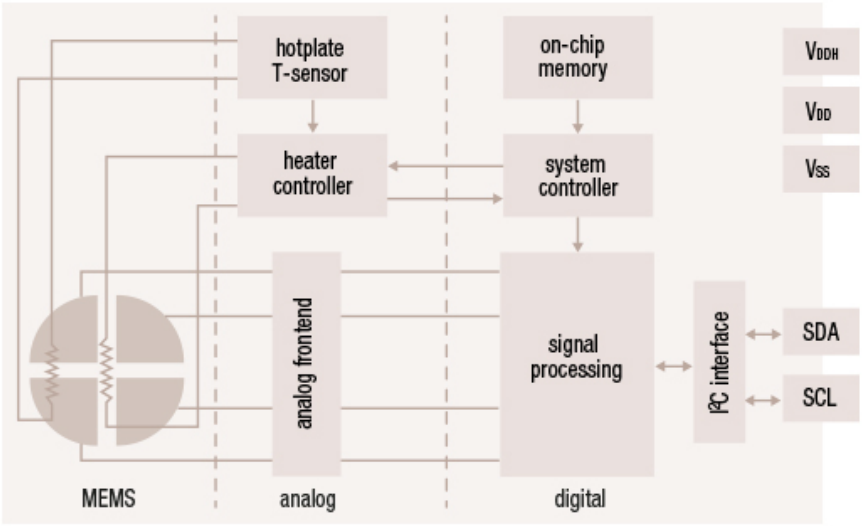
Siloxanes are chemical compounds comprising silicon atoms and oxygen atoms, where an oxygen atom is linked to neighboring silicon atoms. Siloxanes are typically used in cosmetics, deodorants, soaps and detergents. They frequently occur in industry as silicone oils as well as coolants in freeze drying. These compounds do not pose a danger to humans, but siloxanes can damage MOX (metal oxide) sensors as the compounds settle on the sensor element, thus causing a loss of sensitivity as well as an extended response time.

Sensirion made a conscious decision not to launch the product on the market with a reduced operating life, even though the sensor was fundamentally ready for use. Instead, the siloxane problem was to be solved first. “There is no point in putting a product to market knowing full well that its sensitivity will significantly decline,” explains Andrea Orzati. “Sensirion therefore continued its development and solved the problem of siloxanes in the air.” Now Sensirion is able to remove the note in the data sheet that explicitly states that MOX gas sensors are to be kept away from silicones in order to guarantee their functionality and operating life. “I am 100% convinced that this is a revolutionary technology on the market,” states Andrea Orzati.

Four sensor elements on one chip

The final product is the multi-pixel gas sensor SGP, which is the first of its kind on the market according to Andrea Orzati. The SGP combines four sensor elements on one chip, each with different sensor materials, to form one product for capturing the air quality in rooms as part of environmental sensing. On the one hand, this allows several gases to be measured at once; on the other hand, the device is also suitable for measuring individual gases, thus providing an option for compensating disruptive gases using the measurements from the other sensor elements.

The sensor is based on CMOSens Technology from Sensirion that is used in all the company's sensors. Here, both the sensor and the electronics required to process the measured signal are integrated onto a single piece of silicon using a monolithic design. The measured value (for example, the VOC concentration) is then available as a digital sensor output. It is therefore possible to connect the sensor to a microcontroller at very little cost as the digital communication uses I2C communication protocols. The SGP requires a 1.8 V electrical supply. There is also an ultra-low power version available. As Sensirion calibrates each sensor chip during production, the delivered sensors are all fully calibrated.



Functional Block Diagram of the SGP Source: Sensirion

Use in consumer electronics, automotive and smart home applications, among others

Sensirion sees two potential future uses for the sensor. Existing markets should benefit from the new sensors, for example, in automobiles and in smart homes where the end product can offer advantages. At the same time, new markets will appear where MOX gas sensors have so far not been used at all or only to a limited degree. The new long-term stability, which can be attributed to the sensor's resistance against siloxanes, also allows the unit to be used in consumer electronics and mobile devices.

Sensirion AG, Staefa / Zurich, CH
www.sensirion.com

Company and product news

MicroProf TL - thermo unit with fully integrated heating and cooling plate

The MicroProf TL is an optical surface measurement tool for fully automated 3D surface metrology in a variety of applications. PCB design and simulation, 3D-IC, MEMS, stacked wafers and fault analysis are just some of the main applications. With MicroProf TL, the MicroProf series has its latest member. The special feature of the MicroProf TL is the thermo unit with a fully integrated heating and cooling plate. The temperature range extends from 10°C (or -80°C for liquid nitrogen cooling) to 400°C, with fast heating/ cooling rates and uniform temperature distribution over the sample surface.

In addition to the topography measurements, the system can be extended by the microDAC TL, a 2D deformation sensor from Chemnitzer Werkstoffmechanik GmbH. The high-precision camera set-up allows the users to measure global and local deformation fields with an accuracy of up to 50 nm. With the MicroProf TL, it is therefore possible to characterize both lateral and vertical sample deformation under thermal load. This allows the component behaviour to be determined under working conditions and various process steps to be simulated. In combination with the FRT software Acquire Automation XT, the MicroProf TL can execute fully automated temperature profiles. Users can set the target temperatures, temperature ramps and dwell times to be used during the process. Users can also define set points in the heating or cooling process at which the topography and deformation measurements are carried out. MicroProf TL is based entirely on the proven technology of the MicroProf series.

Source: FRT GmbH

FRT GmbH, Email: info@frt-gmbh.com, www.frtmetrology.com

New pressure controller for microfluidics with fastest response and best stability

In April 2017, FLUIGENT has launched Flow EZ, a new pressure controller and successor of MFCS-EZ. Individual modules with an intuitive knob can be plugged together and operated without a PC. The pneumatic technology has been completely redeveloped and patented. The response time is less than a second, allowing near-real-time pressure changes. In terms of stability and gas consumption it is also ahead of current devices in the market. Because of the Flow EZ OLED screen can be adjusted to the reading direction, it can be placed in standing, lying or upside down position. Due to its low weight, compactness and modularity, the Flow EZ can also be used among groups.

Pressure controllers are already in use for experiments with particles or drops, in molecular biology, in cell biology, flow chemistry and rheology. The advantages of a pressure controller over syringe pumps (such as pulseless flow, fast responsiveness, free selectable reservoir size and high precision) have been optimized with the Flow EZ. Biologists and chemists who wants to start with microfluidic droplet experiments benefit from a cost effective solution: the Droplet Kit, which works with any Flow EZ pressure channels and FLOW UNIT models. It is usable for droplets from 20 to 100 µm (with 20µm, 50µm and 100µm markers on the chip) and up to 4000 Hz. Quality monitoring is possible with a QR code. It's important to work with the right equipment and programs to get good results quickly. Otherwise you are busy with implementation and not with the experiment.

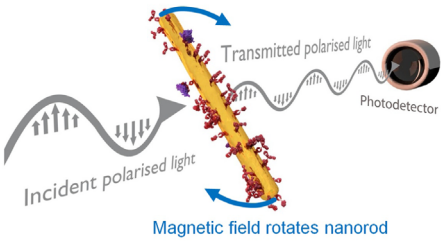
Source: FLUIGENT Deutschland GmbH

FLUIGENT Deutschland GmbH, Email: kontakt@fluigent.de, www.de.fluigent.com

Magnetic nanoprobe-based mix and measure molecular diagnostics for point-of-care applications

In collaboration with international partners within the scope of a European project, the Austrian Institute of Technology (AIT) has recently proven a novel nanotechnological approach to molecular diagnostics. It is based on adding specially designed functionalized magnetic nanorods ('nanoprobes') directly to the sample solution (e.g. serum or saliva) and monitoring their dynamic response to applied time-varying magnetic fields. When target proteins bind to the nanoprobes, this dynamic response is altered due to the increased hydrodynamic volume of the nanoprobes, which allows to directly quantify the concentration of analyte molecules in the sample solution. This simple mix and measure approach allows fast and sensitive monitoring of patient parameters without requiring any further manual user interaction, which makes it ideally suited for point-of-care applications in molecular diagnostics.

The five main innovative features of the technology are: Simple mix and measure technique, no sample preparation, direct measurement of body fluids, fast analysis time as well as easy integration and simple instrumentation. AIT is interested in product development partnerships as well as out-licensing of their patented technology (EP2147314, CN101743475, US9068978).



Detection principle: Analyte molecule binding is determined optically as a change in the nanoprobe rotational dynamics. Illustration by Darragh Crotty, www.darraghcrotty.com

Source: AIT Austrian Institute of Technology GmbH

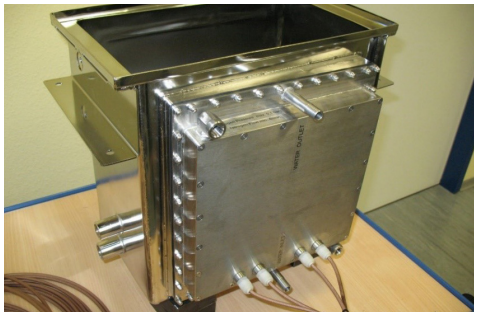
AIT Austrian Institute of Technology GmbH, Center for Health & Bioresources, Molecular Diagnostics
Dr. Joerg Schotter, Email: joerg.schotter@ait.ac.at, www.ait.ac.at

LIGA process enhanced by SONOSYS Megasonic Systems

The LIGA process is based mainly on the three process steps of X-ray lithography, electroforming and molding. The transport of dissolved resist material out of narrow, deep structures, as it is the case in microstructures with high aspect ratios, can be supported by the application of ultrasonic and megasonic powers, respectively. (cf. El-Kholi, Straka (1998), FZK_LIGA_Report, p. 1)

SONOSYS Megasonic Systems with Transducer Plates for Processing Tanks can be supportive for LIGA processes. The Transducer transforms electrical energy into mechanical sound oscillations. This sets the surrounding liquid oscillating. Each oscillation results in alternating phases of positive pressure and vacuum according to whether the Transducer is expanding or contracting. During the contracting phase, which means the vacuum phase, small cavities develop in the liquid due to its restricted tractability. These small cavities collapse during the following expanding of the Transducer, which means the phase of positive pressure. They implode. This phenomenon is called cavitation. High local pressures as well as strong turbulence and fluid flows develop around the cavitation bubbles due to the sudden implosion. These events are the actual criteria which result in the removal of dirt particles from the surface of an object. Cavitation bubbles mainly arise at the interface between the liquid and the object to be cleaned. That is exactly where they are desired. With increasing frequency, the cavitation bubbles become smaller with lower energy and the number of bubbles increase.

SONOSYS Transducer plates are made of Stainless steel and are assembled at the bottom or the side wall of a tank. Transducer plates with PFA-coating are also offered, for example for special applications in the semiconductor industry. The extremely uniform energy transmission ensures a hitherto-unachieved cleaning performance of particles down to the nano range, while at the same time providing the best protection to the microstructures.



SONOSYS transducer plate for processing tanks

Source: SONOSYS GmbH

Sonosys Ultraschallsysteme GmbH , Email: info@sonosys.de, www.sonosys.de

12th COMPAMED Spring Convention: Innovative manufacturing processes of modern implants

The 12th COMPAMED Spring Convention on May 3 in Frankfurt focused on biocompatibility of implants and gave new perspectives in medical technology. 45 selected international participants used the conference not only as an opportunity to get an outlook on this year's COMPAMED, but also to meet again and develop business contacts. The four sessions of the conference concerning the topics "Technologies for the Production of Implants", "Packaging for Implants", "Materials for Medical Implants", and "Microtechnology in Medical Applications" especially focused on biocompatibility. The talks were about coating processes such as Parylene coating, which is able to make any material biocompatible. SCS took up the topic manufacturing processes and advantages of Parylene while Comelec showed further development through combination in multilayer systems with other materials. In the field of electronic packaging, biocompatibility is generated by packaging critical components in casing (e.g. made of glass). The Fraunhofer IFAM also shed light on the opposite: bio-resorption instead of biocompatibility. In this process, materials of implants are supposed to dissolve in the body in the course of time. In its 12th year, the COMPAMED Spring Convention was attended by interested experts, speakers and journalists from Austria, France, Germany, Italy, Spain, Sweden, Switzerland and the USA.

Source: IVAM Microtechnology Network

IVAM Microtechnology Network, Inga Goltermann, Email: go@ivam.de, www.ivam.com

IVAM trade shows and events

IVAM Focus Group Marketing
June 20, 2018, Berlin, DE
12th meeting of the IVAM Focus Group Marketing
www.ivam.de

MSTextiles Forum 2018
June 21, 2018, Berlin, DE
Conference on "Energy for Wearables"
www.ivam.de

IVAM HANDS ON - Predictive Maintenance
July 3, 2018, Dortmund, DE
German Conference on "Predictive Maintenance"
www.ivam.de

IVAM Focus Group Innovation
July 4, 2018, Dortmund, DE
5th meeting of the IVAM Focus Group Innovation
www.ivam.de

Medical Manufacturing Asia 2018
August 29-31, 2018, Singapore, SG
Conference and exhibition on "Manufacturing processes for medical technology". IVAM organizes a joint pavilion
www.ivam.de

'Unternehmertreffen Medizintechnik NRW - JAPAN'
September 26, 2018
"Wearables in Medical Technology"
A German Workshop by NRW.International GmbH
www.ivam.de

IVAM Focus Group Marketing
September 27, 2018, Dortmund, DE
13th meeting of the IVAM Focus Group Marketing
www.ivam.de

COMPAMED
November 12-15, 2018, Dusseldorf, DE
International leading trade fair for suppliers of medical manufacturing. IVAM will present the Product Market "High-tech for Medical Devices" as well as the "COMPAMED HIGH-TECH FORUM".
www.ivam.de

nano tech 2019
February 14-16, 2018, Tokyo, JP
International Nanotechnology Exhibition and Conference
IVAM organizes a joint pavilion
www.ivam.de

MD&M West 2019
February 5-7, 2019, Anaheim CA, USA
IVAM organizes a joint pavilion at the focus area MicroNanotech
www.ivam.de

W3 Fair+Convention
February 25-26, 2019, Wetzlar, DE
Networking fair for the optics, electronics and mechanics sectors
IVAM organizes a joint pavilion and trade fair forum at the special exhibition area "Microtechnologies for Optical Devices"
www.ivam.de

CMEF 2019
May 14-17, 2019, Shanghai, CN
IVAM organizes a joint pavilion
www.ivam.de

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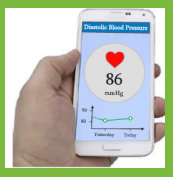

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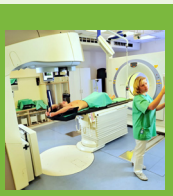
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