



## Microtechnology in France

Céline Bouafia

In 2004, France initiated a new industrial policy in order to respond to an increasingly competitive world economy. In that aim, regional focused “Pôles de Compétitivité” (Competitiveness Clusters) were created with a view to foster innovation and increase growth and employment of leading markets.

This is the reason why the Burgundy-Franche-Comté region, birthplace of the watchmaking industry since the 17<sup>th</sup> century, has become the national reference regarding microtechnology, and why the Pôle des Microtechniques (PMT), the French Microtechnologies Cluster, was created in Besançon in 2005. Microtechnology business fields in France can be divided into five specific axes.

### Business fields in France

The microtechnology processes’ value chains are the ones usually associated with subcontracting with a strong ability to export, a particularly onerous movable and immovable infrastructure along with a horizontal development strategy. Micromanufacturing develops a Bottom-Up approach by the implementation of clean rooms hy-

#### Burgundy-Franche-Comté region is:

A promising environment in Burgundy-Franche-Comté:

The TEMIS science park in Besançon has 250ha dedicated to microtechnologies and health.

MICRONORA, the microtechnologies and precision international fair in Besançon.

#### Industry:

More than 400 companies identified in the microtechnology field, of which 95% are SMEs.

12,000 employees for €1.4 bn turnover

Source: Pôle de Compétitivité des Microtechniques/ Annuaire du pôle

## | Focus: Micro and Nano Industry in France |

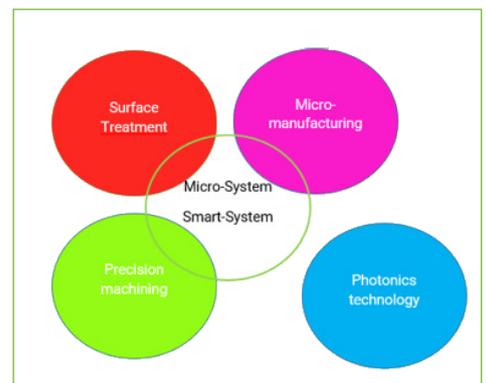
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conventional dry or wet processes and at the micro-nano scale with, for instance, nano-composite materials coating deposition or micro-nano surface structuration.

Microsystems are characterized by the combination of multiple R&D expertise, in processes and in the ability for companies to manage strong subcontracting in numerous specialties. Microsystems are everywhere but require a commercial organisation as well as strong communication in order to address all potential markets.

These five axes are set in the European context of “key technologies”: Photonics technology, advanced materials and advanced manufacturing systems. ➔



#### Burgundy-Franche-Comté region is:

- 1<sup>st</sup> microtechnology region
- 1<sup>st</sup> watch making region
- 1<sup>st</sup> eyewear manufacturer
- 3<sup>rd</sup> surface treatment region

(Source: ARD FC)



Location of the Burgundy-Franche-Comté region in France. Source: Regional Council

bridization technologies. These technologies make it possible to develop microsystems and help heterogeneous integration of components in order to create multi-functional and multi-technologies products.

High precision manufacturing mainly exploits the Top-Down approach. The issue is to bring support to the so called “traditional or conventional” manufacturing technologies, in order to push the current limits in terms of precision, miniaturization and machining of new materials.

The surface treatment industry remains a major activity, particularly in the Franche-Comté area. Like its clients, the industry is committed in a partial concentration movement, a measured relocation and is seeking to expand its productivity as well as the quality of its products.

In France, innovation is supported by research programs along with a strong and open University environment. As for the previous axes, surface treatment is used at different scales: at the “macro” scale with

**Focus: Micro and Nano Industry in France**



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

On the first pages you will find a general view on the French high-tech sector, provided by IVAM's Network Partner Organization Pôle des Micro-techniques (PMT).

IVAM supports members worldwide concerning export issues, provides country-specific information, organizes delegation tours and initiates business-to-business contacts at trade shows and conferences like Health Business Connect. IVAM started the cooperation with PMT in 2016, when both partners cooperated to organize the first 'Health Business Connect – Micro & Nano MEETS Medical Innovation' event in Besançon. Please find more information about last years event and the upcoming conference on page eight.

Digitalization is a hot topic in Europe. A report on the challenging concept of "Industrie du Futur" in France, provided by the French-German Chamber of Industry and Commerce, can be found on page five.

On page six the company CG.tec introduces its micro injection-molding technology that enables highly precise polymer parts for different applications.

The French SME STATICE specializes in tailor-made devices for the medical industry and presents on page seven successful research projects that help to enable early cancer diagnoses.

I wish you a pleasant reading!  
Best regards

Mona  
Okroy-Hellweg




Assembly of a DIXI microsystem  
Source: PMT

Their development draws on a national and European ecosystem. Connections already exist with European Technology Platforms (EPOSS, MINAM, EURIPIDES and MANU-FUTURE), which provide the ability to be in tune with regional and European needs, therefore allowing to promote companies' internationalization.

**Pôle des Microtechniques**

PMT has targeted its business fields by focusing on the main activities of Burgundy-Franche-Comté's companies, to answer their needs efficiently. Moreover, PMT's actions match not only with the region's strategic priorities, but also with the ones at national and European levels.

The major PMT markets are the following:

- Luxury industry (watchmaking, jewelry, silverware, leatherwork)
- Health industry

- Aeronautics, space and defense industry
- Land transports industry

Microtechnologies add value on each of these markets, bringing answers to high stakes as, for instance: the structures' lightening and protection against corrosion or abrasion in a regulatory restricted environment in the aeronautics sector, as well as in high precision manufacturing and micromanufacturing of components and watch movements in new materials.

The control of skills in microtechnology and in multitechnology in very small dimension naturally find their applications in the health sector and more specifically in implants and prosthesis, material and medical-surgical equipment, combined (or frontier) medical devices technology and advanced therapy medicinal products.

In order to support the development of the health and aeronautics, space and defense industry sectors in Burgundy-Franche-Comté, two clusters were created, led by PMT: Innov'Health and AEROµTECH. The aims of the two cluster are also to gather the local players in order to represent them on the best manner, collect their needs and help them to create and to grow their businesses. These two clusters also lead to create more projects, elaborate technological performances and remain at the cutting edge of competitiveness for the region's companies. ➔

**Imprint**

»inno«  
Innovative Technologies – New Applications

**Published by:**  
IVAM e.V.  
Joseph-von-Fraunhofer Straße 13  
D- 44227 Dortmund

**Editors:**  
Mona Okroy-Hellweg  
Iris Lehmann  
Dr. Thomas R. Dietrich

**Contact:**  
Mona Okroy-Hellweg  
Phone: +49 231 9742 7089  
Email: mo@ivam.de



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Source: alcis.net

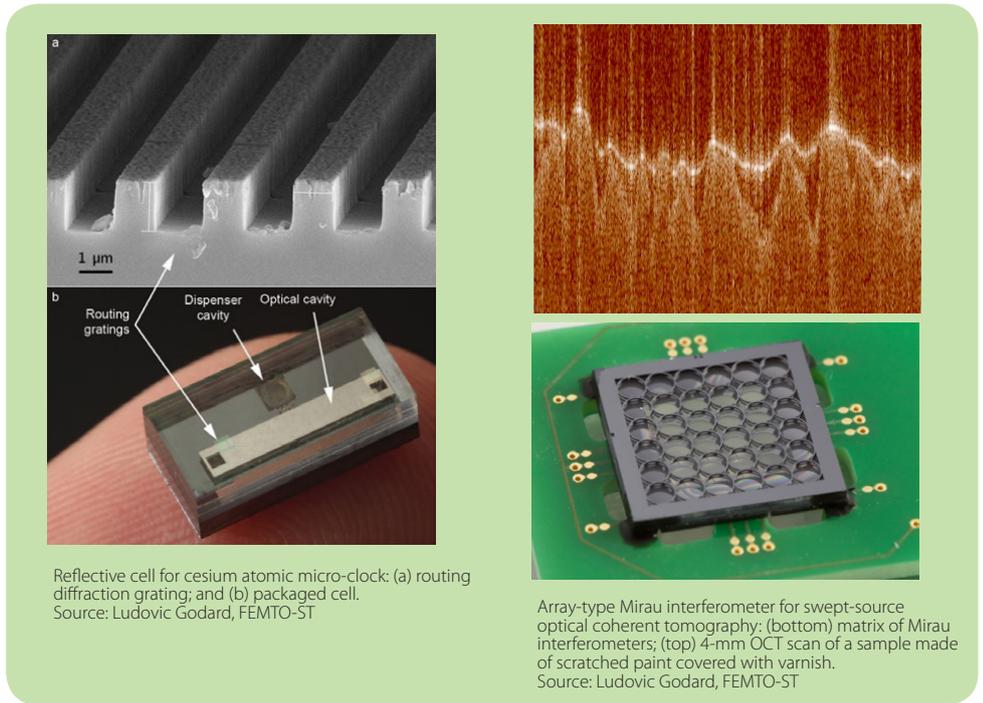
PMT is a founding member of MICROTCHNICS ALLIANCE, which federates Minalogic (F), MicroTEC Südwest (D) and Micronarc (CH) clusters. Synergies exist between the offers of these four territories. They cover the whole microtechnology value chain. It is particularly the case for the smart systems development that gathers specific needs, data processing, information analysis and power management.

The MICROTCHNICS ALLIANCE objectives are mainly to expand networks for the benefit of companies, initiate partnerships within the four regions, develop new technology projects, create new business opportunities, and strengthen international microtechnology visibility.

The cluster team members work in close collaboration with European structures, such as technology platforms which gather companies and academic structures. Furthermore, the organization of conferences, congresses, business meetings and answers to call for proposals allow companies to meet with each other and to identify complementary skills.

**FEMTO-ST institute:  
from academic research to industry**

The French landscape of academic micro-nanotechnology platforms is organized by the CNRS (a worldwide leading French institution for academic research in all scientific areas) within a network, called RENATECH, formed by 5 technology centers attached to five CNRS-affiliated academic labs, each of which being specialized: C2N in Paris, with III-V and silicon nanophotonics, devices and circuits for spintronics, and optoelectronic devices, LAAS in Toulouse, with system integration (energy, photonic and RF), micro-nano-systems for health biology and environment, IEMN in Lille, with III-V micro-nano-opto-electronics and MEMS (micro-nano-electromechanical systems), LTM in Grenoble, with silicon nanoelectronics and spintronic devices and FEMTO-ST in Besançon, with micro-nano-acoustics, micro-nano-optics and MOEMS (microopto-electro-mechanical systems). Beyond the academic research activities, these technological platforms are largely open to industrial collaborations for the development of new process and products requiring the technological facilities operated by these academic centers, whether through subcontracting of the development, or through direct operation by industrial partners.



Reflective cell for cesium atomic micro-clock: (a) routing diffraction grating; and (b) packaged cell.  
Source: Ludovic Godard, FEMTO-ST

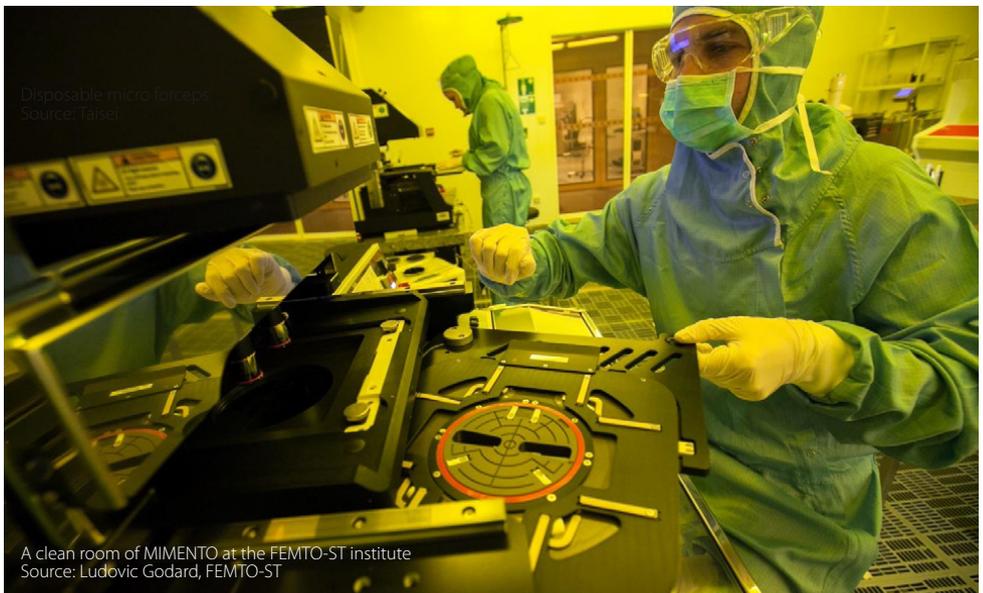
Array-type Mirau interferometer for swept-source optical coherent tomography: (bottom) matrix of Mirau interferometers; (top) 4-mm OCT scan of a sample made of scratched paint covered with varnish.  
Source: Ludovic Godard, FEMTO-ST

To illustrate such fruitful interactions between academia and industries through micro-nanotechnology platforms, a few projects related to the FEMTO-ST public research institute in Besançon, next to the microtechnology competitiveness cluster of the same city, PMT (pôle des microtechniques) are presented here.

FEMTO-ST is a joint research institute between CNRS, the University of Franche-Comté, the engineering institute ENSMM, and the University of Technology Belfort-Montbéliard. Created in 2004 as a merging of the academic labs of the Franche-Comté Region in the broad area of engineering sciences (with a high multidisciplinary profile in microsystems, optics, microwave, applied

mechanics, micro-robotics, computer science and energy science), it has reached today a size of about 800 members, constituting one of the biggest CNRS-affiliated institute in this area. It has a strong dedication to technology and experimental know-how, partly through its micro-nano fabrication platform MIMENTO which is one of the five centers of the French RENATECH network.

The spin-off *frec|n|sys*, created by a former CNRS researcher at FEMTO-ST, is an example of a company operating a pilot line at MIMENTO, for the design, the fabrication, and the commercialization of advanced SAW (surface acoustic wave) and BAW (bulk acoustic wave) devices, such as filters for telecommunication applications. ➔



Disposable micro forceps  
Source: Label

A clean room of MIMENTO at the FEMTO-ST institute  
Source: Ludovic Godard, FEMTO-ST

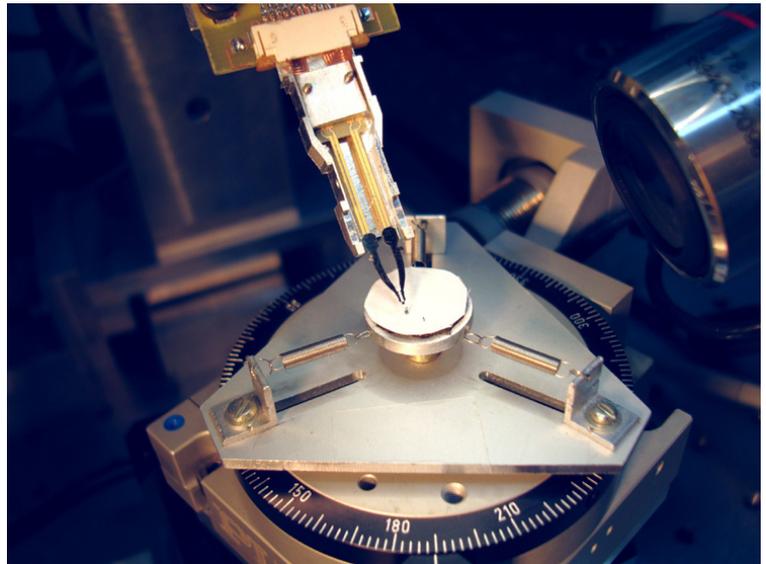


Another spin-off company Silmach, in the field of MEMS devices for innovative hybrid integrated sensors, is closely collaborating with the FEMTO-ST institute together with frec|n|sys and another local spin-off Percipio Robotics in micro-robotics, on novel processes and products based on silicon MEMS technologies involving deep silicon plasma etching, in the framework of a regional smart specialization strategy project called 3S-MEMS.

Another example is the flagship multi-disciplinary project of the FEMTO-ST institute between the RF metrology Dpt and the micro-nano-system Dpt, dedicated to the design of the first EU integrated micro atomic clock. This 12 years project is now in the phase of a technology transfer to an industrial partner for the last step of a scale production phase of the product, which is bringing to the market, through patented technologies, significantly improved performances compared to the only other product commercially available, from the US.

Several other projects are currently under development on the research side, waiting soon for maturity and industrial transfers,

among which one has a low cost miniaturized OCT (optical coherence tomography) microscope for early skin cancer detection, or SPR (surface plasmon resonance) chips for compact and fast proteomic analysis.



Percipio Robotics  
Source: PMT

**Pôle des Microtechniques, Besançon, FR**  
<http://www.polemicrotechniques.fr>

**Pôle de Compétitivité des Microtechniques**  
Temis Innovation - Maison des Microtechniques  
18, rue Alain Savary - 25000 Besançon  
Tél. : +33 (0)3 81 40 47 55 / Fax : +33 (0)3 81 40 47 59  
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## Digitalization in France is on the rise

Alexandra Seidel-Lauer

In Germany they call it “Industry 4.0”, in France “Industrie du Futur”, but the idea is the same: they both support industry in its development towards digital and the internet of things. The objectives and challenges in France and Germany differ from each other while at the same time complementing each other.

### Industry 4.0

With the Industry 4.0 concept, Germany wants to maintain the technological and competitive lead of its factories, while tackling the country’s unfavourable age profile. For France, the main priority is making up for lost time in industrial investment. In Germany, the process is supply-orientated: machine manufacturers and automation solution providers are developing and offering technologies to complete the digital transition. In France, on the other hand, it is driven by demand from users wanting to modernize their manufacturing facilities to stay competitive.

### France’s digital strengths

The fit between the processes in France and Germany might therefore seem to amount to no more than a customer-supplier relationship. But that would be overlooking France’s digital strengths: major technological innovations as well as powerful and highly-regarded software. The importance of digital in France is even reflected in the name of the authority dealing with it – the Ministry of the Economy, Industry and Digital – which is not the case in Germany.

### French SME open up to digitalization

Small and medium-sized businesses in particular have opened up to digitalization in France over the past few years. In fact, more than every second company has already created a strategy for this. A quarter of the companies are already using production machines that communicate with each other. According to experts, over the next three years, numerous companies will seize the opportunity to increase the efficiency of production, either by means of collaborating robots, additive manufacturing processes, augmented reality, the recording and processing of large amounts of data (“big data”) or fully automated factory logistics. Last year, the Innovation Center for Operations (ICO) was opened in the technology centre of Saclay southeast of Paris; the goal of which is to assist French industrial businesses during the introduction of new technologies. Companies expect innovative manufacturing processes to bolster productivity, increase competitiveness and improve customer orientation.



### French start-up scene

The start-up scene in France is very active. Highly conducive financing opportunities and infrastructures have turned Paris, alongside Berlin and London, into a stronghold for European start-ups. A numerous amount of public and private subsidy programmes, new business centres and financing opportunities are all aimed at helping French start-up companies successfully establish themselves on the market. The “Grandes Ecoles” and larger companies have their own incubators and large groups such as Renault, Air Liquide, Total, GDF-Suez, la SNCF, BNP incorporate start-ups in their business centres. The most popular business areas for start-ups are e-commerce, followed by software/high-tech, internet services, social networks and media.

The topics of digitalization and start-ups is a main focus of the French-German Chamber of Industry and Commerce (AHK France). In May of last year, AHK France hosted the first German-French Day of “Industry 4.0 / Industrie du Futur” in Paris. This symposium provided ten German actors in this branch with the opportunity to showcase in France. Martina Mousseau, head of the AHK France office in

Berlin, explains how to successfully enter the French market: “Contacts are very important in France. We can assist in finding the right local partner.” In addition, sometimes it makes sense to establish a representative office in France, in order to be closer to customers as well as partners. That is why AHK France offers German companies support such as sales assistance and relocation services.

As part of start-up programs, AHK France brings together German start-ups with French experts and multipliers. “We help German start-ups by providing information for example about the market, cost structures and locations,” explains Julia Hesselbach, who works as a Digital Economy Manager. The digital landscape and start-up scene, in addition to the legal and tax situation varies greatly in Germany and France. Not to mention the intercultural differences as well. Therefore, in order to help companies successfully enter the French market, AHK France provides support as an experienced and knowledgeable partner.

French-German Chamber of Industry and Commerce  
[www.francoallemant.com](http://www.francoallemant.com)



## Precision in details for injection-molded parts

Claire Flipo

What do lab-on-chips, seats for solenoid valves, isolators for connectors or impellers for fuel pumps have in common? They are all made in polymers out of precision injection-molding and they bear small features. Addressing the challenges of miniature parts is the daily business of CG.Tec injection, founded 20 years ago with this specific target.

### Mold making: a key success factor...

How to inject parts that are smaller than a plastic pellet and weigh less than a milligram? Although micro-injection machines are now available on the market, the plastic processing technology is not the only success factor. Tool construction is of the utmost importance as well. Designers usually face a dilemma when they consider placing the injection gate, ejectors, the parting line and vents on the tiny part surfaces – all the more as some surfaces are functional and should bear no mark from the manufacturing process. The experience of the mold designer plays a key role in the part quality.

As finding mold-makers for precision parts on the French territory has become a pain, CG.TEC has integrated mold-making as a service to customers. The company is meanwhile equipped with high-precision EDM means and micro-milling centers, so as to achieve multiple cavity molds with very low dimensional dispersion.

### ...for precise and miniature features

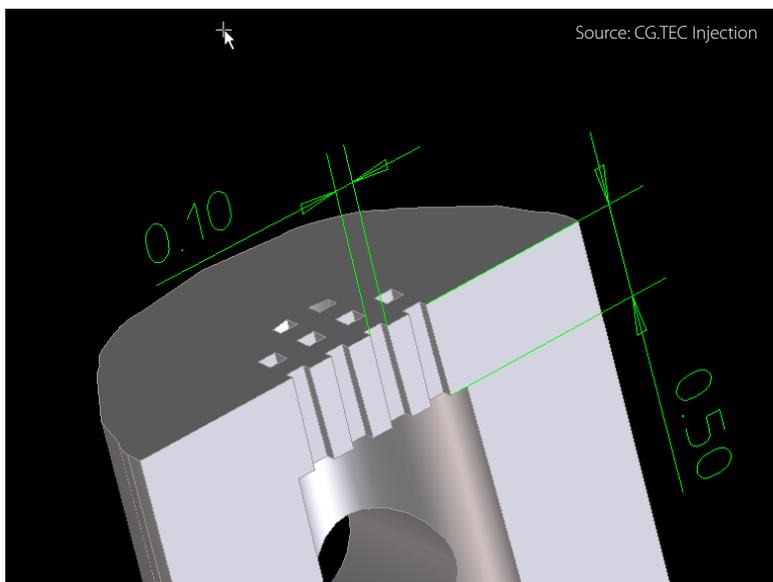
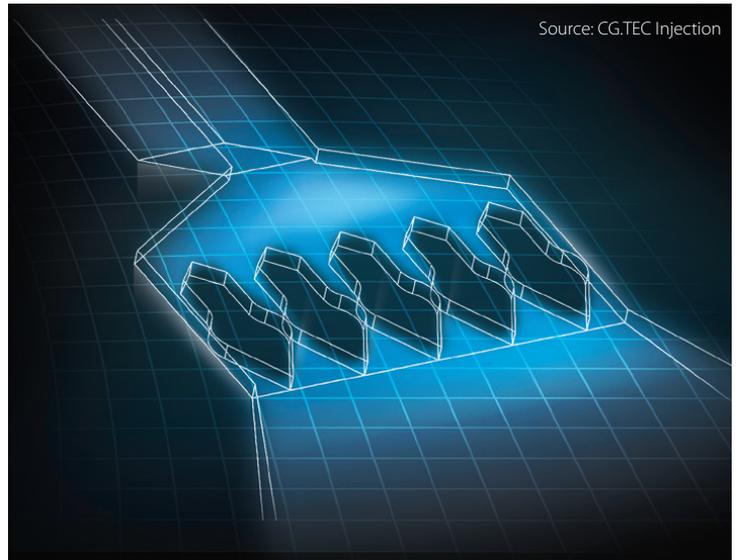
However the trend for miniaturization has some limits for the molds, plastic behavior and metrology: traditional molds are assembled with 5-10  $\mu\text{m}$  total gap in the best case. Combining the mold precision and the polymer shrinkage upon injection-molding makes it difficult to achieve tolerances below

15  $\mu\text{m}$ . All the more as measurement means have their own precision. 3D measurement machines, wherever applicable, have precisions of 1.5-3  $\mu\text{m}$ .

When it comes to micro-features, CG.TEC is in a position to manufacture parts with filtration channels measuring a few micrometers. It operates a 16 cavity-mold for a PEEK pin with through holes of 1/10 mm, each one spaced by 1/10 mm. In a number of projects the company also achieved PEEK tubes and parts with thicknesses of 2/10 mm. Another example: in the framework of the national research project CONPROMI, channels measuring 7  $\mu\text{m}$  over a height of 50  $\mu\text{m}$  were obtained in a Lab-on-chip. This success was rewarded by a golden micron at the 2014 Micronora exhibition in Besançon.

### The automation level being part of the quality

Since CG.TEC transferred its production in own premises in 2011, the company has carried out a heavy investment plan with the



latest electrical injection machines equipped with 6 axis robots. The trend to target 0 ppm for large scale automotive products has paved the way for automated online controls with cameras and handling robots. Where injection-molding was the only

know-how of CG.TEC in the late 90s, it has integrated a multi-disciplinary team to offer quality parts and added value.

The company, who celebrates its 20<sup>th</sup> anniversary in 2017, locates in the French micro-tech region, on the border to Switzerland. This territory, named Franche-Comté, historically produced watches and has a strong industrial know-how focused on precision parts. Manufacturing operations were carried out on a private level, when farmers produced toys or glasses at home during winter time. Sub-contracting has meanwhile become a source of revenue for companies, who take advantage of their international location. CG.TEC strongly benefits from this setting at the cross-roads of European development centers like Lausanne, Grenoble and South Germany.

CG.TEC Injection, Frasné, FR  
<http://www.cgtec.eu/>



## Tailor-made devices for the medical industry

Anne Legain

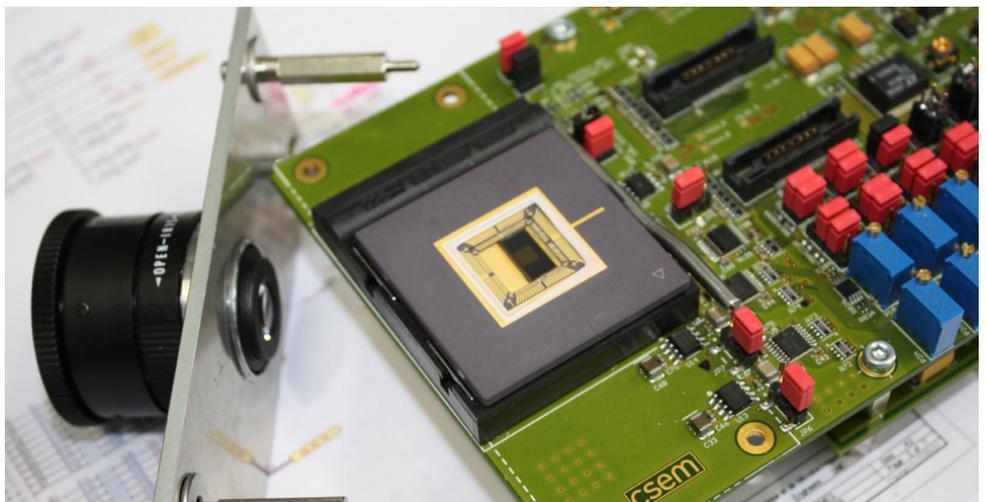
Certified ISO 9001 and ISO 13485, the French SME STATICE specializes in tailor-made devices for the medical industry with a long-term expertise in mechatronics and electronics, as well as in the integration of MEMS (micro-electro-mechanical systems).

Within this expertise, the company develops automated systems, which can manage fluidics, thermal conditions, and data for traceability. The very experienced engineers in the R&D department of the company work on microelectronics and develop software for man-machine interfaces (HMI). STATICE is an efficient partner for the development of the electronic and mechanical interfaces with MEMS/MOEMS, can integrate them in the prototype and produce the resulting product in its own facilities in Besançon/France.

### Research project VIAMOS enables early diagnosis of skin cancer

For more than 25 years, the company has been regularly involved in European research projects. A recent example for the integration of MEMS is the four year FP7 European research project VIAMOS (Vertically Integrated Array-type Mirau-based OCT System) for early diagnostics of skin cancer. The aim of this project was to develop a handheld, low-cost and multifunctional OCT microsystem enabling doctors to perform a painless and earlier detection of skin pathologies. In this project, STATICE provided the concept of system integration, the design of the instrument platform, the system integration of the OCT system at the hardware level and the software control.

The engineers working in the project developed the stitching system of the prototype based on the flexure technology. They integrated and assembled the different components delivered by the other partners of the consortium in order to build the prototype. This prototype is an OCT micro-system with the following components: 3-D packaged micro-optical and MEMS wafers, illumination system, high speed camera, the control electronics, the positioning



High speed imager, Source: FEMTO-ST

system for stitching motion and the software module.

### Research project ESOTRAC focuses on an optoacoustic endoscope for diagnosis of esophageal cancer

The company has also long-term experience in R&D and production of customized catheters and single-use endoscopes with cameras and working channels for the introduction of catheters or instruments for surgery. With this expertise, STATICE recently joined the consortium of the European research project

ESOTRAC (Hybrid-optical and optoacoustic Endoscope for esophageal tracking) which aims to develop a novel optoacoustic endoscope for early diagnosis of esophageal cancer.

Within the 5-country team, STATICE will participate in the development of an innovative endoscope that combines sensing of pathophysiological tissue signatures resolved by multi-spectral optoacoustic (photoacoustic) tomography (MSOT) with morphological disease signatures provided by optical coherence tomography (OCT). The resulting system will operate in label free mode and, due to its tomographic ability, visualize sub-surface tissue features, providing superior information of the esophageal wall compared to conventional video endoscopes.



STATICE Innovation, Besançon, FR  
<http://www.statice.com>

European research project VIAMOS: stitching system  
Source: STATICE



## Health Business Connect 2017

### Micro & Nano MEETS Medical Innovation

For the second time the IVAM Microtechnology Network, in cooperation with the French partner Pôle des Microtechniques, is going to organize the "Health Business Connect – Micro & Nano MEETS Medical Innovation" on July 5-6, 2017, this time in Dortmund, Germany.



The main focus of the Health Business Connect is furthering cooperation between component manufacturers and medical device manufacturers from Germany, France and other countries as well as joint projects, experience exchange and potential opportunities for cooperations. In addition to organized business meetings, there will be interesting keynote lectures as well as a networking lunch for further exchange among the participants.

The event is aimed at medical technology companies on the entire value chain: technology developers, component manufacturers, software, test and analysis businesses and medical device manufacturers.

The Health Business Connect 2017 will be linked to the Dortmund MST Conference, which will take place on the day before, July 5, 2017. At the conference, which is under the motto „Individualized Healthcare Solutions“, international experts from companies and research institutes will present technical trends for individualized medicine and healthcare.

The participants of the Health Business Connect are welcome to attend the MST conference free of charge. On the evening of July 5, there will be

an accompanying program with a city tour and networking dinner, in which the participants of both events can get together and network.

The first Health Business connect was organized by IVAM Microtechnology Network and Pôle des Microtechniques (PMT) as a two-day meeting for companies from the high-tech sector with the focus on medical technology, in Besançon in Summer 2016. The purpose of the event was the international promotion of cooperation between manufacturers of components and devices, software companies and other companies from the field of medical technology and possibilities for entering the medical technology market.

The first day was dedicated to the cooperation of manufacturers of components and medical devices. Questions like “What kind of data distributors have to share with their clients and what kind of data can be held back for the protection of proprietary know-how?” were central. Renowned device manufacturers like Karl Storz or Molex discussed their various viewpoints with component manufacturers like AEMtech, Jenoptik or Staticce. Besançon is a center of the French microtechnology industry, the venue of France’s biggest microtechnology trade fair MICRONORA and the location of the well-known research institute for microtechnology femto-st, which is located at the technology center temis, where the event Health Business Connect took place.

After the discussion of principal questions at the first day of the event, the second day was mainly assigned to almost hundred B2B meetings between the participants.

Many companies decided to participate in Health Business Connect particularly because of



The participants of the first Health Business Connect in Besançon in Summer 2016

these meetings, which had been organized prior to the event. Due to the large demand, many further talks took place during the extensive accompanying networking program.

The participants of the event, who came from 10 countries in Asia, Europe and North America, were fully satisfied with the organization and the results of the event. Pierre Vivien (CEO of PMT) and Thomas Dietrich (CEO of IVAM) both agree: „The mixture of traditional conference, B2B meetings, company visits and networking program was the recipe for the success of this event“.

IVAM Microtechnology Network,  
[www.ivam.com](http://www.ivam.com)




**Sensirion solves long-standing stability problem in metal-oxide gas sensors**

At Sensor+Test 2017 in Nuremberg, Sensirion AG introduced the SGP – a siloxane resistant metal-oxide gas sensor with unprecedented long-term stability. The SGP gas sensor is based on Sensirion’s multi-pixel platform, which integrates four gas sensing elements into a very small 2.45 x 2.45 x 0.9 mm<sup>3</sup> DFN package featuring a fully calibrated air quality output signal. The unique combination of long-term stability and multi-pixel technology opens up new possibilities for environmental monitoring in smart home, appliances and Internet of Things applications. Thanks to its unique performance, the SGP allows the integration of metal-oxide gas sensors into mobile devices. Traditional metal-oxide gas sensors suffer from poor long-term stability including a rapid loss of sensitivity and a strong increase in response time. This degradation is caused through irreversible contamination by certain chemical compounds like siloxanes which are ubiquitous in real-life applications due to their widespread use in consumer products and production environments. Sensirion’s proprietary metal-oxide technology and multi-pixel platform provide the SGP with an unmatched robustness against these contaminants resulting in unique long-term stability and accuracy. Thus, with the SGP a reliable metal-oxide gas sensor is available.



Source: Sensirion AG

 Sensirion AG, Email: [info@sensirion.com](mailto:info@sensirion.com), [www.sensirion.com](http://www.sensirion.com)
**New process for combating germs: tailored antimicrobial coatings for surfaces**

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP is one of the leading institutions for collaborative research and development in thin-film technologies and electron-beam applications. The developed technologies are being effectively successfully employed in the fight against germs. Just recently the World Health Organization (WHO) published a list with twelve families of bacteria that are resistant to conventional antibiotics. But dangerous germs are not only found in hospitals – they are lurking everywhere. The German publication Testbild tested ten hotel rooms in Berlin and found an “exceptionally high concentration of multi-resistant Staphylococci” in eight of them. That sounds alarming. For that reason, there is not just urgent work being done on new antibiotics, but on antimicrobial coatings as well as on processes for germ reduction and neutralization on surfaces found in daily life, especially for surfaces of medical products. Scientists at Fraunhofer FEP have already been working for several years on antibacterial coatings for textile and polymeric surfaces that are highly effective yet tolerated by cells. PVD processes (physical vapor deposition) are employed for tailored and efficient coating of large areas. The scientists make use of the antibacterial effect of silver and copper, for example. In addition, the surface morphology and energetic characteristics work against bacterial adhesion. That means germs are completely unable to even begin to gather on the surface. This strategy is also used for modifying the surfaces of coatings by means of non-thermal electron-beam technology in which the adhesion characteristics of surfaces can be specifically adapted. “The precise composition and release of antimicrobial metal ions is especially important for metallic antibacterial coatings in order to ensure high effectiveness in the fight against germs while at the same time preserving compatibility with cells,” explains Dr. Jessy Schönfelder, head of the Medical Applications Group at Fraunhofer FEP. “Our know-how enables us to create a suitable ratio of components for any purpose and apply it to the surfaces to achieve modified and adapted surfaces with respect to their specific application.” The effectiveness and the mechanisms of dissolution of the antibacterial metallic ions diffusing from the coatings were investigated using Escherichia coli K12 bacteria. Cell biology experiments also demonstrated the compatibility of these coatings with human cells. The scientists are now prepared to develop tailored coatings for any kind of application instance in the fight against germs.



Antibacterial coatings from Fraunhofer FEP

Source: Fraunhofer FEP

 Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP,  
Ines Schedwill, Email: [ines.schedwill@fep.fraunhofer.de](mailto:ines.schedwill@fep.fraunhofer.de), [www.fep.fraunhofer.de](http://www.fep.fraunhofer.de)

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### Medically monitoring premature babies with cameras

A contactless and wireless camera system developed by EPFL and CSEM researchers continuously monitors premature babies' vital signs. This system could replace skin sensors, which cause false alarms nearly 90% of the time. Preliminary tests will be run shortly on newborns at University Hospital Zurich, a partner in the project. Someday soon, premature babies kept warm in neonatal incubators may be medically monitored by a camera system rather than by sensors attached to their skin. This system is about to be tested on premies at University Hospital Zurich (USZ). The underlying technology was developed by EPFL, CSEM and USZ as part of the Swiss research program Nano-Tera. The camera system was developed to improve monitoring of babies' heart rate and breathing. "Skin sensors placed on the babies' chest are so sensitive that they generate false alarms nearly 90% of the time, mainly caused by the babies moving around," said Jean-Claude Fauchère, attending neonatologist at USZ's division of neonatology. "This is a source of discomfort for the babies, because we have to check on them every time. It's also a significant stress factor for nurses and a poor use of their time – it distracts them from managing real emergencies and can affect quality of care." With the camera system, no physical contact is required. The babies' pulse is detected through their skin color, which changes ever so slightly every time their heart beats. And their breathing is monitored through movements in their thorax and shoulders. At night, infrared cameras take over, which means non-stop monitoring.



The optical system was designed by the CSEM researchers, who chose cameras that are sensitive enough to detect minute changes in skin color. They teamed up with the EPFL researchers to design algorithms for processing the data in real time. CSEM focused on respiration, while EPFL worked on the heart rate. "We ran an initial study on a group of adults, where we looked at a defined patch of skin on their forehead," said Sibylle Fallet, a PhD student at EPFL. "With our algorithms we can track this area when the person moves, isolate the skin pixels and use minor changes in the color of these pixels to determine the pulse. The tests showed that the cameras produced practically the same results as conventional sensors." University Hospital Zurich is about to test the system on premature babies. Virginie Moser, the CSEM researcher who is in charge of the set-up at USZ, said: "We plan to take measurements on as many premies as possible to see whether, under real-life conditions, the results we get from our algorithms match the data collected by the on-skin sensors." If so, the camera system could one day replace skin sensors. In addition to cutting down on false alarms, it would also be more comfortable for the babies.

CSEM Centre Suisse d'Electronique et de Microtechnique SA,  
Aline Bassin, Email: [aline.bassin@csem.ch](mailto:aline.bassin@csem.ch), <http://www.csem.ch>

### Nanoimprint is the new Hot Topic

The cooperation between temicon and Coatema Coating Machinery has revealed a brand-new R2R-Nanoimprint line. The new line allows nanoimprinting of seamless structures on rolled products up to the width of 300 millimeters for various applications. At the same time, temicon has ordered with Coatema a production line of one meter working width. This line is going to start operations in the second half of this year. "This is probably the largest production line of its kind in Europe." comments Dr. Oliver Humbach, CEO of temicon. "We are very proud having temicon on as a partner who is an absolute specialist and pioneer in manufacturing of nanoimprint structures," adds Dr. Andreas Giessmann, CEO and president of Coatema. The existing corporation under the label TEMICOAT is significantly moving ahead and now allows the manufacturing of various micrometer and sub-micrometer structures at atmospheric pressure. The scope of applications comprise e.g. lightguide structures, biomedical sensors, microfluidic, decorative and haptic surfaces.

TEMICOAT

temicon GmbH, Email: [info@temicon.com](mailto:info@temicon.com), [www.temicon.com](http://www.temicon.com)

### Optical beam guidance systems for ophthalmic lasers

SwissOptic AG – a company of the Berliner Glas Group – develops and manufactures customer-specific beam guidance systems that are used in all areas of ophthalmology. For more than ten years SwissOptic AG has supplied optical systems to big manufacturers of ophthalmic medical devices used for laser-based eye surgeries (cataract and lasik). These optical systems optimally comply with the specifications of the complete system of the customer. Due to these many years of market experience the SwissOptic experts know the physiological requirements of eye treatments and surgeries and improve the optical systems continuously. The range of solutions that SwissOptic offers in the market segment ophthalmology includes beam expansion systems, zoomable lenses to focus from cornea to lens at various depths, visual systems for the observation duct as well as optical components for OTC applications. The reliable in-house qualification and documentation of the systems guarantee high product and patient safety. SwissOptic AG is a long-term partner for its customers along the entire value chain – from concept to volume production. Further information is available at the website <http://www.swissoptic.com/medical-technology>.

Berliner Glas, Iris Teichmann, Email: [teichmann@berliner Glas.de](mailto:teichmann@berliner Glas.de), [www.berliner Glas.com](http://www.berliner Glas.com)



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