



Microtechnology in France

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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 17th 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-

| Focus: Micro and Nano Industry in France |

Content

 Microtechnology in France	1
Editorial/Imprint	2
Digitalization in France is on the rise	5
 Precision in details for injection-molded parts	6
 Tailor-made devices for the medical industry	7
Health Business Connect 2017 - Micro & Nano MEETS Medical Innovation	8
Company and product news	9
Trade shows and events	11
Subscription service	11

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.

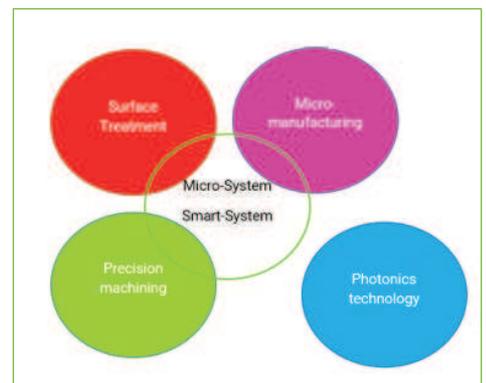
12,000 employees for €1.4 bn turnover

Source: Pôle de Compétitivité des Microtechniques/ Annuaire du pôle

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:

- 1st microtechnology region
 - 1st watch making region
 - 1st eyewear manufacturer
 - 3rd 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

Editorial

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 Microtechniques (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




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 AEROPTECH. 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

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Innovative Technologies – New Applications

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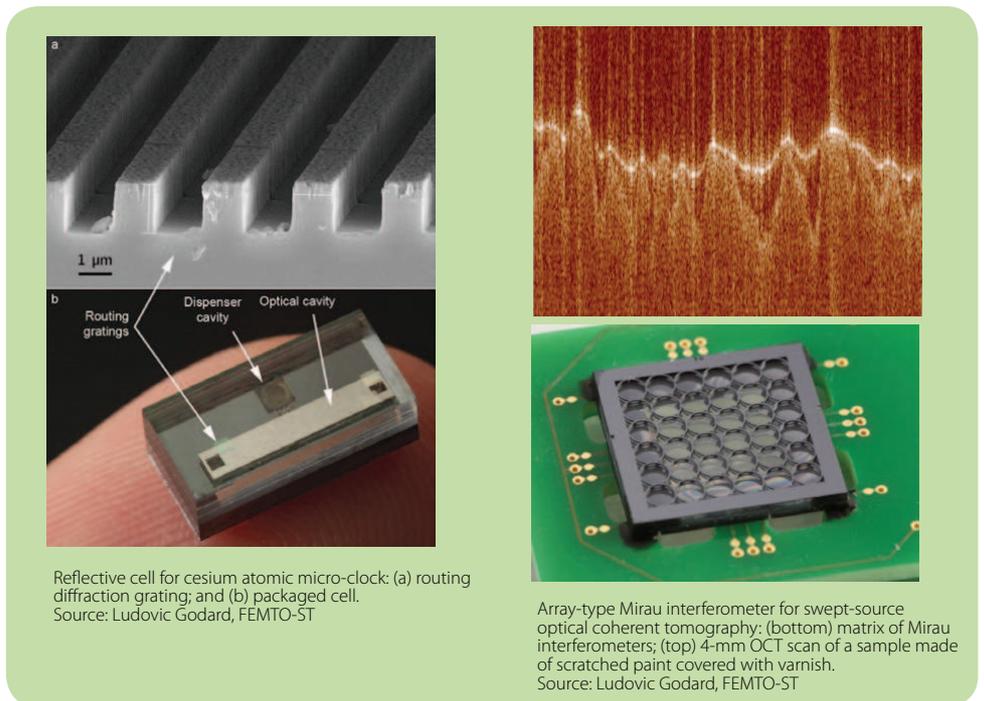
PMT is a founding member of MICROTCHNICS ALLIANCE, which federates Minalogic (F), MicroTEC Südwest (D) and Micronarc (CH) clusters. Synergies exist between the offers of these four territories. They cover the whole microtechnology value chain. It is particularly the case for the smart systems development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



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

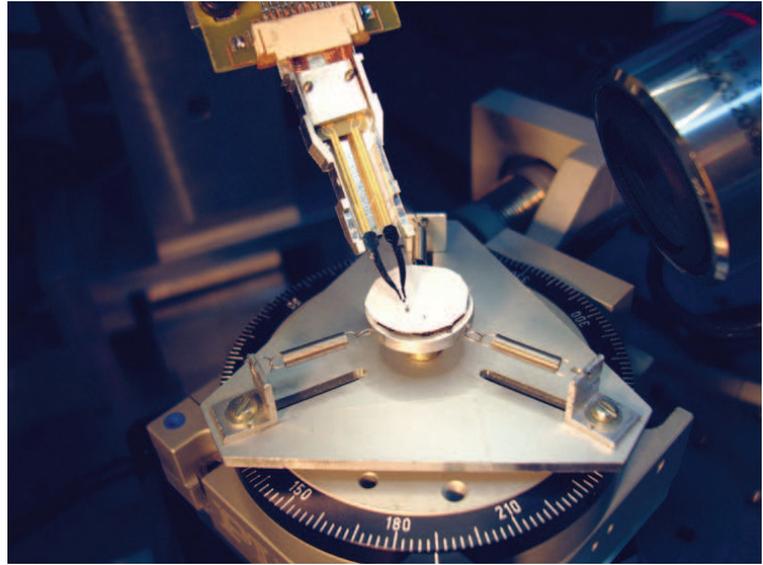


Another spin-off company Silmach, in the field of MEMS devices for innovative hybrid integrated sensors, is closely collaborating with the FEMTO-ST institute together with frec|n|sys and another local spin-off Percipio Robotics in micro-robotics, on novel processes and products based on silicon MEMS 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

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