Press Release
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LYON, France

COVID-19: Yole's analysts point out the impacts on the bioMEMS industry[1]

OUTLINES:

- The bioMEMS device market is expected to reach US$6.3 billion in 2025 with a $CAGR^{2}_{19-25}$ of 9.2%.
- Undoubtedly, healthcare is still a source of a strong interest for MEMS[3] devices.
- Is the new rule for the bioMEMS industry: one player, one MEMS device?
- The TOP 5 bioMEMS companies are manufacturers of pressure sensors and microfluidic chips, led by TE Connectivity, Amphenol and Boehringer Ingelheim…
- COVID-19 outbreak:
  After combining the positive and negative impacts, the overall bioMEMS market is expected to show a 12.4% growth from 2019 to 2020.
  The impact of COVID-19 on bioMEMS market dynamics will not be the same from one application to another.
  In the medium to long term, connected wearables and point of care medical devices should find more interest from healthcare providers thanks to the impact of Covid-19 on healthcare sector (caregivers and patient behavior).

"It is now a reality, the world, and particularly the healthcare sector, will have experienced a before, and an after, the COVID-19 outbreak." asserts **Jérôme Mouly, Senior Technology & Market Analyst and Business Developer at Yole Développement (Yole).** *"The pandemic has strongly hit the medical devices and IVD[4] sector with an impact on sales as well as on applications and usage. However, the impact is slightly different in the healthcare sector than in other domains, such as consumer or automotive markets. Moreover, it is highly application-related".* BioMEMS devices, defined as MEMS sensors and microfluidic devices integrated into medical devices and used for IVD and life sciences, are reflecting the market demand for the products in which they are integrated.
Indeed, the global bioMEMS market was worth US$3.7 billion in 2019 and is expected to reach US$6.3 billion in 2025 with a CAGR between 2019 and 2025 of 9.2% in revenue. The

[1] Extracted from:
- BioMEMS market and technology, Yole Développement, 2020
- Butterfly Network iQ CMUT Sensor, System Plus consulting, 2020
- Point-of-Need 2020 – Including PCR-Based Testing, Yole Développement
- Thermal Imagers and Detectors 2020 – COVID-19 Outbreak Impact – Preliminary Report, Yole Développement

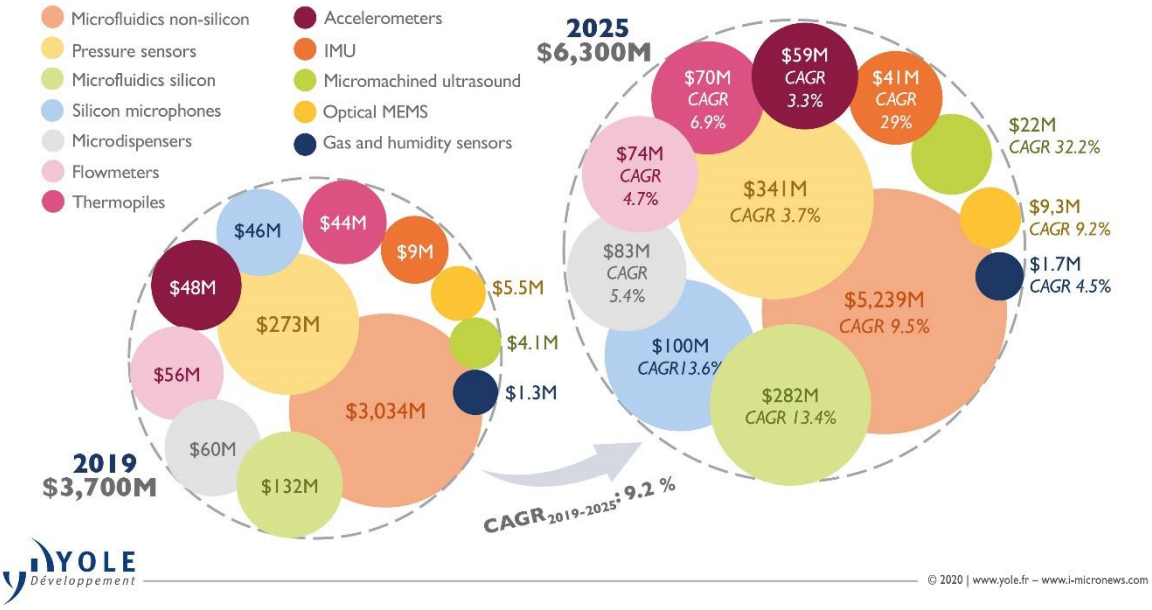
[2] CAGR: Compound Annual Growth Rate
[3] MEMS: Micro Electro-Mechanical Systems
[4] IVD: In-Vitro Diagnostics

microfluidic chips market represents 85% of the market due to the huge market for polymer-based microfluidic chips. This is followed by the pressure sensor market.
In volume, the highest growth expected on the next five years is for MUT[5] for medical imaging and IVUS, and for inertial MEMS (especially IMU[6]) related to fall detection and activity tracking. The larger market segments using mainly microfluidic chips are pharmaceutical research and IVD testing.
The key drivers for the use of MEMS and microfluidic technologies are:

- IT environment and telecommunication (5G network is one major contributor).
- Cost pressure on healthcare: development of systems for home care, point of care and medical wearables to monitor patients out of hospital.
- The contribution of advanced technologies to reduced power and miniaturized systems.

BioMEMS market dynamics – 2019-2025 forecasts by value

(Source: BioMEMS market and technology 2020, Yole Développement, 2020)



In this context, Yole investigates disruptive technologies and related markets in depth, in order to point out the latest innovations and to underline the business opportunities.
In this regard, the Photonic & Sensing team delivers three dedicated reports to highlight the latest technical and market trends: BioMEMS Market and Technology, Point-of-Need 2020 – Including PCR-Based Testing, and Thermal Imagers and Detectors 2020 – COVID-19 Outbreak Impact – Preliminary.

[5] MUT : Micromachined Ultrasound Transducers
[6] IMU : Inertial Measurement Unit

Released today, the BioMEMS market and technology report gives a comprehensive overview of MEMS devices, including pressure sensors, MEMS microphones, inertial MEMS, microfluidic chips, microdispensers, optical MEMS, MUT, flowmeters… All of them are integrated or used in the life sciences and healthcare domains. This study provides the latest major information and key facts of the bioMEMS industry.
Taking into account the COVID-19 impacts at the sensor and end system level, analysts examine the bioMEMS market and propose a complete review of the industry and future trends. Including market forecasts, main player market shares, ecosystem, supply chain and market and technology trends, this report provides a detailed description of this industry. This report also identifies the emerging bioMEMS sensors: design, integration, and usage challenges. What are the economic and technological challenges? What are the impacts of COVID-19 on the bioMEMS industry in both the short and long term? What are the key drivers? Who are the suppliers to watch, and what innovative technologies are they working on? Yole presents today its vision of the bioMEMS industry.

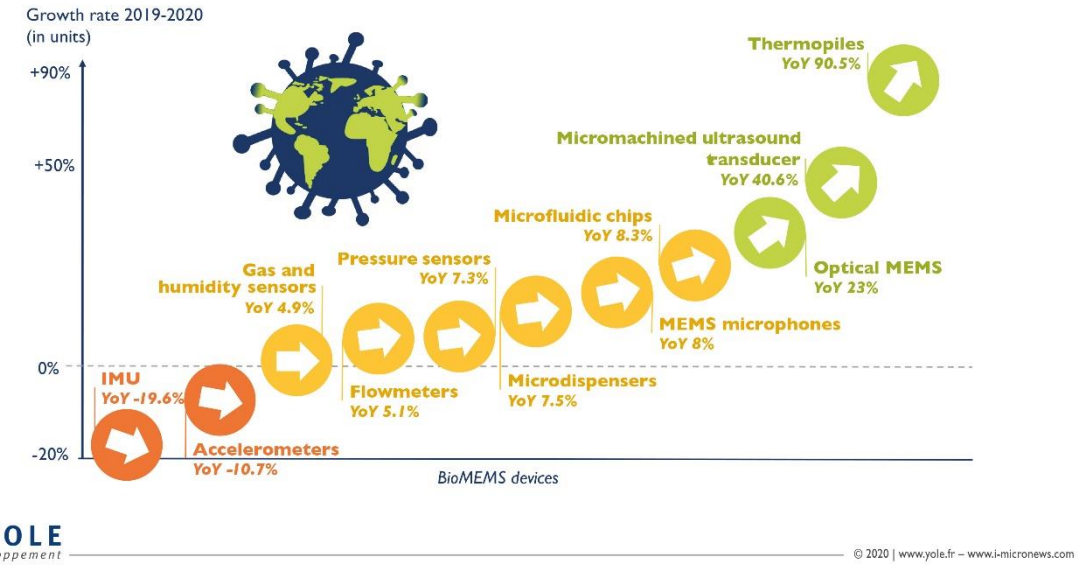
As analyzed by Yole's team in the new BioMEMS market and technology report, acute respiratory symptoms of COVID-19 generated a sudden need for interventional equipment like ventilators, and influenced the requirements for MEMS pressure sensors and flowmeters. There was also a huge demand for non-contact thermometers from Asia, particularly China. IR[7] thermometers play a big role in patient monitoring at hospitals and for implementation of preventive policies in public areas like airports or stations. Thus, IR thermopile shipments are increasing rapidly with a tremendous 90.5% growth expected from 2019 to 2020. In the IVD[8] domain, many diagnostics companies started development projects to provide as soon as possible either rapid point-of-care tests or high-throughput tests for use in the central lab. Some of these tests are built on microfluidic chips, as well as the DNA sequencing flow cells that are useful tools to study the virus and hopefully develop a treatment or vaccine.
"Apart from the requirements of hospitals and central labs, the pandemic has also altered patients' behavior towards more telemedicine and home consultation to limit physical contact" explains **Sébastien Clerc, Technology & Market Analyst, Microfluidics, Sensing & Actuating at Yole**. *"It accelerated adoption of home monitoring and point of care devices".*
One example is the Butterfly IQ probe which uses MUT technology, allowing flexible use by nurses or GPs[9] for early diagnostics at the patient's side. The technology and cost analysis company System Plus Consulting analyses in depth the first CMUT on silicon bonded with an ASIC[10] die for medical ultrasound, in the dedicated structural, process & cost report, Butterfly Network iQ CMUT Sensor.

[7] IR: Infra Red
[8] IVD: In Vitro Diagnostic
[9] GP: General Practitioners
[10] ASIC: Application Specific Integrated Circuit

In the medium to long term, wearables and connected medical devices should find more interest from healthcare systems.
Definitely, the impact of COVID-19 on bioMEMS market dynamics will not be the same from one application to another. Increased demands for respiratory systems will increase the need for bioMEMS for the duration of the pandemic, while the requirement for remote connected medical devices will be intensified in the long term.

COVID-19 impact: the different bioMEMS devices growth rate between 2019 and 2020

(Source: BioMEMS market and technology 2020, Yole Développement, 2020)



Efforts to improve MEMS device reliability, measurement accuracy and compliance with healthcare regulations (requested by the integrators at the system level) require strong skills and experience in order to serve the healthcare sector. Emerging bioMEMS like microneedles, MUT or optical MEMS devices have sometimes complex designs or are otherwise highly challenging for integration when the use case is not itself imposing other barriers.
According to **Jérôme Mouly from Yole**: *"Analysis of the players and supply chain show that bioMEMS makers are often focused on a single MEMS device, sometimes two device types. Most of the Top bioMEMS players also serve the industrial domain, having experience with high-end and highly regulated applications. MEMS foundries are playing a big role, working on high added value projects, developing key process steps like PZT[11] deposition or CMOS-MEMS integration".*

[11] PZT: Lead Zirconate Titanate

A new wave of players is also becoming increasingly involved, as the healthcare sector is currently moving to more preventive and personalized care: consumer MEMS companies are strongly interested in serving consumer healthcare applications, where volumes could be attractive and regulations less strict. However, the frontier between regulated and non-regulated markets is blurred.
Along with the TOP bioMEMS players, newcomers are starting to deliver bioMEMS products in the healthcare sector, and stronger bioMEMS players are emerging through recent mergers and Acquisitions… A detailed analysis of the supply chain is available in the bioMEMS report presented by Yole.

All year long, System Plus Consulting and Yole Développement combine their expertise and deep understanding of the markets and disruptive technologies to publish numerous reports. In addition, our experts realize various key presentations and organize key conferences.
Throughout the year, discover the numerous med-tech-related reports including the BioMEMS, the Point-of-Need Testing, the Thermal Imagers and Detectors and the Butterfly Network ones. Make sure to be aware of the latest news coming from the industry and get an overview of our activities, including interviews with leading companies and more on i-Micronews. Stay tuned!

Press contacts

Sandrine Leroy, Director, Public Relations, leroy@yole.fr
Marion Barrier, Assistant, Public Relations, marion.barrier@yole.fr
Le Quartz, 75 Cours Emile Zola – 69100 Villeurbanne – Lyon –France – +33472830189
www.yole.fr- www.i-micronews.com – LinkedIn – Twitter

About our analysts

Jérôme Mouly serves as a Senior Technology & Market Analyst & Business Developer specialized in microtechnologies within the Photonics & Sensing team at Yole Développement (Yole). Jérôme actively assists and supports the development of strategic projects, working with leading customers of the company. Since 2000, he has also been engaged in more than 100 marketing and technological analyses for industrial groups, start-ups and institutes in the field of MEMS, BioMEMS, wearable & connected medical devices. Through the group's numerous activities at Yole, Jérôme covers the whole microelectronic supply chain including manufacturing processes and device development. Jérôme is also regularly involved in international conferences, giving presentations and delivering keynotes. Jérôme Mouly holds a Master of Physics from the University of Lyon (France).

Sébastien Clerc is a Technology & Market Analyst in Microfluidics, Sensing & Actuating at Yole Développement (Yole). As part of the Photonics & Sensing team, Sébastien has authored a collection of market and technology reports dedicated to microfluidics and other micro-devices for both market segments: medical (including diagnostics, pharmaceutical, biotechnology, drug delivery, medical devices) and industrial (including environment, agro-food). At the same time, he is involved in custom projects such as strategic marketing, technology scouting and technology evaluation to help academic and industrial players in their innovation processes. Thanks to his technology & market expertise, Sébastien has spoken in more than 20 industry conferences worldwide over the last 4 years. Sébastien Clerc graduated from Grenoble Institute of Technology (Grenoble INP - Grenoble, France) with a Master's degree in Biomedical Technologies. He then completed his academic studies with a Master's degree in Innovation and Technology Management in the same institute.

As well as:
With more than 25+ years of experience within the semiconductor industry, **Eric Mounier, PhD**. is Fellow Analyst at Yole Développement (Yole). Eric is daily providing deep insights into current and future semiconductor markets and innovative technologies such as Si photonics, MEMS, quantum computing and new type of sensors. Based on a relevant methodology expertise and strong technological background, he is closely working with the overall teams at Yole to point out disruptive technologies and analyze business opportunities. Eric Mounier has a Semiconductor Engineering Degree and a Ph.-D in Optoelectronics from the National Polytechnic Institute of Grenoble (France).

Dimitrios Damianos, PhD joined Yole Développement (Yole) as a Technology and Market Analyst and is working within the Photonics, Sensing & Display division. Dimitrios is daily working with his team to deliver valuable technology & market reports regarding the imaging industry including photonics & sensors. After his research on theoretical and experimental quantum optics and laser light generation, Dimitrios pursued a Ph.D. in optical and electrical characterization of dielectric materials on silicon with applications in photovoltaics and image sensors, as well as SOI for microelectronics at Grenoble's university (France). In addition, Dimitrios holds a MSc degree in Photonics from the University of Patras (Greece). He has also authored and co-authored several scientific papers in international peer-reviewed journals.

Sylvain Hallereau has been Project Manager at System Plus Consulting since 2000. He is in charge of costing analyses for Integrated Circuits, Power semiconductors and LEDs. He has significant experience in the modeling of manufacturing costs for electronics components, Sylvain holds a Master degree in Microelectronics from the University of Nantes, France.

Véronique Le Troadec has joined System Plus Consulting as a laboratory engineer. Coming from Atmel Nantes, she has extensive knowledge in failure analysis of components and in deprocessing of integrated circuits.

About the reports

BioMEMS Market and Technology

Pressure, inertial, MEMS ultrasound, microfluidics chips and other sensors, are driving the growth of the life sciences and healthcare market – Performed by Yole Développement

Companies cited:
10X Genomics, Abaxis, AEMtec, Affymetrix, Agilent Technologies, Amazon, Amphenol, Amplifon, Analog Devices, Apple, Azbil, BioFire (Biomérieux), Biotronik, Boehringer Ingelheim, Bosch Sensortec, Boston Scientific, Butterfly Network, Capital Bio, Cepheid (Danaher), CiDRA Precision Services, Cochlear, Demant, Excelitas, Facebook, Food & Drugs Administration (FDA), First sensors, Fitbit, Fraunhofer, GN Resound, Google, Heimann Sensors, Hitachi, Honeywell, Illumina, IMEC, IMT MEMS, IMTAG, Invenios, Ion Torrent, Knowles, Medspray, Medtronic, Melexis, Merit Sensors, Micro Liquid, Microfluidic ChipShop, Micronit Technologies, Microsoft, MiniFab (Schott), Murata, NXP, Omron, Oxford Nanopore, Perkin Elmer, Philips Innovation Services, Quidel Corp., Renesas, Robert Bosch, Roche Diagnostics, Rogue Valley Microdevices, Sensirion, Siargo, Siemens, Silex Microsystems, Sivantos, Si-Ware, Sonova, Sony, Starkey, STMicroelectronics, Stratec Consumables, TDK, TDK Invensense, TDK Tronics Microsystems, TE Connectivity, Teledyne Dalsa, Teledyne Micralyne, Thermofisher Scientific, ThinXXS, Tong Hsing Electronic Industries, TSMC, Withings, X-Fab, and many more…

Point-of-Need 2020 – Including PCR-Based Testing
COVID-19 is shaking up the diagnostics industry and will have both short- and long-term impact. – Performed by Yole Développement

Thermal Imagers and Detectors 2020 – COVID-19 Outbreak Impact – Preliminary Report
How the COVID-19 epidemic is changing the thermal imaging and sensing market and industry.-Performed by Yole Développement

Butterfly Network iQ CMUT Sensor
First CMUT on silicon bonded with an ASIC die for medical ultrasound.- Performed by System Plus Consulting

Related reports:

- Medical Wearables: Market and Technology Trends 2019
- Status of the MEMS Industry 2019
- Status of the Microfluidics Industry 2019

About System Plus Consulting

System Plus Consulting specializes in the cost analysis of electronics, from semiconductor devices to electronic systems. Created more than 20 years ago, System Plus Consulting has developed a complete range of services, costing tools and reports to deliver in-depth production cost studies and estimate the objective selling price of a product… More

About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide… More

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