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inno · Innovative Technologies - New Applications

| Focus: Medical Solutions |

MEMS-based Gas Analysis for Future Medical Diagnostics

Dr. Alexander Graf
Dr. Jessy Schönfelder
Dr. Michael Scholles

The fast diagnosis of diseases has become of major interest during the last years. The COVID-19 pandemic as well as the detection of antibiotic-resistant bacteria illustrates that there is urgent need for portable devices that allow point-of-care diagnostics. The Fraunhofer Center MEOS is working on a solution by combining different approaches with a strong focus on interdisciplinary collaboration.

A special focus for point-of-care (POC) devices is the analysis of gaseous components. It is known that diseases change the metabolism in the human body. This has an impact on the composition of e.g. urine and breath. Common marker substances belong to the group of volatile organic compounds (VOC). The major key to enter this attractive POC device market is (1) the reliable and highly accurate detection of individual VOCs, and (2) linking the measured data to diseases to enable reliable diagnosis. One envisioned use would be compact and cost-effective systems within doctors' offices or nursing facilities that enable quick and easy diagnostics.

Microsystems for biomedical applications

A range of interdisciplinary competencies is required for the associated development. This starts with the development of a method for the actual diagnostics derived from the medical requirements and includes, for example, a precise definition of sampling for test reproducibility. The technical and commercial requirements for POC diagnostics can usually only be met by using microsystems for core functions such as the high-precision detection of VOCs in very small concentrations, which are manufactured as silicon components using established processes in the semiconductor industry. On the one hand, this is the only way to realize enhanced diagnostic functionalities within a small size. On the other hand, by scaling the manufacturing costs for large quantities, microsystems become an attractive choice for the use of POC diagnostics.

Miniaturized ion mobility spectrometry for VOC detection

The sensor is one challenging component for future devices for medical diagnostics. The combination of gas chromatography and mass spectrometry (GC-MS) is one of several established methods. The advantage of this laboratory method is the possibility to react to changing parameters like humidity and other interfering substances. However, the necessary sample collection and transfer to the laboratory has an impact on the sample itself. It is time-consuming and requires expensive analytics. This limits the use of common laboratory methods like GC-MS for broad POC applications. The use of portable sensor concepts like ion mobility spectrometry (IMS) overcomes these limitations. However, it requires a very comprehensive study for each application scenario, like the diagnosis of one

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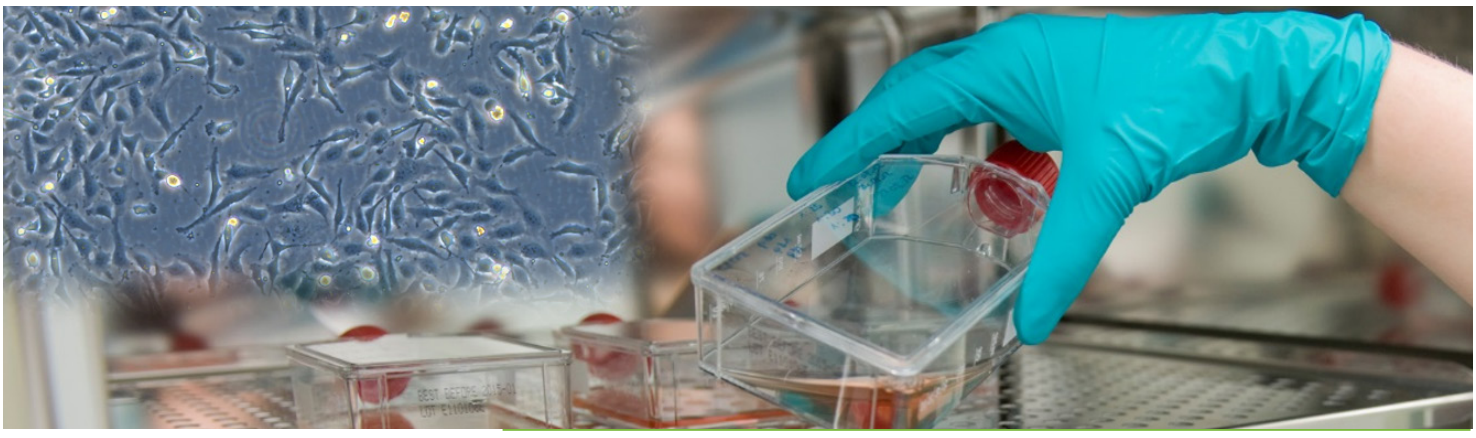

Basic studies on cell cultures on the emitted VOC profile are performed. Source: Fraunhofer IZI

Editorial

Focus: Medical Solutions

International trade shows are picking up steam again and are finally back in full force this year. After the restrictions of the last few years, the anticipation of the exhibiting companies and institutes is enormous, e.g. with a view to COMPAMED/ MEDICA in Düsseldorf next week. Numerous innovations in the field of medical technology have been massively advanced in the last pandemic years and are now waiting to be presented to the international trade audience.

This issue of »inno« is about, for example highly variable laser-based tomographic imaging to investigate biological, technical and hybrid specimen on the mesoscale. Photonics innovations for medical application is another interesting topic. You will also get an insight into highly precise manufacturing methods like micro molding, rapid microfluidic fabrication or the manufacturing of paper-based electrochemical biosensors. Our topics range from medical wire, long printed circuit cables, active implants and components, antifouling coatings and a tool for innovating vascular access to MEMS-based gas analysis or microfluidic solutions. I hope you enjoy reading this issue.

Best regards

Mona Okroy-Hellweg

Impressum

»inno«
Innovative Technologies – New Applications

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Breath gas has a unique footprint of volatile organic compounds (VOC) that correspondents with the health condition.
Source: JRP-Studio – stock.adobe.com

particular disease with specific biomarkers. Another fundamental requirement is the manufacturing process. A special type of IMS is differential ion mobility spectrometry (DMS) or field asymmetric ion mobility spectrometry (FAIMS). This kind of IMS is very well suited for miniaturization and the use of microtechnology processes. Fraunhofer IPMS follows this concept and has developed a microsystem based on it. The core component is an IMS chip that involves a FAIMS-based ion filter and detector and is manufactured by use of silicon-based microtechnology. In combination with the required electronics, this has resulted in a laboratory demonstrator that is able to detect typical VOCs.

Accessing new applications

There have been numerous studies aimed at detecting diseases based on the exhaled or excreted VOC profile, such as various cancers, inflammation as well as liver, respiratory, and neurological diseases. However, an important unmet need is the standardization of the methods. Moreover, there are also patient-to-patient variations as well as confounders originating from diet, age and medication. On the other hand, a major advantage is that the samples are obtained non-invasively from exhaled breath, the headspace above urine, feces or skin swabs. Recently, in April 2022, the FDA authorized the first COVID-19 diagnostic test using breath samples with a portable GC-MS device. This demonstrates the high potential also for other future VOC-based methods for non-invasive and fast screening tests, and is one competence of Fraunhofer IZI.

Outlook for new medical solutions

Chip-based IMS development and method expertise converge at the Fraunhofer Center MEOS. The available basis of IMS chip and application reference represents a promising opportunity for new medical solutions that can be developed together with customers.

Fraunhofer Institute for Photonic Microsystems IPMS, Dresden, Germany
https://www.ipms.fraunhofer.de

Functional demonstrator with integrated IMS Chip and additional components. Source: Fraunhofer IPMS

Innovating Vascular Access

Dr. Jens Ebnet

Ebnet Medical GmbH from Schwerin, Germany, develops devices for vascular access. The founder is still an active emergency physician. An innovative Peripheral Intravenous Catheter (PIVC) is designed for future reduction of frequent, severe and costly complications.

Peripheral Intravenous Catheter (PIVC) insertion to get access to the vascular system is a critical step in life-saving infusion therapy. PIVC application is one of the most common invasive procedures in medicine with PIVCs being sold billion times per year worldwide. Despite highest standards in modern medicine, conventional PIVCs often cause pain and fear with PIVC failure and complication rates being high. Children and vulnerable patients are particularly affected and technical innovation is urgently needed. Ebnet Medical aims at improving the vascular access care continuum by several need driven product developments. The founder, a specialist in anesthesiology, intensive care and emergency medicine, is still an active emergency physician.

Future reduction of complications

The innovative tool is designed for future reduction of frequent, severe and costly complications. It can be easily integrated in existent workflows. Improved PIVC control and more precise insertion into the vein by only one hand will increase first puncture success rates. Ultrasound guidance can be continuously applied by the other hand. In contrast to product solutions currently marketed or under development, a guide wire will not be necessary to create superior performance and hence clinical value. Simplicity and safety in vascular access are key paradigms of Ebnet Medical when finalizing product development. The aim is to develop medical products without increasing technical or product complexity. Application and material costs as well as waste will be reduced to a minimum. Supply chains will be kept short. Ebnet Medical systematically addresses relevant milestones to decrease development and investment risks.

A positive correlation between Ebnet PIVC and beneficial outcomes has to be proven in studies. Evidence generation for a superior functionality and performance was initiated even at an early stage. A new PIVC prototype series (Minimum Viable Products) was evaluated in suitable test environments (not in patients) by clinical experts at a renowned German University Hospital. In a first step, the innovative functionality was confirmed. The product will also address catheter tube kinking and blockage. In daily medical routine, kinking of catheter tubes and infusion lines leading to costly complications and reduced period of use still occurs quite frequently.

Kinking: dangerous for patients

Kinking can be dangerous for patients, e.g. when the flow of an anesthetic/sedating agent (e.g. during surgery) or of a life-saving therapeutic (e.g. chemotherapeutic) is interrupted during the medical procedure. Kinking catheter tubes and infusion lines should not be accepted. A new technology under development by Ebnet Medical offers improved solutions for a non-kinking design of catheter tubes and infusion lines. Successful first tests of non-kinking catheter tube prototypes were already run. Positive feedback from clinical experts was obtained. The aim is to ensure catheter tube patency to increase PIVC lifespan and cost-effectiveness significantly. The new technology is suitable for all types and diameters of catheter tubes and infusion lines. It is, beside a core patent application, extensively secured by other Ebnet Medical patent applications. The company also filed patent applications for PIVC components to make fixation of PIVC to the skin faster and more reliable. Catheter dislodgement is a major concern for patients and medical experts.

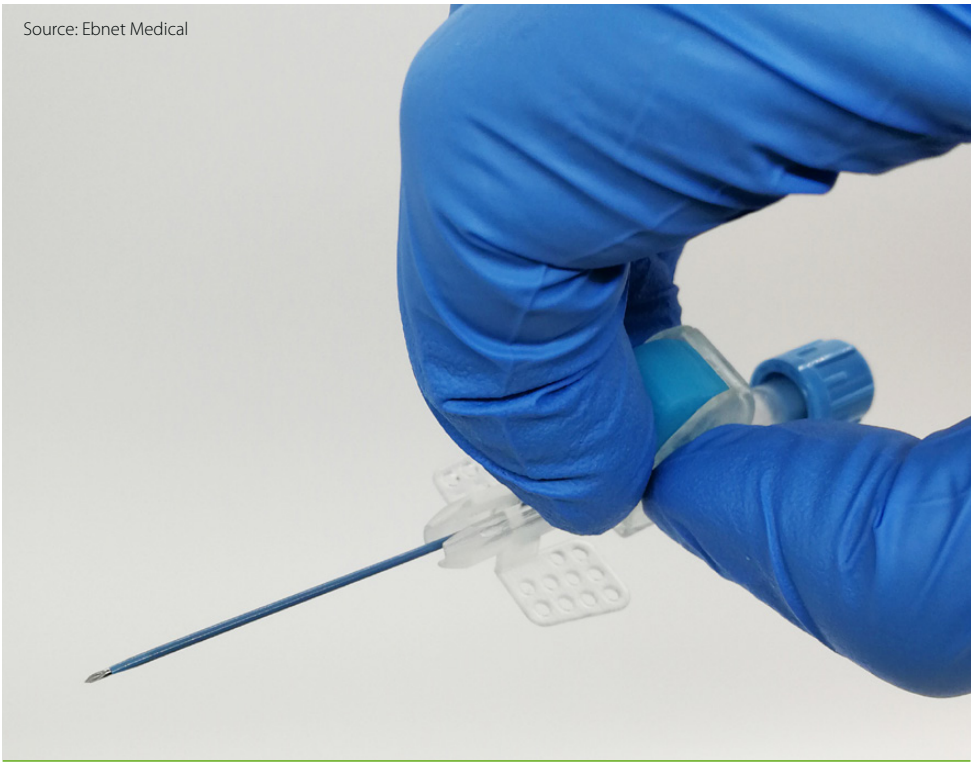
The Ebnet PIVC is therefore designed to overcome most relevant weaknesses of conventional PIVCs in the future.

Journey to platform technology

Due to its need and value driven business approach, Ebnet Medical has a deep understanding of links between medical practice and technical innovation and offers practical solutions. Feedback from clinical experts is continuously obtained. Further feedback is highly appreciated and can be directly considered for product development.

Its extensive and constantly growing international patent portfolio allows Ebnet Medical to create a competitive advantage in vascular access innovation. Safety in vascular access leading to excellent patient care is Ebnet Medical's top concern. Certification pathways and timelines for EU and US are evaluated simultaneously with the aim to shorten time to market introduction. Modifications and follow-on products will lead to a disruptive and scalable platform technology for various catheter types in human and veterinary medicine.

Ebnet Medical GmbH, Schwerin, Germany
https://ebnetmedical.com



Source: Ebnet Medical

Micro Molding Stimulates Innovation in Medtech

Aaron Johnson

Micro molding when undertaken by an experienced specialist can create amazingly innovative parts. However, there is a vast difference between a micro molder that can make one perfectly formed innovative micro molded part, and one that has the scalability and sustainability to ramp up production volumes to the multi-millions over a protracted period of time.

Micro molding is today the solution used by many medical device OEMs to achieve their exacting manufacturing requirements, as it can produce tiny, complex, and feature rich components, efficiently, cost-effectively, and in volume. The correct use of micro molding technologies is today what gives successful medical device OEMs competitive advantage, and drives product innovation and profitability. Micro molding can provide high quality parts with high dimensional accuracy that are crucial for sensitive medical applications such as specialist devices for cancer treatment and diagnosis, small molded catheter tips, micro-needles, small surgical instruments, dental implants and infection control devices, and staples, to name but a few. Advances in material development – with the introduction of high-performance polymers that have enhanced strength characteristics, toughness, thermal properties, and chemical resistance – mean that numerous medical device OEMs are looking to micro molding.

Micro molding enables ground-breaking medical devices.

It is the case that throughout history, medical advances have been made due to technological innovation, and micro molding can be seen as the latest technological innovation that enables the design, manufacture, and clinical use of ground-breaking medical devices. Not only does the technology allow for the manufacture of complex micro parts, but manufacturing in plastic in many cases reduces part cost, reduces weight (a key consideration for the medical sector), and allows for functioning products to be made using fewer overall components, which in turn reduces assembly time and cost. For the medical device industry that lives with cost pressures and a demand to reduce product development times, any technology or manufacturing solution / process that allows for the attainment of product functionality while reducing costs is to be welcomed. It is here that micro molding finds its sweet spot. The use of such cost-effective and sophisticated technologies will help to mitigate the pressures on the profitability of medical device OEMs.

Micro molding in the medical device sector, however, is often not straightforward. In the area of material usage, for example, micro medical devices often require the integration of different materials, such as thermoplastics, biocompatible metals, and silicones. Micro manufacturing solutions often lean towards the use of complex secondary assemblies and overmolding techniques, all of which require an innate understanding of the processes – especially a knowledge of the bonding and compatibility of different materials – and the use of state-of-the-art manufacturing technologies.

Faster time-to-market and lower cost products

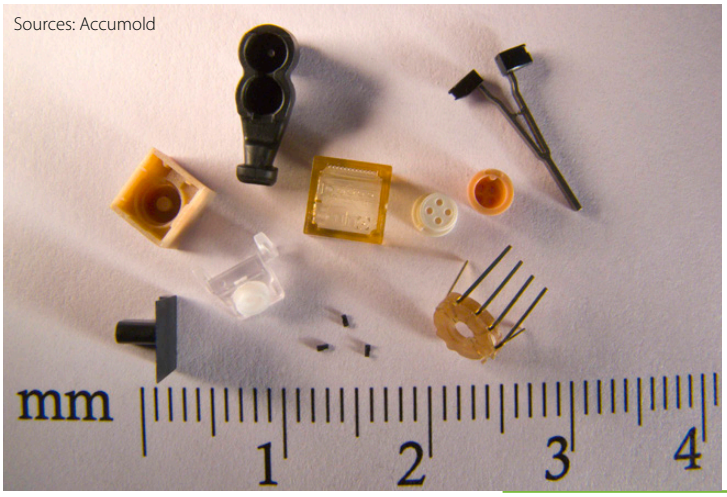
For any medical device OEM seeking to work with such exacting technologies and procedures, it is vital that they locate and work with experienced micro molders that are aware of, work with, and are experienced in trouble-shooting the implications of tool design, material choice, and the numerous processing complexities that exist in the area of micro molding. Key to success is that medical device OEMs view their chosen micro molder as a product development collaborator. Micro medical plastic product manufacture requires that the relationship between OEM and micro molding specialist is a true partnership, but often run differently from a traditional OEM/supplier relationship. In micro manufacturing, most of the mission critical issues occur at the design and prototyping stage of product development. This can and often does include material choice and even packaging considerations. A true partnership will ensure faster time-to-market with more efficient and lower cost products.

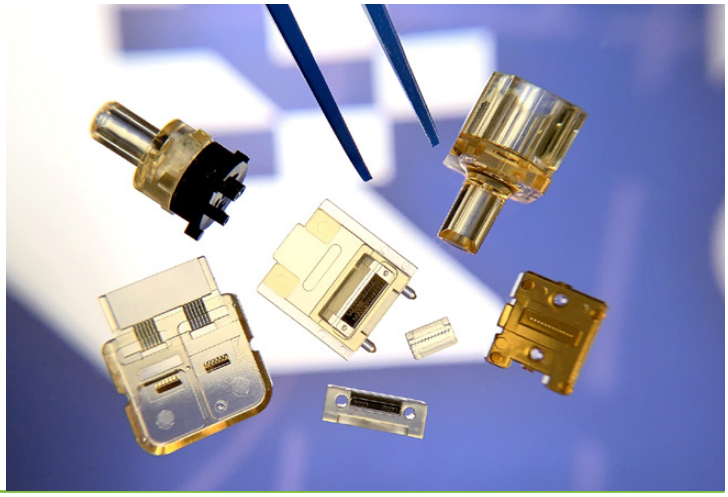
Regulatory environment is gaining importance

The regulatory environment is also one that is becoming more and more important for medical device OEMs, and ensuring a partnership with a micro molder that has an understanding of this environment is disproportionately important. Much of the focus today is on constantly evolving approval processes. Engaging a micro molder with an innate understanding of the vagaries of international the approval process will save enormous amounts of time and money.

Accumold, Ankeny IA, United States
https://www.accu-mold.com

Sources: Accumold



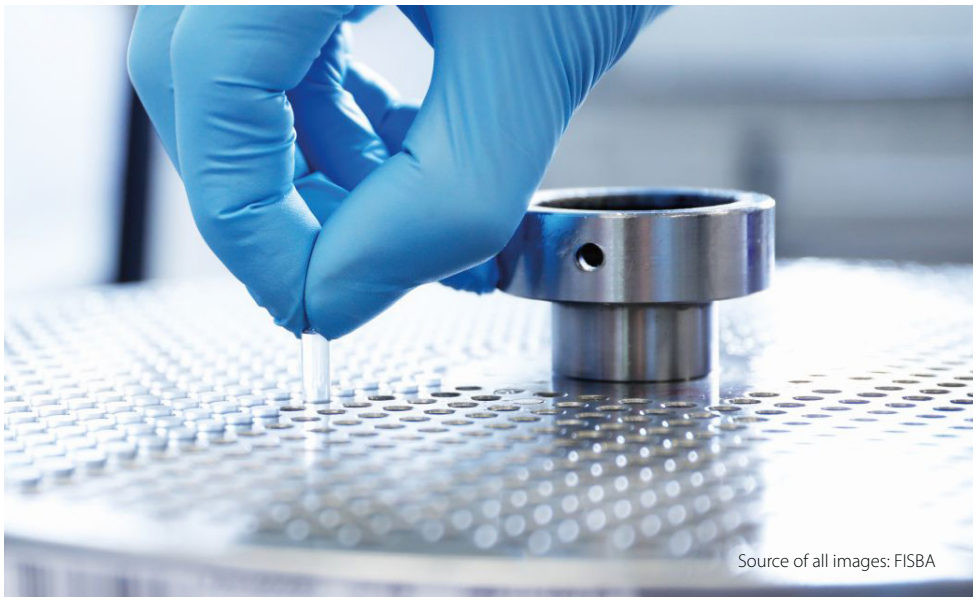


MedTech Imaging Solutions need Photonics Innovations

Dr. Martin Forrer
Joe Delfino

Established in 1957, the family owned Swiss company FISBA has become a leading global supplier of high precision micro optical components and imaging systems to the medical and industrial markets. FISBA's reputation for quality and performance has grown along with our range of distinctive optical product offerings. FISBA offers clients with custom requirements a development path that extends from R&D and design services to prototype and full production capabilities.

FISBA is a preferred supplier of optical components and systems to the endoscopy market. The need for constant innovation and exceptional imaging performance in endoscopy drives us to excel in the solutions created along every aspect of the development process, from our DFM (Design for manufacturing) philosophy, optical fabrication know-how, test and validation, to product delivery. Our engineers have a profound understanding and experience in the underlying optical technologies and manufacturing processes to bring your product to life.



Source of all images: FISBA

Imaging innovations in endoscopic devices

The endoscopy and robotic surgical markets rely on high precision optical components and complex assemblies to deliver the best possible image for surgeons. Endoscopic procedures require miniaturized optical components which must endure harsh conditions including sterilization processes. We take pride in our operational excellence and our ability to deliver high precision optical components and imaging systems tested to the highest quality standards in this industry.

Miniaturization driving chip on tip micro-optics to sensor assembly

The increase in minimally invasive clinical procedures and desire to improve patient outcomes drives the need for smaller endoscopic devices. Reducing the surgical access diameter for minimally invasive clinical applications creates challenges. Imaging technology continues to respond by developing miniaturized CMOS sensors that require higher precision optics to be assembled as integrated micro-vision chip on tip systems. Applications served by flexible endoscopic devices, may have to integrate 3 functions in parallel, illumination, imaging and working channel; whereas stereo vision in robotic surgery is generally separated from the other functions with different access tools.

Compact stereo-vision optics and designs tested to MTF performance

High quality stereo vision integrated in endoscopic system with double chip on tip CMOS sensors in robotic surgery is becoming a widely adopted imaging modality. Compact high-quality micro-optics on dual sensor integrations enable the surgeon to experience distance, depth and geometry in the target application, often a key factor for fast orientation in complex organ environments. For best experience and use without eye-fatigue, it is a precondition to qualify the micro-optic systems for the two "eyes" to the highest quality standards, performed with modulation transfer function (MTF) imaging targets. Optimized endoscopic stereo-vision systems designed to be scalable, reliable, and meeting the demanding requirements for robotic surgery applications are key to this growth market.

Compact angled viewing with micro-prisms

Angled viewing is a long-standing function for optimized endoscopic imaging, especially when coupled with rigid endoscopes, allowing the surgeon to capture more visual information on the clinical application. FISBA provides key enabling imaging technology - coated micro-prism systems in combination with additional imaging optics and optimized mirror coatings

- to achieve angled endoscopic viewing system designs. A main driver for efficiency is the miniaturized size of the micro-prism systems, not exceeding the overall diameter of the imaging optics.

Design and production of miniaturized glass aspheres for distortion control

Imaging with 4K resolution has become the standard in high-end endoscopy. To take full advantage of 4K resolution means reducing distortion for the benefit of equidistant resolution and location identification. Precision molded glass aspheres provide a solution space for optimizing the optical design and minimizing distortion. FISBA designs and produces high-end precision molded aspheres offering repeatable and consistent performance with industrial scalability. A driver for the scalability and precision in glass molding is our in-house knowledge, capacity and expertise in manufacturing the precision tools for molding.

Design and coatings optimized for NIR fluorescence imaging

Clinical endoscopy is being enhanced by fluorescence imaging, for the specific benefit of perfusion imaging and multifocal tumor identification. The design and realization of these dichroic functions has expanded into the near-infrared spectral domain (NIR). FISBA designs and implements micro-optic coatings that enhance the imaging capabilities and allow for greater image contrast. A driver for the effectiveness in fluorescence imaging is the knowledge and expertise on how to spectrally separate the signal amplitudes between visual and fluorescence channel.

Illumination LED solutions over fiber-bundles integrated to the tip

Multispectral endoscopic imaging coupled with software and artificial intelligence modalities give the surgeon a valuable tool in the detection and identification of smaller early stage lesions. Structured illumination provides another layer to advanced endoscopic imaging systems. FISBA has expertise in the design and integration of fiber-optic flexible light bundles, optimized miniature LED illumination systems, and know how to efficiently couple sources to fiber to maximize brightness. Further requirements such as control of tightness and illumination fiber integrity over prolonged use-cycles are drivers for the system performance.

FISBA is a global leader in the design and manufacture of high precision micro optical and opto-mechanical systems for medical endoscopy and robotic surgery. Getting medical imaging devices to market with the right solution has never been more critical. The companies knowledge and long-standing expertise in building custom imaging systems is an advantage for customers

FISBA AG, St. Gallen, Switzerland
https://www.fisba.com/en

Microfluidic Solutions for Medical and Diagnostics

Alicia Thiehoff

Nowadays, there is a great need for highly efficient and accurate diagnostic systems. In order to save both time and money, you can transform passive diagnostic tests into active microfluidic systems. These tests are not only faster than their passive counterparts, but also more accurate and comprehensive.

Building Point-of-Care systems using microfluidics

Particularly exciting for the field of microfluidics is the Point-of-care testing for pathogens such as MRSA or COVID-19. Here, there are various possibilities to perform these tests quickly and thoroughly – without having to send samples to central laboratories. That way, the test is performed closely to where the sample is collected, and the result is needed. This diminishes the need for the expensive and time-intensive shipping of the samples. Point-of-care diagnostic systems are significantly more accurate than a simple rapid antigen test, while being smaller and less expensive than a large laboratory. It is a fully digital system that allows quantitative measurements and thus tracking and monitoring.

For this purpose, Bartels Mikrotechnik has worked together with a client that sells a test system that enables rapid detection of all relevant hospital germs and other pathogens. The portable device is small enough that it can be easily added to pharmacies, hospital wards, medical offices and other places where these tests are needed. In addition, the system can also be quickly and cost-effectively converted to other viruses or germs. Thus, switching between COVID-19 and MRSA is easily feasible.

A major advantage over simple rapid tests is that the viral load can also be determined. Thus, not only is it tested whether antigens are present, but also in what quantity they are present. In addition, antibodies can be tested and thus an unrecognized and survived disease or the immune status can be visualized and quantitatively classified. In the case of, for example, COVID-19 tests, a decision can then be made whether further vaccination is necessary. This allows for thorough Point-of-care testing.

Modular systems to build medical solutions

The COVID-19 pandemic has led to some major changes in the area of Point-of-Care and medical systems. One significant difference is that Point-of-Care systems are now more widely recognized. Since COVID-19 started, almost everyone has learned about different types of Point-of-Care and laboratory testing. This has increased the importance of this topic in society in general. Simultaneously, the need for Point-of-Care devices skyrocketed, and many labs had to expand their resources and testing capabilities. This benefited their suppliers. A common challenge when it comes to building Point-of-Care devices is the degree of flexibility needed. While most systems have a similar general set-up, they still require adjustments for specific tests. Bartels Mikrotechnik's approach to this issue is to offer modular systems. That way, a client can adapt the system to their specific needs and requirements.

Micropumps, which pump minute quantities of gases or liquids, are at the heart of microfluidics. Their services are indispensable in many fields.

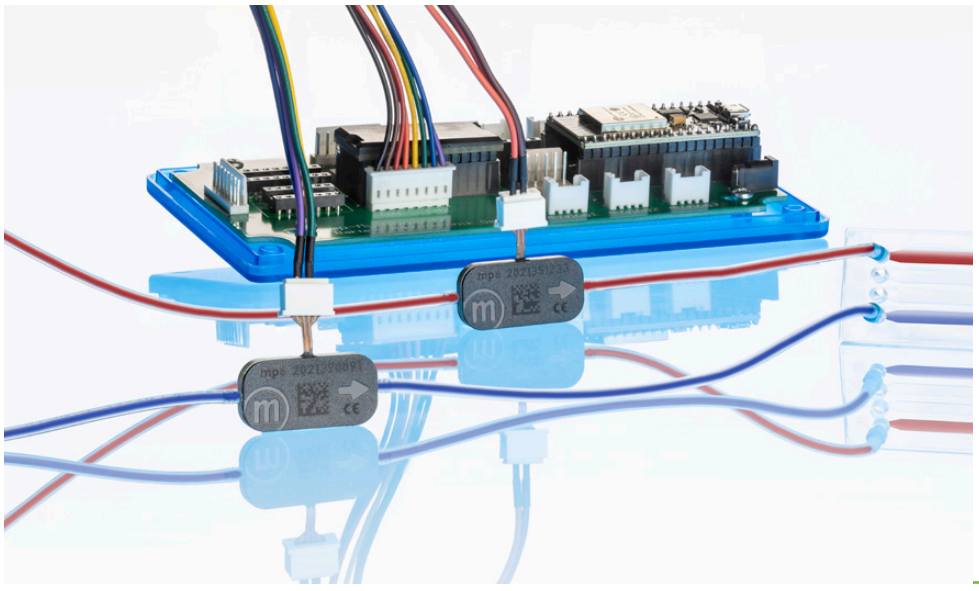
Sources: Bartels Mikrotechnik

In Point-of-Care applications, their main job is to transport the right liquids at the right time to ensure a consistent and accurate test result. In the next step, you add microelectronics that allow for the easy control of the micropumps and any additional components needed. As a result, we now have a rich portfolio of electronic components for microtechnology, from laboratory applications to integration into mobile devices.

About Bartels Mikrotechnik

For more than 25 years now, Bartels Mikrotechnik has been a globally active manufacturer and development service provider in the field of microfluidics and microtechnology. Together with our partners, we help our customers to find the right microfluidic solution for their application. As microfluidic solution maker, Bartels offers a complete, application-oriented and modular liquid handling system. With our evaluation kits and the mpSmart you can test our mp6 micropump directly in your application. We have already prepared everything for you. We also have a large partner network that enables us to offer you high-quality components tested by us to complement your microfluidic system.

Bartels Mikrotechnik GmbH, Dortmund, Germany
https://www.bartels-mikrotechnik.de



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Low-Energy Electron Beam for Antifouling Coatings

Nic Gürtler
Dr. Ulla König

Electron beam technology can be used to reliably treat and functionalize surfaces. Now the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP has succeeded in producing anti-adhesive coatings on plastic film by applying low-energy-accelerated electrons without the use of additional chemical crosslinkers.

Non-sterile surfaces of medical devices or implants can lead to serious infections caused by pathogenic germs or other undesirable microorganisms. Antifouling coatings can prevent their growth and help to optimize implants or medical devices by the functionalization of their surface. An example for application are dental implants in dentistry.

Electron beam technology for surface treatment

Low-energy electron beam technology (Ebeam) is a multifunctional tool with a wide range of applications that can be used specifically to modify surfaces. By using low-energy electron beam technology, surfaces can either be gently disinfected or sterilized, materials can be surface-sensitively hardened by crosslinking processes, or surface properties such as wettability can be effectively modulated. Innovative surface-sensitive functionalization technologies guarantee the preservation of material bulk properties while allowing the surface properties to be customized. The use of low accelerating voltages (< 300 kiloelectron volts, keV) in low-energy, non-thermal electron beam processes guarantees very good material compatibility and sustainable material preservation.

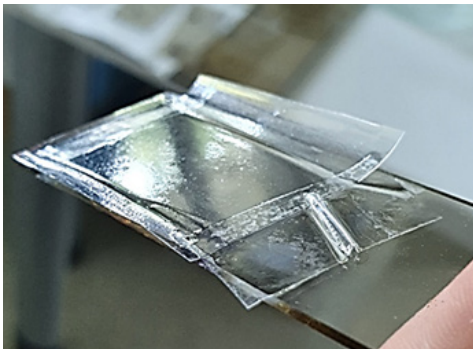
The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP has just recently succeeded in producing anti-adhesive coatings on plastic film by applying low-energy-accelerated electrons without the use of additional chemical crosslinkers.

What this actually means in practical terms?

Nic Gürtler, PhD candidate in the business unit for Medical and Biotechnological Applications at Fraunhofer FEP explains in detail: “Surface functionalization with accelerated electrons is fast and done without environmentally harmful chemistry. Low-energy accelerated electrons allow chemical bonds close to the surface to be restructured, crosslinked, broken or re-formed. When accelerated electrons collide with a surface, different reactive species such as ions and radicals are formed, which is an important part of surface-specific modification processes. The atmospheric environmental conditions during the electron beam process can be individually adapted to the material and thus influence the desired degree of functionalization. Specifically, we were able to achieve a stable, non-toxic hydrogel coating on hydrophobic polyethylene (PE) and polyethylene terephthalate (PET) films.”

Ebeam-Grafting for antifouling coatings

The Ebeam-supported coating process Ebeam-Grafting offers the opportunity to equip materials with selective surface functions so that biocidal, biocompatible or anti-adhesive properties can be achieved, depending on the specific requirement. All process parameters of the non-thermal Ebeam-induced coating process can be individually monitored and modularly adapted. As part of various research projects at Fraunhofer FEP, Ebeam-Grafting has already been successfully established as a two-step coating process



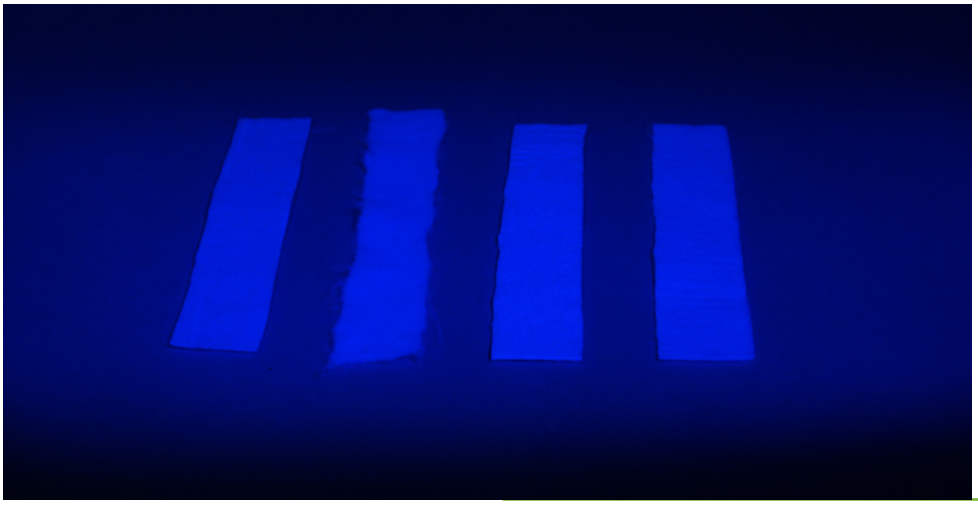
Plastic film with stable anti-adhesive coating, manufactured by the two-stage low-energy ebeam-induced coating process „Ebeam-Grafting“. Source: Fraunhofer FEP

for equipping different hydrophobic plastic surfaces with antifouling attributes. The cell- and protein-repellent surface properties achieved by Ebeam-Grafting can be applied in technical industrial sectors or especially in the field of biomaterial research for the development of new medical devices or implants, where uncontrolled biofilm formation is to be prevented. These Ebeam functionalization processes can, for example, help to optimize dental implants in dentistry.

The low-energy electron beam technology and thus also Ebeam-Grafting is inline capable, i.e. it can be easily integrated into industrial processes in a customer-specific basis. In order to realize, for example, the modification of large flexible material surfaces, such as packaging, the technology can also be implemented in roll-to-roll systems.

Dr. Ulla König, Head of the Business Unit for Medical and Biotechnological Applications, sums up: “One of the core competencies of Fraunhofer FEP is the development of special low-energy electron beam sources and systems for a wide range of applications. The focus of our work is on the technological development of individual customer-specific plant concepts.” This research was carried out as part of the internal Fraunhofer-funded Discover project “SaveLife”.

Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP, Dresden, Germany
https://www.fep.fraunhofer.de



Functionalization of textiles for medical applications with Ebeam-Grafting technology
Source: Fraunhofer FEP

Dr. Cacie McDorman

Medical Wire for Treating and Monitoring of Cardiovascular Disease

Medical wire-based components are essential for cardiovascular therapeutic devices. They play the crucial role of sensing, transmitting, or stimulating signals within the body. These components must be biocompatible, and depending on the application, must offer features such as lubricity, conductivity, or fatigue resistance.

Non-sterile surfaces of medical devices or implants can lead to serious infections caused by pathogenic germs or other undesirable microorganisms. Antifouling coatings can prevent their growth and help to optimize implants or medical devices by the functionalization of their surface. An example for application are dental implants in dentistry.

Working with Alleima

Medical device manufacturers must choose the appropriate wire configuration for their devices, from size to coating to multi-wire configurations such as stranding and coiling, to optimize efficiency and reliability of their device. One of the advantages of a creative partnership with Alleima, formerly Sandvik Materials Technology, is working with its teams of experts throughout the various stages of customized precision wire manufacturing. At the company's Business Unit Medical a team of engineers specialized in all stages of manufacturing medical wire, from choosing a proper metal melt to value added additions and packaging, work with customers to ensure that the medical wire components needed are perfectly customized to the application. Alleima has over 160 years of experience in developing advanced materials for the most advanced industries. In the medical field, Alleima works with more than 200 alloys and specializes in choosing the best materials and configurations. In 2016 the Exera brand was introduced for medical wire and wire-based components to differentiate them from the large Alleima product portfolio. Exera wire-based components are used in a variety of applications from continuous glucose monitoring to neurostimulation to cochlear implants, catheters, guidewires, and heart failure monitoring.

Cardiac Catheters

Offered as an alternative to drug-based therapy, catheter ablation is used to treat arrhythmias, especially when the condition interferes with the patient's quality of life. The treatment process involves passing catheters through the blood vessels to the heart where the heart's electrical activity is recorded, and the location of the arrhythmia is determined. This affected area is then cauterized using radio frequency or cryoablation, which keeps this area of the heart from conducting electricity. This procedure is used to treat conditions such as supraventricular tachycardia (SVT). Medical wire for ablation leads used in treating such conditions must meet some extremely strict requirements, such as flexibility and responsiveness for precise manipulation in the body, as well as adequate lubricity to prevent trauma to contacting tissue. In addition to these requirements, many OEMs want to incorporate additional features or combine multiple wires into their devices. Medical devices for the treatment of cardiovascular disorders have advanced, but the industry is constantly under pressure to provide effective, affordable devices. In the US alone, approximately 950,000 people die from cardiovascular diseases each year, with cardiovascular disease accounting for more than half of all deaths in women. To keep up with escalating demands, OEMs are trying to combine more features, such as remote monitoring capability or multiple wire-based components, into the same product footprint. Such examples are catheters produced by Alleima, which can not only place a stent, but also simultaneously sense blood flow or cauterize an area.

Heart Failure

Alleima has also produced medical wire-based components used for monitoring heart failure. According to the CDC, approximately 6.2 million adults in the US have heart failure. These components are composites of several wires to realize all features while maintaining a compact footprint. Implantable heart monitoring devices can detect changes in pulmonary artery pressure or fluid volume to allow for earlier intervention and management by physicians. These devices are comprised of a composite medical wire that is capable of both sensing and transmitting signals. This capability also allows for remote monitoring by doctors, who can adjust medication doses in response to readings. Patients with these devices are less likely to require hospitalization, which encourages further development of less invasive and more effective solutions. By working with a team of medical wire experts, development times can be reduced, and correct device designs can be implemented from the onset. Our engineers work closely with customers, allowing for the proper configurations to be used to increase cyclical fatigue or prevent shorts within multi-wire components. Choosing the correct coating, stranding pattern, or metal for such applications can prevent OEMs from requiring multiple device iterations and multiple in vivo trials prior to FDA or EMA approval.

Alleima - Business Unit Medical,
Palm Coast, United States
https://www.alleima.com/wire

Sources:
Alleima

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IVAM. www.ivam.com

Manufacturing Paper-Based Electrochemical Biosensors

Dr. Rainer Hainberger
Dr. Giorgio C. Mutinati

The H2020 IMPETUS project paves the way towards the real-world application of paper-based quantitative electrochemical diagnostic test cards, thereby clearly advancing the current state-of-the-art, which up to now has mostly focused on individual fabrication processes and device concepts.

There is an increasing demand in medical diagnostics for inexpensive, fast, easy-to-use and quantitative systems for detection of molecular biomarkers. These systems are intended to close the gap between the currently available non-quantitative tests (e.g. simple color test strips) and complex analyses in special laboratories. The Horizon 2020 IMPETUS project www.project-impetus.com combines paper, printing and microchip technologies to realize a pilot line in an industrial environment capable of manufacturing fully integrated paper-based electrochemical biosensors that directly transfer the measured data to the user's smartphone. These biosensors are designed as self-powered disposable test cards (standard credit card size) that combine the simplicity of lateral flow tests with quantitative readout, which is enabled by the implemented electrochemical detection method. As an application example, IMPETUS will fulfil the consumer need for fast and inexpensive point-of-care discrimination between bacterial and viral infections. In fact, infectious diseases are amongst the prime challenges to the global healthcare system, and acute febrile illness is the most common reason for seeking medical care in any region of the world. Since a suitable primary care tool to determine the source of an infection is not available to date, broad-spectrum antibiotics are often prescribed as a precaution, even though these are not effective in treating viral infections.

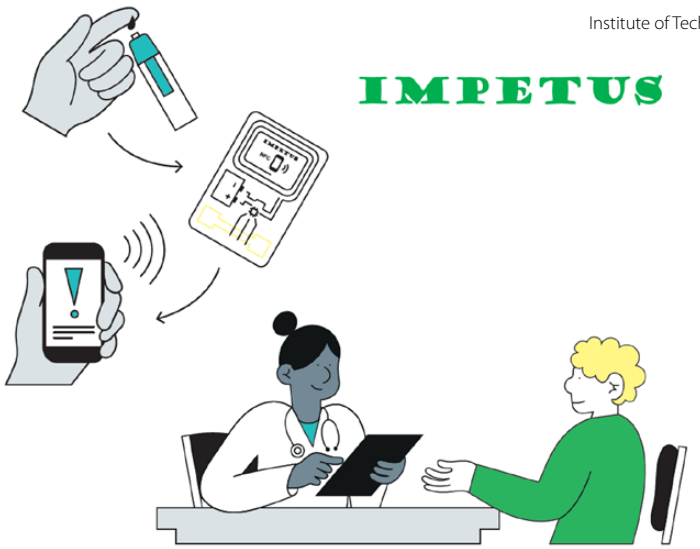
The IMPETUS approach

The IMPETUS goals are achieved by developing new technologies for paper manufacturing, coating and surface modification, and the respective processing is working hand in hand with the ink development (cellulose-based inks for fabricating the printed battery as well as bio-inks for surface functionalization and reagent deposition). A highly integrated and energy efficient silicon microchip is developed that enables electrochemical signal acquisition, storage and contactless NFC transmission. The microchip is mounted onto the paper substrate by an inline placement process. Paper is employed as substrate for the printed circuits and the microchip, but also as an active component of the printed battery as well as of the biosensor.

Source:
Technische
Universität Chemnitz

The IMPETUS pilot line is based on a series printing machine (roll-to-roll, roll-to-cutsheet), which is designed for the production of mass products. The machine is located in the production facility of the company tagtron gmbh in Austria. Within the framework of the IMPETUS project, this printing machine was upgraded for the specific research requirements with the following units for an inline production process: screen printing unit, flexographic printing unit, inkjet module unit, chip mounting unit and the necessary drying units (IR, HFD, UV). As result, the pilot line offers the possibility to be easily adapted for various sensing applications (e.g. medical diagnostics, food safety) accessible to interested third parties after the project end.

Source:
AIT Austrian
Institute of Technology Gmbh



The partners of the IMPETUS project

IMPETUS is a collaborative project, which has received funding from the European Union's Horizon 2020 research and innovation program (topic H2020-PILOTS-05-2017 Paper-based electronics) under grant agreement No. 761167 and is coordinated by Dr. Rainer Hainberger of the AIT Austrian Institute of Technology GmbH. The project has been launched in January 2018 and brings together fourteen leading partners with a strong focus on industrialization: four research institutes (AIT Austrian Institute of Technology GmbH, Silicon Austria Labs GmbH, Papiertechnische Stiftung, Technische Universität Chemnitz), five small-medium (Maurer Services GmbH, Maurer Engineering UG, Pro-Active sprl, Saralon GmbH, tagtron GmbH) and five large enterprises (Felix Schoeller Holding GmbH & Co KG, Infineon Technologies Austria AG, R-Biopharm AG, Ricoh UK Products Ltd, Sun Chemical Ltd).

AIT Austrian Institute of Technology GmbH,
Vienna, Austria
https://www.ait.ac.at

Learning About Cells Using Microfluidic Devices

Kasper Moth-Poulsen

The medical industry is seeing a transition from central labs to distributed laboratories to self-monitoring devices. Examples of extremely powerful self-test devices are pregnancy tests and covid test systems. For other conditions, such as cancer detection, more complex testing devices are needed, since the state of individual cells need to be monitored. For this purpose, lab-on-a-chip systems are being developed – allowing for the study of cell colonies and high resolution multivariable tracking of growth within the colony.

A widely used concept in this regard is the "mother machine" device, originally developed prof. Suckjoon Jun at Harvard and today used by many research groups, as well as a growing number of industrial actors. Mother machine devices are typically fabricated from a micro or nanofabricated master, that are replicated using PDMS resin technology to form microfluidic devices. The process involves 4 primary steps (outlined in Fig. 1). Step one involves patterning alignment marks on a Si substrate. Step two involves printing the base layer (typically from SU-8). Step three involves building growth channels and step four involves building the primary trench channel.

An important performance parameter for the final devices is the precision in size of the fabricated channels, since this will be determining rates of diffusion of nutrients and proliferation rates of the cells that are to be studied.

Micro and nano fabrication

At ConScience, we are experts in micro and nano fabrication, and we have developed ways to produce advanced multilayer devices with very high precision in the alignment of the different layers. This is particularly relevant for production of high precision mother-machine devices (Fig. 2). ConScience offer custom-designed systems to study fluids under sub-micrometer confinement for biological research and fundamental polymer science. Based on our own work in the field of nano-fluidics, our systems have been developed in close collaboration with our customers, aiming at maximizing comfort and flexibility for nano-fluidic experiments. The system comprises framed nano-fluidic chips, chip holders, and a pressurizing unit that can be assembled easily. Our nano-fluidic chips (Fig. 2 inset) are custom-designed and made of PDMS or glass, fused silica and glass-silicon composite materials with a high degree of biocompatibility and high resistance to difficult environmental conditions (e.g. aggressive chemicals and/or high temperatures).

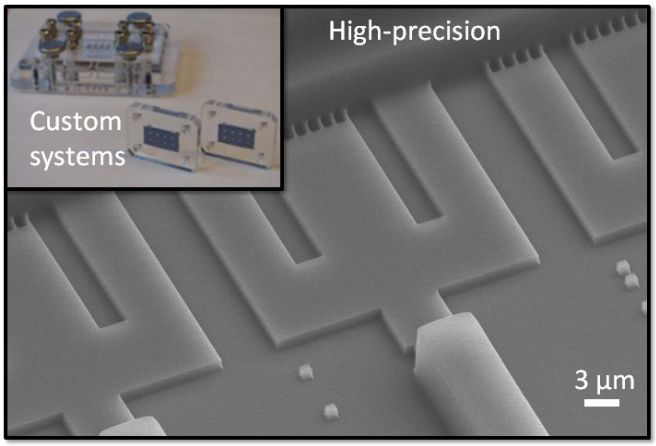


Fig. 2: High-precision microfluidic molds and custom systems. Source: ConScience

Importance of High E-beam Precision

Mother machine devices has become the state-of-the-art in the field of microbial single-cell analysis , offering unrivaled spatial and temporal resolution. One major advantage of the technique lays in the versatility of the mother machines, making them suitable for the cultivation of a variety of organisms under controllable environmental conditions. However, each application poses specific requirements for the design of the device, of which the channel geometry is the most important factor. Hence, a high precision of the channels is vital to ensure that a given organism with specific morphology fits well in the mother machine channels. Only a proper adjustment of the channel geometry to the cell size can guarantee unimpaired cell growth and the generation of high-quality imaging data as a result of well-separated and aligned cell elongation. For example, If the channels are too wide, the cells will tilt and block the channels. In contrast, If the channels are too narrow, the cells are going to be squeezed, resulting in not well separated cell growth and difficult data processing, and, possibly, mechanical stress on the cells. Hence, a sub-micron resolution is crucial for optimally functioning mother machine devices. Furthermore, advanced mother machine devices feature constrictions with widths of typically 300 nm at the beginning of the mother machine channels to facilitate cell loading and to improve media supply. The achievement of this critical feature size lays beyond the possibilities of photolithography and requires a more precise fabrication technique, such as electron-beam lithography.

ConScience AB, Mölndal, Sweden
https://www.con-science.se

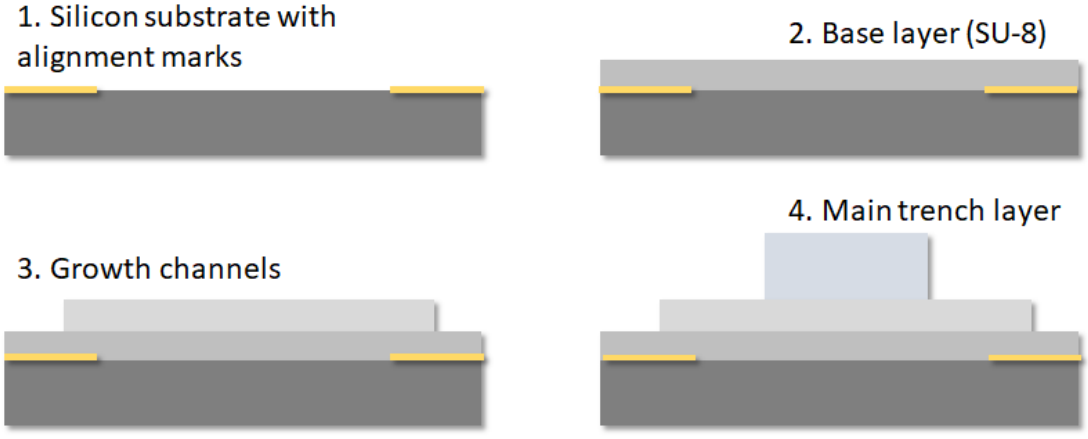


Fig. 1: Mother Machine basic fabrication concept and process.

Source: ConScience

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IVAM.
www.ivam.com

Hannes Benecke
Dr. Sonja Johannsmeier
Dr. Tammo Ripken

Highly Variable Laser-Based Tomographic Imaging

Since the discovery of X-rays in 1895, the use of non-destructive imaging techniques has expanded considerably. Laser Zentrum Hannover e.V. (LZH) has developed a scanning laser-based tomograph to investigate biological, technical and hybrid specimen on the mesoscale. The highly flexible technique can provide new insights in many fields of research.

Microscopic imaging has always been of high interest in the field of industrial and biomedical research. Non-destructive techniques in particular offer great benefits for researchers. One of these techniques is tomographic imaging, where an object is sliced into virtual sections without the need for physical cutting. Well-known examples of this method are medical ultrasonography or X-ray tomography. A similar approach is used at the LZH, using light instead of X-rays: The Scanning Laser Optical Tomograph (SLOT) is a laser-based device that acquires tomographic data from samples of up to a few centimeters in size.

Quality control of implants and the imaging of 3D cell clusters

In SLOT, a laser beam is scanned across a sample, followed by the measurement of the remaining intensity of the incident laser light. This results in a two-dimensional image of the sample absorption. Acquiring many of these absorption images in combination with a full rotation of the sample results in a complete dataset, which can then be reconstructed to provide a three-dimensional representation of the sample. Additional contrast channels can be used simultaneously. Fluorescence is most frequently used for biological samples, as it allows researchers to distinguish between stained cell types or tissue sections. Being highly customizable, SLOT has shown great potential in scientific research. The non-destructive technique is of particular interest for quality control of technical, biological, or hybrid samples. These can include cellular constructs as well as implants. For example, inserting delicate cochlea implants into the inner ear requires considerable surgical skill and extensive training. Investigations of the implant site allow the researchers to evaluate the insertion quality as well as tissue characteristics, such as inflammation. Another application is the imaging of 3D cell clusters. Such cellular spheroids are increasingly used in substance testing and drug development, as they represent human physiology more accurately than the respective 2D monolayers. Their production however requires quality control to ensure both the correct shape and internal characteristics of the 3D constructs. SLOT can be employed for such control measurements: Thanks to its high sensitivity, photobleaching is reduced to a minimum. Simultaneous measurements of absorption and fluorescence also reduce the acquisition time.

SLOT as a versatile and cost effective solution for 3D imaging of specimen on the mesoscale

A basic SLOT setup can be constructed at the fraction of the cost of other 3D setups, such as lightsheet microscopes. Furthermore, the entire system is characterized by a compact design, making it interesting as an affordable table-top device for laboratory applications. Custom extensions to the basic setup are possible to exploit additional image information. Apart from absorption, scattering and fluorescence, second harmonic generation-imaging has also been demonstrated with the tomographic device. This was realized by using a fs-laser instead of laser diodes. SHG imaging of collagen networks is of particular interest in tissue biology, as it reveals the native tissue architecture without the need for destructive slicing. A recent development enabled hyperspectral tomographic imaging: A fluorescence spectrometer was integrated into the setup, and the lasers were replaced by a white light source to acquire additional spectral information. The method can generate 3D representations from any optically clear sample (i.e. samples with a homogeneous refractive index). Biological samples can be treated with a number of established clearing protocols. Even hard tissues such as bone and tooth can be treated that way. Transparent technical specimen are equally suited for inspection. Due to the rotation of the sample, intransparent structures such as implants or other inclusions do not create artefacts during image acquisition but can be depicted as part of the sample. SLOT is therefore also applicable for quality control in additive manufacturing, for example, to provide feedback on multi-layered designs and improve the printing process. Intransparent samples can be imaged as well, when only the surface is of interest. Using different wavelengths, it is possible to distinguish between different surface components, e.g. depicting a bacterial biofilm on a metal dental screw. The full rotation of the sample then allows for an accurate evaluation of biofilm growth. Continuous research will define the technical limitations of the SLOT technique. Automation of the setup results in a user-friendly device that can serve its purpose across disciplines. SLOT therefore makes for a versatile and cost effective solution for 3D imaging of various samples on the mesoscale.

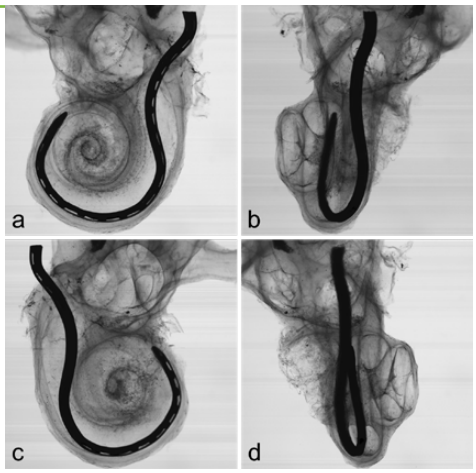

Figure 1: Explanted murine cochlea after insertion of a cochlea implant. SLOT provides a full 360° rotation, allowing for an assessment of the insertion quality.

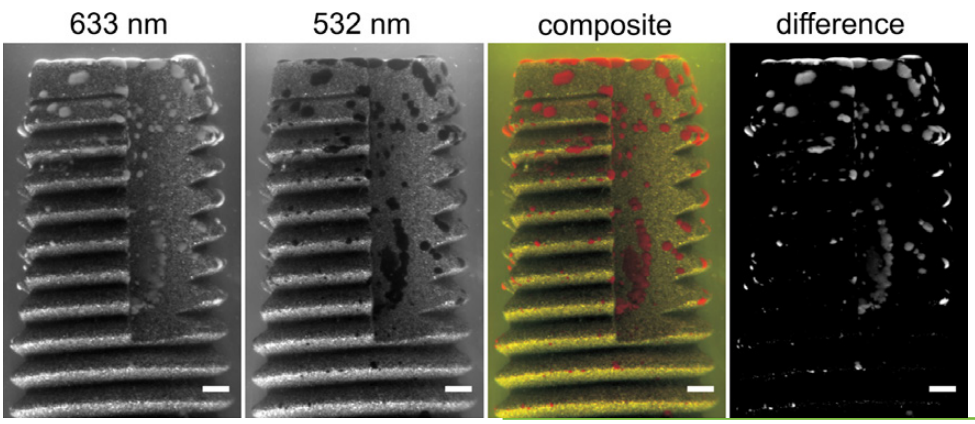

Figure 2: Dental implant with biofilm and a groove cut into it. The image was acquired by collecting the light scattered by the specimen. The biofilm is unstained and was reconstructed from the different scattering properties at two different wavelengths. The images gives a clear overview of the growth distribution. Scale bars: 500 µm.

Laser Zentrum Hannover e.V., Hannover, Germany
https://www.lzh.de/en

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IVAM.
www.ivam.com

Dr. Martin Schüttler
Dr. Oliver Bärtl
Carolina Remke

Ideas Need Flexibility – Active Implants and Components

CorTec provides novel implantable technology to overcome current limitations: With its Brain Interchange Implant, CorTec enables researchers, medical institutions and industry to investigate new therapies; furthermore it develops components and subassemblies for Medical Devices.

Electrical brain stimulation has been clinically used since the 1990s to treat neurological diseases. Most companies in the field of medical device development are unwilling to take device development risks and therefore rely on established components and technologies, limiting new therapy developments. Research on electrical stimulation has increased in recent decades. With these new findings, novel treatment options might become reality in the course of the next decade. What still limits the innovation in neurotechnology, is the lack of devices that meet the specific needs of researchers and physicians.

CorTec is developing the Brain Interchange Platform Technology that enables researchers, physicians and industry to develop new therapies based on new research findings.

How the Brain Interchange works:

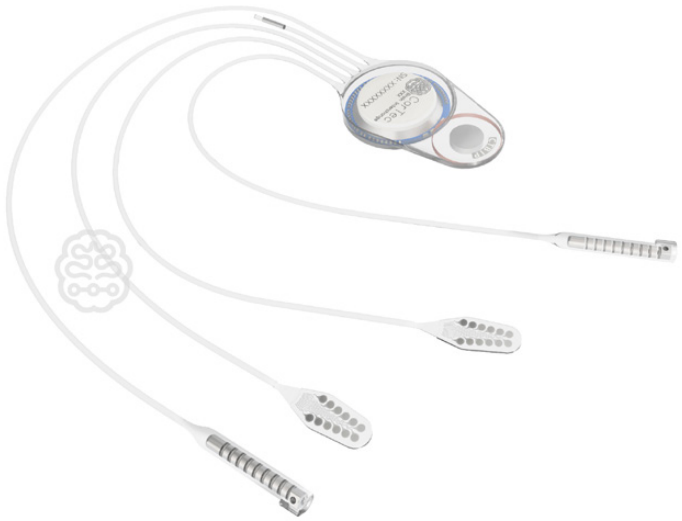
The Brain Interchange system can be used in a wide range of device designs, in scientific studies and as components of complete therapeutic systems. The low-latency system allows open- and closed-loop interaction with the nervous system, enables data processing outside the body and tailored brain stimulation in response to biological signals. The active implantable system can continuously monitor the patient's physiological condition (recording of neural activity) and readjust the applied electrical stimulation based on the evaluated data (closed loop functionality) according to the patient's individual therapeutic needs at any given point in time.

The Brain Interchange system consists of three components:

1. Implantable unit: Multi-contact AirRay grid electrodes are connected to the functional core and the electronics, which are protected by a proprietary hermetic ceramic encapsulation. The electrodes are typically placed on the brain's surface as the direct interface to the nervous system. The electronics amplify, filter and digitalize streams of neural signals to the external unit and modulates the brain activity by applying electrical pulses via the grid electrodes.

2. External unit: This component wirelessly powers the implantable unit using an inductive coil and wirelessly communicates with the implantable unit via a proprietary 2.4 GHz protocol.

3. Processing unit: An external computer powers the external unit and communicates with it using USB. It runs algorithms for processing the stream of recorded neural data and initiates stimulation commands with super low latency.



From idea to device – above and beyond neuroscience

All components of the Brain Interchange System are available for medical device development in industry and research. With over 10 years of experience, CorTec is providing solutions that are suitable for pre-clinical and clinical applications. Although, CorTec's Brain Interchange System has been developed for the treatment of neurological diseases, the technology spectrum and components are not limited to neurotechnology and can be adapted to the individual requirements of the application.

- High Channel Ceramic Implant Housing Technology providing 100 or more electrical feedthroughs.
- Voidless Silicone Overmolding Technology for the protection of electronics.
- AirRay Electrodes for interfacing with the peripheral and central nervous system. They offer an unprecedented combination of flexibility, softness, stretchability, thinness, and contact density.
- Electromechanical Interconnection Technology for active implants.

Based on the technological competences in active implant technologies and individual device design, CorTec provides all needed solutions for future therapies. The services include all important steps by providing solutions to realize the idea of a product, the development and testing and manufacturing of the approved medical device.

CorTec GmbH, Freiburg, Germany
https://www.cortec-neuro.com

Long Printed Circuit Cable Enables New Generation Medical Imaging Technology

Donato Caraig:
Abdul Khan

Medical imaging technology has been experiencing impressive growth and rapid advancements in the past 25 years. It moved from 2D to 3D and now is shifting to 4D capabilities. Within the wide assortment of medical imaging modalities, ultrasonic medical imaging techniques have provided the healthcare industry with an ever-increasing number of diagnostic tools for complex tissue analysis and 4D imaging. Such tools have equipped physicians with rapid, advanced, and precise diagnostic techniques.

Obtaining a precise and high-resolution inner heart image requires an ultrasound imaging procedure consisting of a 2-mm-diameter catheter probe (with flexible circuit cables containing more than 100 conductors inside) attached to a transducer. The catheter probe is then inserted into the femoral artery and passed up to the cardiac chambers.

Long Flexible Printed Circuit - New Generation Catheter

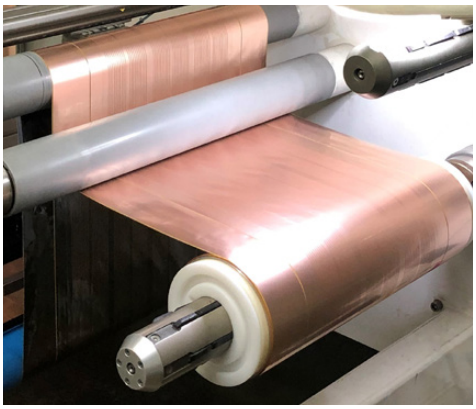
Imaging catheter probe construction requires a flexible circuit to be 2-m long, versus the typical 300 mm. As new advancements in diagnostic imaging modality have evolved and are now demanding more functionality, so has the need for additional conductors in the same catheter probe diameter. To manufacture extremely precise – and perfectly placed – microconductors requires a significant amount of investment in equipment and process control. The most recent micro cable designs are now capable of 30 percent more conductors in the same amount of space.

Inside the catheter probe, the advancements are evident. Flexible circuitry comprised of dielectric with micro copper conductors, which is the wiring backbone that connects the transducer piezo elements and is used to transmit and receive acoustic signals. The piezo elements then convert sound into small electrical signals that are routed back to the system for processing. It is also critical that the flexible circuit dielectric has the correct acoustic impedance requirements for a given frequency.

Fabrication Process

More transducer elements and additional signal lines are required to enable faster signaling speeds to produce real-time and high-resolution images while maintaining the same overall catheter probe size. This drives the need for increased miniaturization. Miniaturization techniques that are used to increase routing density must be managed carefully. By using advanced, tightly controlled photolithographic processes, advanced software design algorithms, and stable dielectrics, increased routing density can be achieved while preserving the reliability, electrical signal integrity, and veracity of the acoustic information being transmitted.

For a flexible circuit manufacturer to adequately provide solutions for current and future ultrasonic catheter probe designs, it is imperative that design tools, specialty materials, and fabrication techniques all be production-ready to work synergistically to satisfy the imaging industry's evolving requirements.



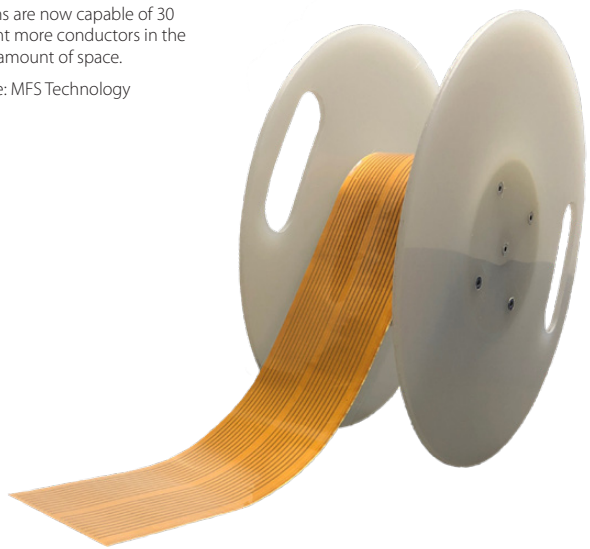
High volume production-ready in roll-to-roll manufacturing, more than two meters long with 60 µm conductor pitch.
Source: MFS Technology

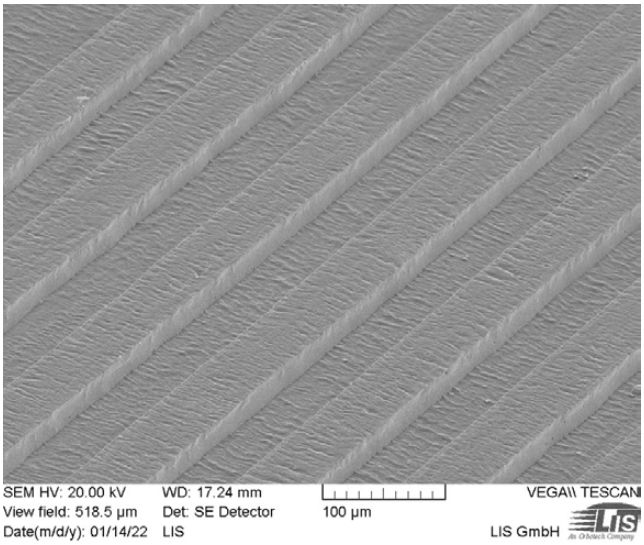
MFS Technology

MFS Technology is the innovation leader and pioneer in FPC, PCB, and Rigid-Flex. With 30 years of proven superior design, flexible manufacturing, and excellent quality, MFS Technology provides diversified products and services to over 200 blue chip MNCs globally. Headquartered in Singapore, MFS Technology owns four subsidiaries in China and Malaysia, covering different market segments such as automotive, mobile, consumer, industrial, medical, and data storage.

MFS Technology Europe UG
http://www.mfstechnology.com

The most recent micro cable designs are now capable of 30 percent more conductors in the same amount of space.
Source: MFS Technology





An SEM image of the flexible circuit. Source: MFS Technology

Rapid Microfluidic Fabrication Service

Dr. Carl Dale

Microbritt is an innovative start-up company which uses a patented micromilling method to produce a variety of customer-defined products; including the rapid fabrication of microfluidics from a range of materials: glass, silicon, polymers, and even piezoelectrics. Microbritt helps medical diagnostic companies increase their rate of innovation.

Microbritt formed as a company from a patented micromilling method developed at Newcastle University in the UK and started trading in October 2021. Since incorporation, Microbritt has been working closely with customers to help them fabricate bespoke microfluidics: microscale channels which transport a patient sample (mostly blood) to a sensing site on a medical diagnostic test.

The need for microfluidics

Since the COVID-19 pandemic, there is much more awareness of the field of medical diagnostic technologies, and the appetite for the rapid testing for a variety of diseases. Infectious diseases are one focus for the technology, but cancers are also the subject of point-of-care (PoC) testing – conducted at the site of the patient with rapid outcome – which can be used to diagnose, or to monitor a disease. PoC tests can either be undertaken at a doctor's office without the need for samples being sent to a centralized testing facility, at a localized testing facility, or at home by the patient (disease monitoring).

The tests generally work in a similar fashion to blood glucose tests which are used routinely by diabetics: a finger prick of blood (50 microliters) is used for testing. For emerging high-tech sensing technologies, this sample needs to be filtered and mixed with other chemicals (buffers) to breakdown the blood to release the biological analytes (eg cancer markers) and transport them to the testing site. Additionally, the microfluidic system must be integrated alongside the specific sensing technology: all of which takes numerous rounds of optimization, and development pain! Therefore, the need for rapidly fabricated bespoke microfluidics is currently in great demand and will accelerate year by year for the foreseeable future.

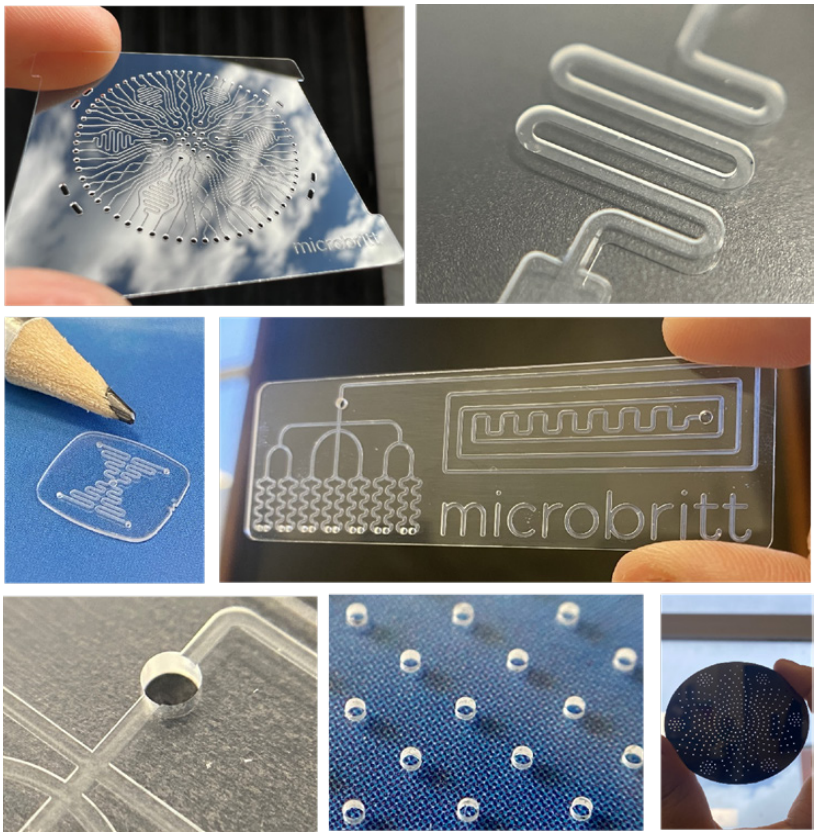
Rapid Microfluidics Fabrication Service

In the microfluidics market, Microbritt uses its patented micromilling method to rapidly fabricate bespoke microfluidics devices demanded by its customers. For those not in the know, think of micromilling as akin to 3D printing but as a subtractive process down to the microscale – a tiny drill. Companies who need to rapid microfluidic prototypes can upload their designs to Microbritt's fabrication portal which are rapidly fabricated and delivered worldwide. Using conventional cleanroom techniques can be very slow and costly leading to innovation bottlenecks; therefore, as most medical diagnostic devices companies go through many rounds of optimisation prior to commercialization, they need access to a streamline customer friendly fabrication service that helps them to increase their rate of innovation. Microbritt helps to solve this challenge!

Microfluidics from a range of materials,

The company can fabricate microfluidics from a range of materials, where others can't as a rapid fabrication service: Polymers for cheap and early prototypes, but do not have good chemical resistance to the harsh buffer chemicals solutions (buffers) needed for the final product; Silicon for specialist applications where the microfluidics are integrated directly on a sensing chip, or to act as a mold to cast cheap and dirty PDMS microfluidics; Glass being more expensive but extremely robust to harsh buffer solutions; Lithium Niobate (and other piezoelectrics) for bespoke applications where microfluidics are integrated with a surface acoustic wave (SAW) technology for fluid mixing, and cell transportation in cell sorting devices. Microbritt's products can range from small samples to wafer-scale fabrication. Additionally, Microbritt also works with other Microfluidic suppliers to post-process their large volume microfluidic products fabricated at wafer-scale; typically, this involves placing deep micro holes/vias for fluid inlets and outlets in glass and silicon – Microbritt can drill these holes to high-quality, with no-tapering and rough edges like seen by other fabrication technologies. Microbritt is currently looking for commercial partnerships to ease supply chain problems, and for collaboration to develop the next generation of state-of-the-art microfluidics.

Microbritt Ltd, Newcastle upon Tyne,
United Kingdom
https://portal.microbritt.com



Trade Fair Special

COMPAMED 2022

November 14 -17, 2022 in Dusseldorf

„High-tech for Medical Devices“

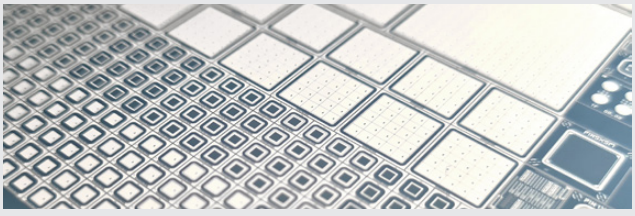
COMPAMED is the leading international marketplace for medical manufacturing suppliers. After the pandemic years 2020 and 2021, full halls and exhibitors from all over the world await the international audience again this year. Modern medical technology for diagnostics and therapy must meet increasing requirements for mobility and energy efficiency. For this reason, the demand for miniaturization solutions of medical components remains at a high level. With 47 exhibitors, the „Hightech for Medical Devices“ marketplace initiated by the IVAM Microtechnology Network is the largest joint area at COMPAMED. This year, the IVAM section includes companies and institutes from nine nations, including Germany, Finland, Austria, Switzerland, Greece, Spain, Great Britain, France and the USA. A special focus is on optics and precision technology companies. Furthermore, a wide variety of microcomponents, sensors, actuators and sensor systems, micropumps, coatings, smart textiles as well as manufacturing and processing methods and services are among the innovations on display. In addition, the COMPAMED HIGH-TECH Forum in Hall 8a will provide insights into research and development, explain technology trends in the industry and provide information on relevant foreign markets for medical technology companies. More than 60 international speakers will present lectures, discussion rounds and networking sessions to initiate contacts on all four days of the trade fair.

AEMtec GmbH, a leading provider of hybrid micro and optoelectronic applications develops, qualifies and produces complex modules for the medical sector, such as Wearables, Handhelds, Diagnostics, Medical Equipment, Imaging and Acoustic Systems and Laboratory Diagnostics. Especially in times influenced by pandemics the usage of reliable microtechnology is of high importance. AEMtec is appreciated as competent partner for the miniaturizing of high quality modules, especially because of the cutting-edge technology equipment (UBM, SBA, Dicing, COB, FC, SMT, Box-Build). (Hall 8a, G19.4)

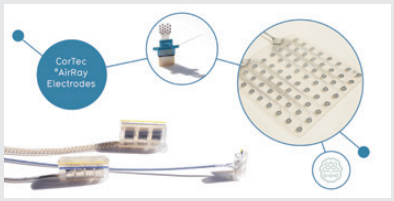
The expertise of **Art of Technology AG** consists of system miniaturization and cost optimisation, low power electronics and energy management, cryptography and security electronics as well as special technologies such as 3D-MID and others. Art of Technology AG offers numerous services such as concept and technology studies, design reviews and troubleshooting, design and development (hardware and software) as well as prototype production and industrialisation. Typical applications are medical devices, intelligent implants, optical systems and space or other extreme environments (ATEX) where high reliability is required. (Hall 8a, F19.2)

Beutter GmbH & Co. KG manufactures fine-mechanical components of high manufacturing depth in small and medium series. We supply all areas of medicine technology and are certified according to ISO 13485:2016. We have all dedicated machining technologies (turning, milling, grinding, honing) as well as fitting sub-assemblies and packaging under cleanroom-conditions. Our constantly monitored and certified suppliers, together with our design support for your product, complement our portfolio. Beutter manufactures supplying parts and assemblies for example for surgical instruments, implants up to risk class III or protheses. (Hall 8a, H23.3)

CiS Research Institute for Microsensors develops, optimizes and manufactures microsystems for customer-specific sensors and sensor systems. The focus is on silicon technologies and assembly and packaging technologies. The spectrum of medical sensor applications includes spatially and energy resolved detectors for high energy radiation and light, diodes for dosimetry, force and pressure sensors as well as optical sensors and modules from ultraviolet to visible and near infrared up to the mid infrared range. (Hall 8a, H23.4)



Trade Fair Special

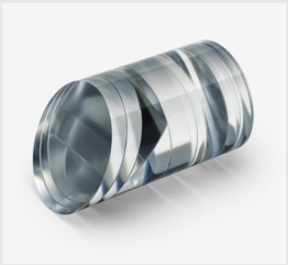


CorTec enables communication with the nervous system – for the cure of disease. Our Brain Interchange technology is an implantable system that records and stimulates brain activity chronically for long-term use. As a closed-loop system, it can control stimulation online based on brain activity recorded simultaneously. In addition, we are providing single individual components like flexible electrodes or high-channel encapsulations together with electronics and software. They are characterized by the same set of features: high precision, high flexibility in design, high number of channels. (Hall 8a, H19.5)

EPIC (European Photonics Industry Consortium) is the world leading industry association that promotes the sustainable development of organizations working in the field of photonics in Europe. EPIC represents over 800 companies and fosters a vibrant photonics ecosystem by maintaining a strong network and acting as a catalyst and facilitator for technological and commercial advancement. EPIC publishes market and technology reports, organizes technical workshops and B2B roundtables, and supports EU funding proposals, advocacy and lobbying, education, and training activities. (Hall 8a, F35.5)

ES Systems is a developer and manufacturer of high-quality sensors based on micro-electronics technologies. ES Systems', MEMS based, sensors measure pressure, fluid properties and temperature. ES Systems products are ideal for the industrial, medical and aerospace markets either as stand-alone components or being integrated within equipment. Towards the latest requirements and developments of the 4th industrial revolution, ES Systems has developed innovative smart, autonomous, low power and wireless sensors ideal for integration to IoT systems and solutions. (Hall 8a, F29.6)

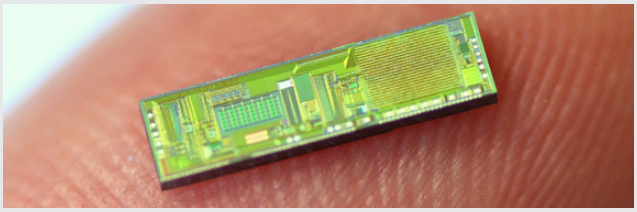
Driving innovation in micro optics, **FISBA** excels in the design and manufacturing of singlets, compound elements and micro systems enabling ultra compact imaging and illumination solutions for Life Sciences applications.



We offer volume production processes ensure high accuracy and repeatability for microlenses starting at diameters 0.3 mm. We are strong in the development of Micro Vision Systems and Compact Light Engines. For example: The FISBA READYBeamTM. It is an extremely compact multi-color laser module including full electronic integration and active thermal management. (Hall 8a, G19.7)

With over 500 employees, the **Fraunhofer Institute for Laser Technology ILT** is one of the most important contract research and development institutes in its field worldwide. Our core competencies are laser beam source development, laser production and measurement technology, as well as laser medical technology. In the latter, the ILT develops novel processes and systems for microfluidic sorting and screening applications, applicators for therapeutic laser treatments and laser processes for manufacturing, such as welding transparent plastics. (Hall 8a, F19.5)

The **Fraunhofer IMS** presents smart sensor systems for upcoming medical device generations. The main topics range from active implants to in-situ diagnostics and non-invasive healthcare applications. Prominent products are e.g. energy-efficient pressure sensors which show a unique long-term stability and high accuracy and are used in several CE-approved implants. One of further product examples is a smart patch that detects atrial fibrillation directly on the patient with the artificial intelligence of miniaturized electronics. (Hall 8a, G19.2)

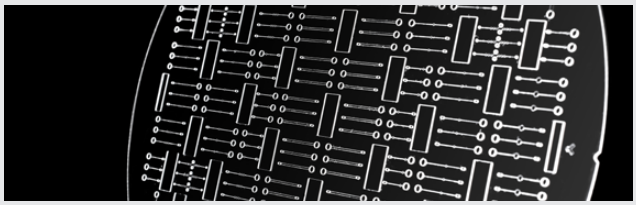


Trade Fair Special

Hahn-Schickard develops intelligent cross-industry products using microsystems technology, from the first idea to production. Hahn-Schickard shows innovations at the booth in hall 8a/ booth F29.4 and presents customer-specific sensor development, sensor integration and manufacturing in an own MEMS clean room as well as the realization and approval of in-vitro diagnostic products (learn more at BIPORO in hall 15, booth K16). (Hall 8a, F29.4)

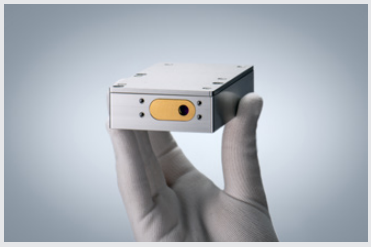
Precise pumps - smart solutions. **HNP Mikrosysteme** offers pumps worldwide that dose the smallest amounts of liquid extremely precisely. Five series allow smallest dosing volumes from 0.25 µl and volume rates from 1 µl/h to 1152 ml/min. Applications are Laboratory automation, pharmaceutical production, medical and analytical technology, such as sample preparation for the determination of blood parameters or pathogens (SARS-CoV-2). HNPM develops OEM pumps and offers compact, ready-to-use dosing systems for analysis, research and development, like LiquiDoS as a functional solution for laboratories. (Hall 8a, F29.5)

Cost effective glass components for Life Science, Diagnostics and medical applications. **IMT** develops and produces large volumes of consumables, custom-made microfluidic devices, optical components and sensors in glass and quartz.
Capabilities: Structured metallic and dielectric coatings, etching of channels and nanopatterns, integration of on-chip electrodes, waveguides, optical filters and apertures.
Applications are sequencing, Lab-on-a-Chip, Organ-on-a-Chip, Single Cell Detection & Analysis, HTS, Microarrays, glass components for medical instruments & equipment. (Hall 8a, G19.1)

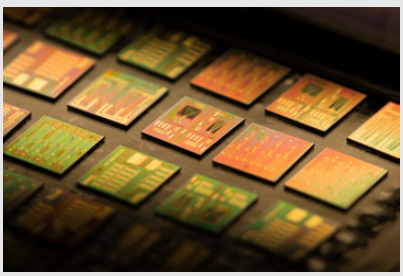


Innovative Sensor Technology IST AG combines thin-film or thick-film technology to manufacture a wide variety of sensor elements for temperature, flow, conductivity, humidity and biological metabolite monitoring. These sensors combined with new Peristaltic Micropumps and Viral RNA extraction kits, complete the medically compliant IST AG product portfolio for the following specialist applications in a complex environment of constantly evolving standards, disrupted manufacturing processes, and reduced design cycles. (Hall 8a, H29.1)

As an OEM solution provider, **Jenoptik** enables customized systems to meet the growing demands for photonic solutions in Life Science & Medical Technology and to solve essential challenges in several industries. Jenoptik will demonstrate its competencies and key technologies in R&D and manufacturing based on components, sub-systems and functional models. See how to reduce development time for imaging systems with SYIONS, inform yourself about our color tunable, high brightness light source for minimally invasive illumination, or get inspired from our solutions for dentistry and surgery. (Halle 8a, H19.1)



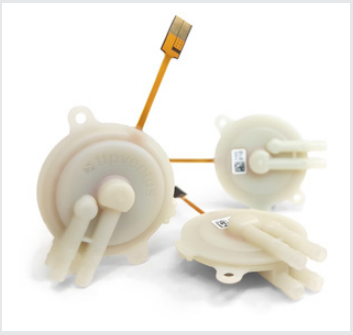
JePPIX brings together the European InP and Triplex photonic integrated circuit (PIC) supply chain as a coherent force to advance and promote PIC technology. JePPiX promotes and facilitates an open-access, horizontal and generic foundry model that keeps pace with the market, bringing in new users, enabling specialization, and facilitating the supply chain agility that is needed for new sectors. (Hall 8a, F35.5)



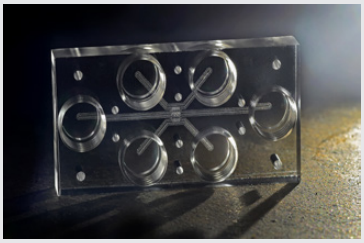
Trade Fair Special

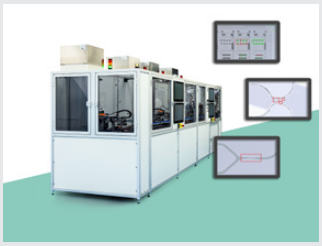
The biosensor of **Jobst Technologies GmbH** enables the measurement of glucose/lactate/glutamine/glutamate simultaneously even in complex mixtures like whole blood. By using a flow-through biosensor, glucose & lactate can be either analyzed with a rate of 48 samples per hour in analyzers or monitored simultaneously like in the first continuous glucose & lactate monitor for critically ill patients (EirusTM Getinge). The miniaturized sensor can be used in-vivo for subcutaneous or intravascular application. In combination with micro-pumps the biosensors enable self-calibrating, auto-sampling portable analyzers. (Hall 8a, H29.1)

At the heart of any pressure based fluid handling system is the need to control the working pressure with a high degree of accuracy and precision. Disc Pump from **LEE Ventus** (formerly TTP Ventus) is a piezoelectric micropump for gases and microfluidics. With its near-infinite control, pulsation free flow, silent operation and compact from factor, Disc Pump is an evolutionary step forward in using pressure to control microfluidics. The company shows enabling innovation in applications like pipetting, Organ-on-a-Chip (OOAC) systems, Point-of-Care (POC) diagnostics and more. (Hall 8a, H23.6)



LightFab delivers 3D precision glass parts for various applications and markets: 3D micro fluidics are used for cell treatment, nozzles are used for spraying or encapsulation, optofluidics are used for diagnostics. Also components for endoscopes or other optical instruments are produced from customers CAD data as prototypes or in series. The award-winning LightFab 3D Printer delivers ultrafast laser technology for extremely precise subtractive 3D printing of glass and also for internal glass welding, waveguide writing and additive multi-photon polymerization in one machine. (Hall 8a, F19.8)

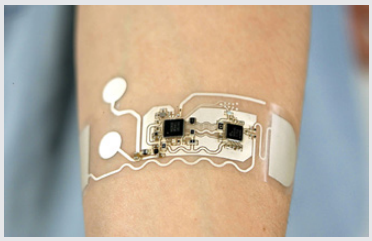




MABRI.VISION automates quality testing. With its MICRO.SPECTOR the company is showing their latest AOI product for automated optical inspection of miniaturized components and microstructured surfaces. The MICRO.SPECTOR testing system can be operated as a stand-alone high-speed microscope or fully integrated into an automated production process. By using our variable lighting system, transparent and non-transparent materials, such as microfluidic chips, can be checked for defects, scratches, particles, flaws and geometric properties. (Hall 8a, H29.5)

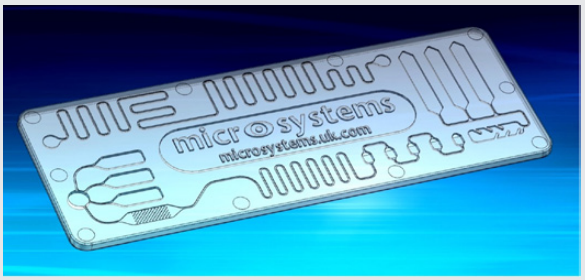
Mabuchi Motor is a worldwide leading supplier of small DC motors. Its globalized production and supply system enabled the company to provide 1.35 billion motors to the automotive, healthcare and consumer markets in 2021. Thanks to their reliability, compactness and efficiency, Mabuchi motors have been adopted by leading equipment manufacturers namely for surgical and patient monitoring equipment as well as drug delivery systems. In 2021, Mabuchi Motor Group acquired the Swiss company Electromag SA specialized in high-speed brushless DC motors for demanding medical applications. (Hall 8a, H.23.7)

Mabuchi Motor Electromag SA is a leading expert and manufacturer of brushless DC motors for demanding healthcare applications of up to 300 W. One of the hallmark features of Electromag motors is their quietness and low vibration level for speeds up to 100,000 rpm. Renowned for their reliability, Electromag motors offer up to 92% efficiency. Based in Switzerland, Electromag is the preferred motor supplier of leading global medical device manufacturers in the fields of critical and home care ventilation, orthopedic power tools and dentistry. The company is ISO 13485 certified. (Hall 8a, H23.7)



MedPhab is Europe's first Pilot Line dedicated to manufacturing, testing, validation, and upscaling of new photonics technologies for medical diagnostic devices. The MedPhab Pilot Line network consists out of world-class RTOs and industrial partners with a unified„way of working" and covers all project stages from prototyping to manufacturing development towards ISO13485, thus enabling accelerated product launch with reduced R&D costs. MedPhab's services and R&D partners are available to companies through a single entry point at www.medphab.eu . (Hall 8a, F35.1)

Lab on a chip - **Micro Systems UK Ltd. - United Kingdom** utilized all of their knowledge and experience in both micro and nano technology to produce micro fluidic components with multi-channel features below a 1-micron tolerance. Displaying a range of different micro fluidic components in single or two materials which incorporates 100- 50-micron micro channels, together with integrated optics with a surface finish less than 20µ Ra. (Hall 8a, F19.7)



Microdul is a private Swiss company founded in 1991 as an MBO from Phillips Semiconductors in Zürich and is your trusted partner for advanced microelectronics. Our expertise covers all steps of the process from development to engineering to production and test of custom applications based on IS9001 and ISO13485. The business areas include the production of miniaturized electronic modules, mainly for medical implants (AIMD), the development of mixed-signal ASICs with extremely low power consumption or standard products, and printing of conductive, resistive and insulating layers on ceramics. (Hall 8a, F19.4)

Die Mikrop AG is the leading source for Swiss precision miniature optics, serving all high-tech markets. Since over 40 years, we develop, manufacture and assemble highly complex, miniaturized optical components and micro-optic modules. As one of only few companies worldwide Mikrop is able to manufacture serial high precision lenses in reliable top quality, starting at diameters of just 0.3mm and up to 15mm. Customers and markets include, Endoscopy, Medical Engineering, Machine Vision and Micro Sensors. Our products are, Micro-Objectives in glass an plastics and Micro-Cameras. (Hall 8a, F29.3)

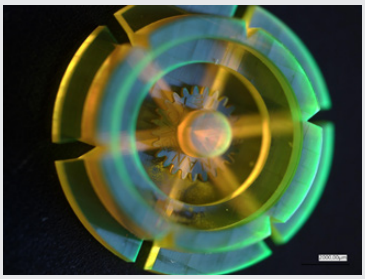
For many companies, it is difficult to find customised professional trainings - especially for small and medium-sized enterprises. At the same time, trainings of employees is of great importance in order to remain viable and competitive in the future. Given this background, the coordination office (**mIQu**) was established which crosslink companies from the micro and nanotechnology sector in order to widely distribute professional training offers, but also to initiate workshops with suitable partners.

mIQu
im Rahmen des geförderten Projektes KoWeMi

MMT GmbH is a one-stop service partner for medical technology and life science products. For product development, MMT offers cost-effective production of complex components, functional prototypes and tools using various manufacturing technologies such as laser sintering, 3D-Printing, vacuum casting, injection molding and mechanical processing. Together with Little Things Factory GmbH, MMT can offer its own comprehensive microfluidic systems and offer a wide range of microsystem technology as a solution and development partner. (Hall 8a, H29.7)

MMT
Micro Mechatronic Technologies

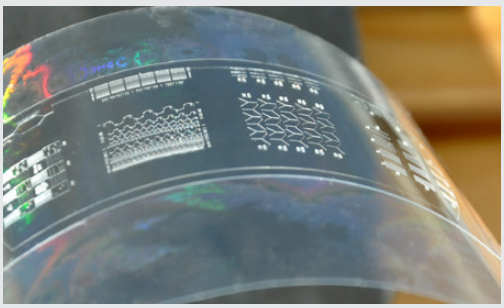
Trade Fair Special



NanoVoxel GmbH is the first all-in-one service provider for industrially manufactured micro parts.
By further developing of the latest 2PP 3D printing technology, combined with leading competencies in micro injection molding and metallization processes, NanoVoxel is able to produce parts and components with resolutions in the micro-/nanometer range from prototypes to series production. NanoVoxel Service is used in various industries including consumer electronics, medical, microfluidics and many others. (Hall 8a, F35.4)

Die Optiprint AG will be presenting its new products at Compamed 2022. Among others, the company will show Flex- and flex-rigid PCB's, Ultra-thin rigid multilayer PCB's for interposer applications (Chip-Packaging Solutions), Ultra-fine line structures line/space < 25µm, Printed Circuit Boards with Ticer foil – thin film resistor technology or FaradFlex capacity foil and DIG, EPIG or ISIG - alternative surface finishes to ENEPIG – These surface treatments are particularly suited for gold wire bonding. (Hall 8a, H19.4)

PhotonHub Europe will establish a single pan-EU Photonics Innovation Hub which integrates the best-in-class photonics technologies, facilities, expertise, and experience of 53 partners from all over Europe, including the coordinators of EU pilot lines and local photonics hubs representing 18 regions, as a one-stop-shop solution offering a comprehensive range of supports to industry for the accelerated uptake and deployment of photonics. (Hall 8a, F35.5)



PI Ceramic, a Physik Instrumente (PI) subsidiary located in Lederhose, Germany, is one of the global leaders for piezoelectric ceramic products. In the field of medical technology, PI Ceramic develops piezoelectric actuators and sensor components for applications like therapeutic ultrasound, microfluidics, ultrasonic sensors, medical implants and diagnostic imaging. With 30 years of experience in piezo technology, PI Ceramic offers piezoceramic solutions from miniaturized to large elements as well as profound assembling expertise. (Hall 8a, H23.1)

The **Sensirion AG** Sensirion is a manufacturer of innovative flow (gas/liquid flow, differential pressure) and environmental sensors (humidity, temperature, VOCs, CO2, particulate matter, formaldehyde). These enable safe and reliable devices for ventilation, anesthesia, drug delivery, diagnostics and digital health applications. The product highlights at this year's COMPAMED are tiny flow sensors for smart inhalers and other digital health applications as well as a liquid flow sensor suitable for subcutaneous drug delivery. (Hall 8a, H19.7)

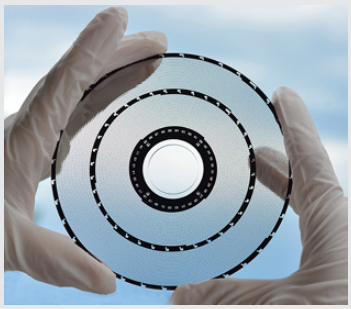
SCS - Specialty Coating Systems is a world leader in Parylene, liquid, ALD and multi-layer conformal coating services and technologies with 50 years of experience and 21 worldwide locations, including 5 in Europe, 9 in the Americas and 7 in Asia. SCS conformal coatings offer excellent moisture, chemical and dielectric barrier properties to protect components in the medical device, electronics, transportation, aerospace and defense industries. (Hall 8a, F19.1)

50 SCS YEARS
SPECIALTY COATING SYSTEMS™
A KISCO Company

Trade Fair Special

From its original background (watch-making industry), **Statice** has developed strong skills in the field of micro-technologies. Through years, Statice has gained a large experience in the field of biomaterials and applied mechatronics for the medical areas. Furthermore, in order to help customers to reach the market, Statice has developed a manufacturing service. Statice is certified ISO 13485. The fields of skills are: biomaterial, electronic, mechanic, mechatronic, machining, assembly, injection molding, micro-fluidic, manufacturing and most recently: regulatory affairs. (Halle 8a, F29.1)

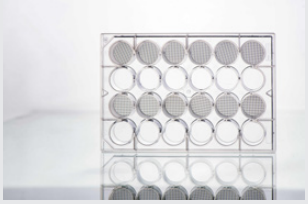
SUSS MicroOptics provides high-quality optics for medical and life science applications. The company produces tailored refractive and diffractive micro-optics for imaging, sensing, or beam-shaping applications. Based on extensive experience in optical design, engineering, wafer-level manufacturing, metrology, and packaging it supports from the concept phase to mass manufacturing. Customers benefit from smaller package sizes, reduced handling complexity, less packaging costs as well as a shorter time to market. (Hall 8a, H19.6)



SwissOptic AG is part of the global technology group Jenoptik and stands for highest precision in the world of optics. With many years of experience, we develop, manufacture and integrate optics, mechanics and electronics into innovative system solutions for the light-using industry worldwide. In medical technology, our high-performance optics are used in various areas of ophthalmology. For the prevention, diagnosis and treatment of diseases, many instruments are based on optical methods. This is where SwissOptic comes into play.

IVD Solutions **TE Connectivity**'s In Vitro Diagnostics (IVD) and life science experience makes it a trusted contract development and manufacturing (CDMO) partner for several upcoming microfluidic projects. Trust us to work with your concepts, designs, usability and clinical research challenges to support the commercialization of your products with the right quality and manufacturability. The unique combined offering under one roof is your shortest path to market. Services are CRO & regulatory product development, HFE & usability testing, transfer to manufacturing and contract manufacturing. (Hall 8a, H29.2)

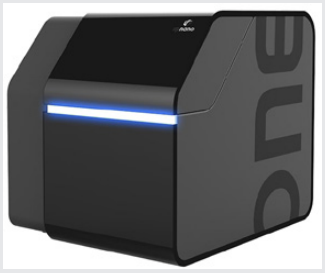
Microfilters, micromembranes, micro titer plates and microfluidic chips are used in a wide variety of applications in medical technology, prevention and therapeutics, analytics or biotechnology. Precise and reproducible adjustment of the structure sizes and geometries as well as the layer thicknesses is of decisive importance. **temicon** covers the areas of tool development, prototyping, the first small series up to series delivery in 100.000+ parts scale. (Hall 8a, H29.8)



E-textiles for medical applications. Textiles for life sciences and medical technologies require special properties, such as sensory or actuator characteristics, force-flow-compatible design, application-specific pore sizes, large internal surface area or structural anisotropy. **The Textilforschungsinstitut Thüringen-Vogtland e.V.** developes textile based solutions for vital parameter monitoring, decubitus prohylaxis and CPT of lymphedema, pressure relief and improved physiological comfort of bandages and orthoses, implants, e.g. patient-specific solutions or weaving and embroidery processing of shape memory materials abdominal swabs and more. (Hall 8a, G19.6)

titv
Das Institut für Spezialtextilien und flexible Materialien

Trade Fair Special

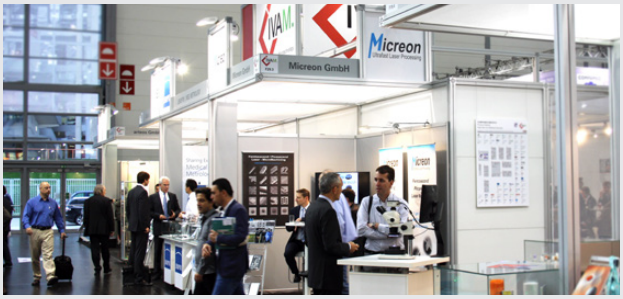


The Austrian technology company is an expert when it comes to microfabrication using 3D printing. **UpNano** develops, manufactures and distributes high-resolution laser lithography system for the production of micro components made of plastic. Providing hardware, software and materials that are attuned to one another, the company offers its customers a complete solution for innovative product and production approaches in both the scientific and industrial sectors. (Hall 8a, F35.4)

The Cheminert M Series liquid handling pump by **VICI AG International** is a syringe-free pump capable of delivering a bidirectional flow over six orders of magnitude The M Series pump has no separate fill cycle, and the capacity is unlimited. Two basic models are offered — one with a flow range of 5 nl/min to 5 ml/min and one with a range of 1 µl/min to 25 ml/min. The standard pressure rating is 100 psi, but both models are available in a high-pressure version. Some high-pressure configurations can hold pressures up to 1500 psi. USB and RS-422/485 communication protocols are incorporated. (Hall 8a, H23.5)

Perfection to the detail: **Zünd Precision Optics** is a reliable partner in medical technology for high quality planar optical components and systems from 0.2mm up to 50mm in various shapes. The added value includes grinding, lapping, polishing, coating, varnishing and curing of optical glasses, quartz and glass ceramics. The company is pleased to support customers in the development of components and assemblies with the highest precision and cleanliness requirements from the prototype till the serial production. (Hall 8a, F29.3)

The **IVAM Microtechnology Network** unites people who are excited about key enabling technologies and the way these technologies will shape the future. Being an international microtechnology business network and technology marketing expert, IVAM connects professionals in the high-tech industries and supports them in bringing innovative technologies and products to market and gaining a competitive edge in international competition.



Trade Fair Special

COMPAMED HIGH-TECH FORUM by IVAM

MONDAY, 14. NOVEMBER

11:30	*Opening* **Dr. T. R. Dietrich**, IVAM
11:40	*Future from Fukushima - Medical Industry Cluster Project and Cooperation with NRW* **K. Takahashi**, Fukushima Prefectural Government

Printed Electronics for Next Generation Wearables and Diagnostics

Session Chair: Ralph Liedert, VTT Technical Research Centre of Finland

12:00	*Printed Electronics Towards Stretchable and Skin Conformal Wearable Devices* **R. Liedert**, VTT Technical Research Centre of Finland
12:20	*Printed Electronics Enabling IoT Based Health Monitoring* **A. Tauriainen**, Screentec Oy
12:40	*Technology Platforms for Medical Wearables* **E. Jung**, Fraunhofer IZM
13:00	*Advanced Digital Technologies in Point of Care Diagnostics* **Dr. F. Kurth**, CSEM SA
13:20	Break

Smart Sensor Solutions

Session Chairs: Dr. Jana Schwarze, Dr. Victoria Jakobi, IVAM

13:40	*Silicon-Based Microsensors for Medical & Health Care Applications* **Dr. M. Schädel**, CiS GmbH
14:00	*Sensors & Data Analytics - A Smart Hospital Case Study* **N. Valantassis**, ES Systems
14:20	*Systems Engineering for Healthcare Application* **M. Baum**, Fraunhofer ENAS
14:40	*Edge AI-based Sensor Nodes: From Single Smart Medical Device to Connected Healthcare Applications* **K. Seidl**, Fraunhofer IMS
15:00	*Force Sensors for Pressure Surveillance in Pumps and Other Medical Devices* **M. Zoller**, Senstech AG
15:20	*Biosensors for Continuous Metabolic Monitoring in Medical Devices for Critical Care* **G. Jobst**, Jobst Technologies GmbH
15:40	*Textile Sensors for Blood Pressure Measurement Without Cuff* **K. Ullrich**, TITV e.V.
16:00	*Developments in Piezo-Electric Sensing Solution* **L. Dillon**, CeramTec GmbH
16:20	*Smarter & Smaller, Healthcare Smart Ring as a New Trend in Japan* **C. Geng**, MedVigilance Inc.
16:40	*Nanomaterial based Electronic Biosensors: Status and Prospects* **L. Alves da Silva**, Fraunhofer ENAS
17:00	End of Session

TUESDAY, 15. NOVEMBER

Europe meets USA - High-Tech for Medical Devices

Session Chairs: Dr. Jens Ebnet, Ebnet Medical Gmbh Dr. Victoria Jakobi, IVAM

10:30	*Opening* **Dr. T. R. Dietrich**, IVAM
10:45	*Business in U.S.* **J. Ohneck**, AEMtec GmbH
11:00	*The Benefit of Using 3D Printing Technologies for Medical Applications* **S. Yohannes**, Formlabs Inc.
11:15	*Alleima™, Former Sandvik Materials Technology, Forged from the Past, Engineered for the Future* **J. Blanton**, Alleima AB
11:30	*New Multilayer Encapsulation Provides Ultra-Thin Film Barrier Protection for Medical Applications* **M. Van Gompel**, Specialty Coating Systems
11:45	*False Positive Interference in Serological Assays* **E. Gravens**, Omega Biologicals, Inc.
12:00	*FVD: All-In-One Variable Dispense Pump* **S. Fragoso**, Fluid Metering Inc.
12:15	*Innovations in CMOS Chip-on-Tip Endoscopy* **T. Gunja**, OMNIVISION GmbH
12:30	*Reducing Catheter Associated Urinary Tract Infections Through New Catheter Technology* **Dr. J. Meliones**, UR24
12:45	*New Standard of Care for Acute Pain Management* **S. Eror**, Solo-Dex Inc.
13:00	*Design and Manufacturing of Laser-Cut Hypotube for Vascular Delivery Products* **T. Dickson**, Lumenous Device Technologies
13:15	*Fist Assist: A Global Device for Arm Circulation and Arm Vein Care for Medical Conditions* **T. Singh**, Fist Assist Devices LLC
13:30	*Development of Magnetic Medical Devices: From an Engineering Perspective* **M. Schilling / A. Hirka**, Dexter Magnetic Technologies GmbH
13:45	*A New Generation of Needle Free Cartridge Injectors* **M. Timm**, IntegriMedical LLC
14:00	*Delivering Many Treatments with a Single Platform* **K. D. Ellis**, Pintler Medical LLC
14:15	*Risk Mitigation: Collaboration between USA Manufacturing & European Medical Companies* **K. McCarthy**, Sleepnet Corporation
14:30	*The Future of Medical Device Within a MDR Compliant World* **G. Haberland**, DANNIK
14:45	*Challenges and Opportunities with Global Medical Products Launches – The Regulatory Perspective* **K. Dennis**, UL Solutions
15:00	*Success Story of an US Company Entering the European Market: It's A Small World After All* **A. Johnson**, Accumold
15:15	Summary and Discussion **J. Ebnet**, Ebnet Medical GmbH **Dr. T. R. Dietrich**, IVAM
15:45	Opening Networking **Dr. T. R. Dietrich**, IVAM **R. Klemm**, Messe Düsseldorf North America
16:00	Networking, Snacks and Drinks (participation free of charge for exhibitors and visitors, but registration is needed beforehand)
16:45	End of Networking

WEDNESDAY 16. NOVEMBER

Laser and Photonics Applications - EPIC Tech Watch

Session Chair: Antonio Castelo, EPIC – European Photonics Industry Consortium

10:20	*NanoVoxel – The New Method for Overnight 1µm-Resolution Micro-Fabrication* **D. Foglia**, NanoVoxel GmbH
10:40	*MedPhab - First European Pilot Line for Photonic Medical Devices* **J. Hiltunen**, MedPhab
11:00	*Miniaturized, High Performance Microscopes for Point-of-Care Applications* **S. Dochow**, JENOPTIK Optical Systems GmbH
11:20	*MicroOptics for LifeScience* **Dr. P. Heissler**, SUSS MicroOptics SA
11:40	*3D Cell Culture Handling Platform Based on Photonic Technologies* **F. Schmidt**, Lucero Bio, AZ BioVentureHub
12:00	*Shining a Light on Product Development* **T. Ackrill**, G&H Group
12:20	*Integrated Photonic Biosensing* **J. Leuermann**, Bioherent
12:40	*Wafer-Level F2R – Assembly Solution for Small Form-Factor Photonic Devices* **A. Sielecki**, Philips
13:00	*Healthcare Manufacturing Solutions at Scale in Europe – Simon Schwinger, Business Enablement at Jabil Optics* **S. Schwinger**, Jabil Optics
13:20	*760 nm: Jenoptik's New Color for Aesthetic Applications* **Dr. A. Pietrzak**, JENOPTIK Optical Systems GmbH
13:40	*New Forms of Cooperation in Times of Pandemics and Antibiotic Resistance: The Leibniz Center for Photonics in Infection Research* **Dr. J. Hellwage**, InfectoGnostics Research Campus Jena and Leibniz Health Technologies
14:00	Break

Microfluidic Session Part I: Microfluidic Platforms - Shortcut to a Product

Session Chair: Claudia Gärtner, microfluidic ChipShop GmbH

14:20	*Microfluidic Platform - Starting Halfway to the Finish Line* **C. Gärtner**, microfluidic ChipShop GmbH
14:40	*Speed-Up from the Fabrication End - Approaches for a Quick Turnaround* **F. Schmieder**, Fraunhofer IWS
15:00	*Open Platform for Microfluidic Multi-Organ-wSystems* **S. Wölf**, Heidelberg University
15:20	*Integrated Preparation of Biological Samples for Faster Diagnostics* **A. Michanek**, AcouSort AB
15:40	*Supply Chain Issues for Microfluidics* **R. Utz**, Te connectivity
16:00	*Microfluidic Multi-Organ-Platform* **H. Erfurth**, TissUse GmbH
16:20	End of Session

COMPAMED HIGH-TECH FORUM by IVAM.

Hall 8a, Booth G40

Current program at:
https://www.ivam.de/events/compamed_high_tech_forum_2022

THURSDAY 17. NOVEMBER

Microfluidic Session Part II - Microfluidics: The Bits and Pieces to make-up a System

Session Chair: Claudia Gärtner microfluidic ChipShop GmbH

10:20	*Bead Based Multiplex Assays for Serology and Antigen Detection of SARS-CoV-2* **Dr. T. Schumacher**, Institut Virion\Serion GmbH
10:40	*µTAS for Automatic Readout of Diagnostic Microbeads in Multiplex Diagnostics* **G. Meineke**, Fraunhofer ILT
11:00	*Micro Annular Gear Pumps and Systems - For Continuous Applications with Low Pulsation Requirements* **R. Ehret**, HNP Mikrosysteme GmbH
11:20	*Where Photonics Meet Microfluidics – Challenges and Opportunities for Consumables in Glass* **T. Bauert**, IMT Masken und Teilungen AG
11:40	*Advanced Methods for the Production of Next Generation Flow Reactors Out of Glass* **K. Kadel**, MMT GmbH
12:00	*Advanced Control in Microfluidics* **J. Watson**, LEE Ventus
12:20	*Analytic & Diagnostic Solutions for Biotech Applications Enhanced by High-Efficient Active Microfluidics* **F. Siemenroth**, Bartels Mikrotechnik GmbH
12:40	*Optical QC-Technologies for Microfluidic Devices* **Dr. U. Marx**, MABRI.VISION GmbH
13:00	*New Generation of Piezo-Electric Micro-Valves & Pumps* **Dr. A. Shabanian**, muVaP GmbH
13:20	*Integrated Microfluidic Chips: New Opportunities for MedTech Manufacturers in Pursue of Miniaturization at Volumes Production* **R. Mutton**, FEMTOprint SA
13:40	*Injection Molding of Fused Silica Glass for Next Generation Medical Solutions* **Dr. F. Kotz-Helmer**, Glassomer GmbH
14:00	*Design-your-Lab: How to Efficiently Puzzle your Microfluidic Building Blocks* **C. Gärtner**, microfluidic ChipShop GmbH
14:20	*Design-your-Lab: How to Efficiently Puzzle your Microfluidic Building Blocks - Hands-On Session* **Various Exhibitors**
14:50	End of Session

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IVAM Product Market
High-tech for Medical Devices

November 14 - 17, 2022 • Hall 8a, F19, F29, F35, F39, G19, H19, H23, H29

AEMtec GmbH
Berlin, DE
G19.4

Art of Technology AG
Zürich, CH
F19.2

Beutter Präzisions-Komponenten GmbH & Co. KG
Rosenfeld, DE
H23.3

CiS Forschungsinstitut für Mikrosensorik GmbH
Erfurt, DE
H23.4

CorTec GmbH
Freiburg, DE
H19.5

EPIC (European Photonics Industry Consortium)
Paris, FR
F35.5

ES SYSTEMS
Athens, GR
F29.6

FISBA AG
St. Gallen, CH
G19.7

Fraunhofer Institute for Electronic Nano Systems ENAS
Chemnitz, DE
G19.5

Fraunhofer Institute for Laser Technology ILT
Aachen, DE
F19.5

Fraunhofer Institute for Microelectronic Circuits and Systems IMS
Duisburg, DE
G19.2

Hahn-Schickard
Villingen-Schwenningen, DE
F29.4

HNP Mikrosysteme GmbH
precise pumps - smart solutions
Schwerin, DE
F29.5

IMT Masken und Teilungen AG
Greifensee, CH
G19.1

Innovative Sensor Technology IST AG
Ebnat-Kappel, CH
H29.1

IVAM Microtechnology Network
Dortmund, DE
F29

JENOPTIK
Jena, DE
H19.1

JePPIX
Eindhoven, NL
F35.5

Jobst Technologies GmbH
Freiburg, DE
H29.1

LEE Ventus
(formerly TTP Ventus)
Cambridge, GB
H23.6

LightFab GmbH
Aachen, DE
F19.8

MABRI.VISION GmbH
Aachen, DE
H29.5

MABUCHI MOTOR CO., LTD.
Frankfurt am Main, DE
H23.7

Mabuchi Motor Electromag SA
Ecublens, CH
H23.7

MedPhab - 1st European Pilot Line for Photonic Medical Devices
Oulu, FI
F35.1

Microon GmbH
Hannover, DE
H29.4

Micro Systems (UK) Limited
Warrington, GB
F19.7

Microdul AG
Zürich, CH
F19.4

mikrop ag
Wittenbach, CH
F29.3

mIQu - coordination office for professional training in micro-technology, Dortmund, DE
F35.8

MMT GmbH
Siegen, DE
H29.7

muVaP GmbH
Schallstadt, DE
H19.3

NanoVoxel GmbH
Vienna, AT
F35.4

Optiprint AG
Berneck, CH
H19.4

PhotonHub Europe
Brussels, BE
F35.5

PI Ceramic GmbH
Lederhose, DE
H23.1

Sensirion AG
Stäfa, CH
H19.7

Specialty Coating Systems
Pliezhausen, DE
F19.1

Statice
Besançon, FR
F29.1

SUSS MicroOptics
Hauterive, CH
H19.6

SwissOptic AG
Heerbrugg, CH
H19.1

TE Connectivity - IVD Solutions
Mondragon, ES
H29.2

temicon GmbH
Dortmund, DE
H29.8

Textilforschungsinstitut Thüringen-Vogtland e.V.
Greiz, DE
G19.6

UpNano GmbH
Vienna, AT
F35.4

VICI AG International
Schenkon, CH
H23.5

Zünd precision optics ltd.
Diepoldsau, CH
F29.3

G40
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H29
H29.4 Microon	H29.5 MABRI. VISION
Storage	Meeting Room
H29.2 TE Connectivity	H29.7 MMT
H29.1 Jobst Technologies & IST	H29.8 temicon

H23
H23.4 CiS Forschungs-institut	H23.5 VICI AG International
H23.3 Beutter	H23.6 LEE Ventus
Storage	H23.7 Electromag & Mabuchi Europe
H23.1 Physik Instrumente	

H19
H19.4 Optiprint	H19.5 CorTec
H19.3 MuVaP	H19.6 SUSS MicroOptics
Storage	H19.7 Sensirion
H19.1 Jenoptik & SwissOptic	

F39
Storage

F29
F29.1 Statice	Meeting Room	F29.3 Mikrop & Zünd precision optics
IVAM BUSINESS LOUNGE		
F29.6 ES SYSTEMS	F29.5 HNP Mikrosysteme	F29.4 Hahn-Schickard

G19
G19.1 IMT Masken und Teilungen	G19.2 Fraunhofer IMS	Storage	G19.4 AEMtec
G19.7 Fisba Optik	G19.6 TITV		G19.5 Fraunhofer ENAS

F19
F19.1 Specialty Coating Systems	F19.2 Art of Technology	Storage	F19.4 Microdul
F19.8 LightFab	F19.7 Micro Systems UK	Storage	F19.5 Fraunhofer ILT

F35
F35.8 mIQu	F35.1 MedPhab
Storage	Storage
F35.5 EPIC	IVAM Office
	F35.4 NanoVoxel & UpNano

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November 14-17, 2022, Düsseldorf, DE
Product Market "High-tech for Medical Devices" and „COMPAMED HIGH-TECH FORUM" in Hall 8a, F29 (IVAM Lounge)
https://www.ivam.de/events/compamed_2022

CMEF 2022 (postponed date)
November 23-26, 2022, Shenzhen, CN
Asia Pacific's leading medical industry platform
https://www.ivam.de/events/cmef_2022_postponed_date_

Mid-Week Coffee Break - November 2022
November 23, 2022, online
Virtual technology talk between IVAM Members,
the host is TDC Corporation with Chisato Maeda
https://www.ivam.de/events/mid_week_coffee_break_november

Get to know IVAM!
November 23, 2022, online
Information event about the network and
the benefits of membership
https://www.ivam.de/events/get_to_know_ivam_november2022

IVAM Focus Group Marketing
November 29, 2022, Dortmund, DE
Audio content for corporate communications & marketing
https://www.ivam.de/events/ivam_focus_group_marketing_1122

QuApps 2022
December 6+7, 2022, online
2nd International Conference on Applications of
Quantum Technologies
https://www.ivam.de/events/quapps2022

Get to know IVAM
December 14, 2022, online
Information event about the network and
the benefits of membership
https://www.ivam.de/events/get_to_know_ivam_december2022

Mid-Week Coffee Break - December
December 21, 2022, online
Virtual technology talk between IVAM Members,
the host is Microrelleus, S.L. with Raúl Garcia
https://www.ivam.de/events/mid_week_coffee_break_december

MD&M West 2023
February 7-9, Anaheim, CA, US
Medical Design & Manufacturing - IVAM presents
Micro Nanotech Area in Hall C
https://www.ivam.de/events/md_m_west_2023

W3+ Fair 2023
March 29+30, Wetzlar, DE
Networking fair for optics, microtechnology and
precision engineering
https://www.ivam.de/events/w3_fair_2023

IVAM Hightech Summit 2023
May 3+4, Bochum, DE
Microtechnologies for a Smart World
https://www.ivam.de/events/ivam_hightech_summit_2023

IVAM Annual General Meeting 2023
May 3, Bochum, DE
with Evening Event
https://www.ivam.de/events/ivam_annual_general_meeting_2023

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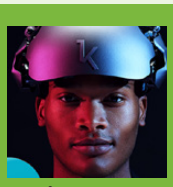
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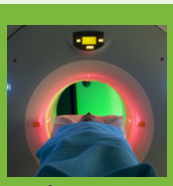
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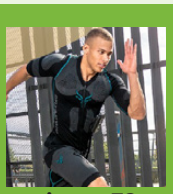
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