

Forecast 2022 for Sensors/MEMS

Focus on the impact of COVID-19 on the commercialization process global supply chain.

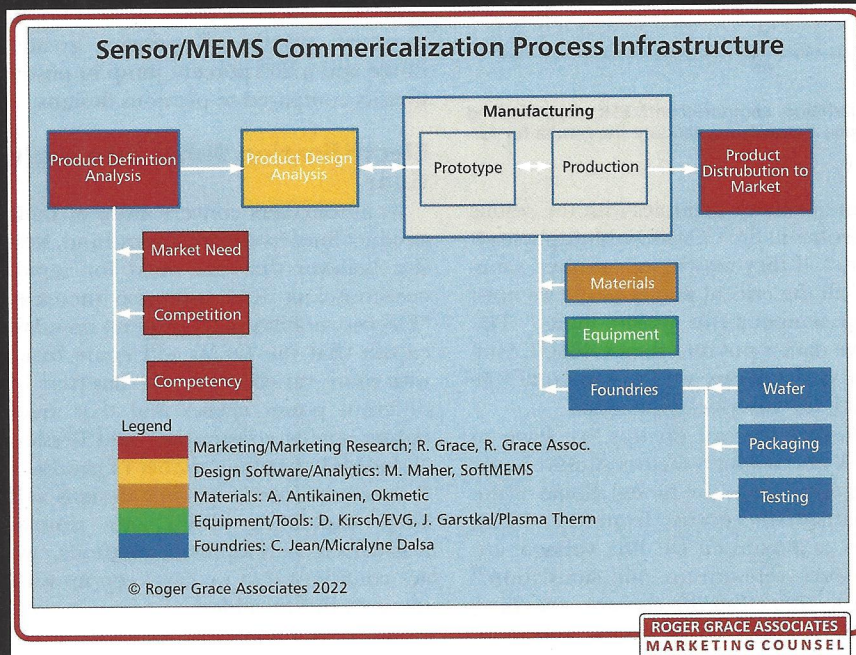


Figure 1: MEMS commercialization process supply chain infrastructure is quite similar to that for semiconductors. It encompasses a broad and complex spectrum of disciplines, materials, equipment, and facilities. (Image: Roger Grace Associates)

This article is a marked departure from my annual reporting on the past year's performance of the health of the MEMS industry vis-à-vis my *MEMS Industry Commercialization Report Card*.^[1] Here, I have requested several of my colleagues representing the breadth of the sensors/MEMS commercialization process global supply chain (Figure 1) to provide forecasts for the sensors/MEMS industry for 2022 and the challenges that the industry will face in 2022, strategies that they can embrace to overcome them, and the current and future state of the sensors/MEMS industry. Additionally, they shared opinions on emerging technologies and the possible future impact of COVID-19 on the industry, including the global supply chain. Comments have been edited for length and clarity.

Why does addressing this topic matter? The global supply



A motion sensing chip produced at the HT Microanalytical facility in Albuquerque New Mexico. (Image: HT Microanalytical)

chain for semiconductors has received significant coverage in the media, and especially in the automotive sector. Sensors/MEMS have faced similar challenges while being approximately a scant 1/30th its size. Designers and manufacturers of sensor/MEMS-based products must be cognizant of these issues to effectively support their ability to create possible alternate scenarios in bringing their products to market in a timely fashion.

Marketing/Market Research

Roger Grace, President, Roger Grace Associates

Several market research organizations have estimated the worldwide sensors market to be approximately \$190B (US) in 2022 with an approximately 10 percent CAGR over the next several years. Application sectors that will lead this growth include IoT, e-health, wearables (especially with printed and e-textile sensors), automotive, environmental monitoring, agriculture, and smart homes. The total worldwide sales of sensors/MEMS continued to increase during 2021 despite the effects of COVID-19 on the workforce and global supply chain. The increase in average sales price could account for some of this increase.

The expected continued presence of Covid into mid-late 2022 will continue to have a negative effect on the in-person attendance at trade shows for 2022 and beyond. Sensors Converge in October 2021 hosted approximately 2,000 attendees at its hybrid venue versus its typical 6,000. About 5,000 attendees are expected at their late June 2022 hybrid venue. Trade shows,



EV Group, headquartered in Austria, provides a broad line of fully automated process equipment including bonders and aligners to support the MEMS and semiconductor fabrication of 200mm and 300mm silicon wafers. (Image: EV Group)

whether virtual, hybrid or in-person will continue to play a significant role in the marketer's toolbox. Additionally, digital media including webinars, podcasts, videos, enhanced websites, and email campaigns will be embraced due to their recent demonstrated efficacy.^[2]

Design Analysis

Mary Ann Maher, President, SoftMEMS

The product design landscape has changed during COVID-19. The challenges for software suppliers were to facilitate the many engineers working from home on different devices and to enable collaborative design and sharing of design data by remote workers. This turn of events prompted design software suppliers to speed up moving along trends, such as deploying cloud computing solutions and online design platforms.

With employees unable to go to the office or lab to access fabrication and testing equipment, some product development groups re-oriented to put more effort into simulation and modeling in the meantime. This activity enabled software suppliers to see an uptick in the need for software and related services.

Time will tell, but hopefully companies who invested in simulation and modeling will reap the benefits of better design insights as they return to other activities and perhaps

modify their behavior in the future to include more modeling and simulation.

Design and Manufacturing

Todd Christenson, CTO, HT Microanalytical

Application of microfabricated sensors to the Internet of Everything Moving is experiencing a growth spurt even beyond that of the large build-up of the past. The competing nature, however, of rising demand of ever more capable microsensors with a stifled material and labor supply is challenging insertion of this new technology into new products.

An approach to managing supply chain quite contradictory to that enjoyed even as little as a year ago has been required. Volatility in availability of certain stock items has made it a priority to establish and qualify more and new vendors more regularly. Exacerbating the problem is the natural tendency of raw material stockpiling which also increases cost.

Equipment

Dave Kirsch, VP/GM, EV Group

During the last two years, delivering equipment and providing customer support presented both challenges and opportunities. Resources available pre-2020 became difficult to access, as did the ability to interface in person with customers. Implementing alternatives, including remote meeting platforms and



Plasma Therm produces a broad line of plasma etch and deposition equipment from its St. Petersburg Florida headquarters supporting the 200mm and 300mm silicon MEMS and semiconductor sectors. (Image: Plasma Therm)

heads-up devices, as well being able to leverage our established regional offices and technology teams enabled us to safely meet, and even exceed, the commitments to our customers.

Looking forward, Sensors/MEMS, more than any other micro-manufac-

tured component, will drive both innovative concepts and solutions as well as inspire and motivate the most creative minds in industry today. As industries are called upon to simultaneously develop and deploy critical technologies, such as bolometers, biosensors, and other sequencing and analyzation tools, the advancements in process technology, engineering, and component manufacturing necessary to support them will benefit from past adversity and our innovations will be pushed to supply and support these required solutions.

Jim Garstka, VP Sales, Plasma Therm

The impacts of COVID-19 have affected everyone, in many ways since it was first cast upon us in early 2020. We have experienced significant supply chain challenges and minor personnel disruptions and continue into 2022, resulting in some shipment delays and increases to our standard lead times. In some cases, lead times have increased by 4 to 12 weeks depending on the application configuration and platform type.

To help reduce the overall lead time issue directly affecting our customers, we have continued a path of vertical integra-

tion, implementing new methods of cross-training, significantly increased hiring, and proactively partnered with key suppliers.

COVID-19 has presented us with both challenges and opportunities. We fully expect the overall demand for our plasma etch, deposition, material modification and die singulation process equipment to continue to increase faster than the industry average.

Materials

Anna-Riikka Vuorikari-Antikainen, CCO, Okmetic, and Chair of Semi Silicon Manufacturers' Group

Strong growth is expected to continue until 2026 with CAGR being approximately 7 percent. The increasing popularity of IoT in semiconductors, increasing demand for smart consumer electronics and wearable devices, and growing adoption of automation in industries and homes are some of the growth drivers for the MEMS and Sensors market.

The rapid market growth and technology advancements put more pressure on the size, performance, and integration of MEMS and Sensor devices and on their streamlined and cost-effective manufacture. These factors have driven new requirements also upstream the semiconductor supply chain.

Silicon wafers' importance on device performance, Total Cost of Ownership, and time to market has been recognized and co-operation between silicon wafer suppliers and device manufacturers is increasing. Thus, the demand trend toward device and process-optimized wafer solutions is expected to continue.

Foundries

Claude Jean, EVP/GM, Teledyne Dalsa Semiconductor

The COVID-19 pandemic has exacerbated a situation in the supply chain that would have emerged anyway in 2020-2021. The semiconductor industry's bad management of historically repetitive up and down cycles is well known. COVID-19 has caused several interruptions in the already complex semiconductor supply chain, and therefore, a perfect storm.

Our 2020 and 2021 growth came mostly from new products and new markets and driven by real end demand. Unlike during previous cycles, we see suppliers limited not only by Covid absenteeism, but also by government mandates dictating where suppliers should



Silicon and silicon on insulator wafers are the platform from which all MEMS and semiconductor devices are manufactured. The 200mm and 300mm wafers are produced at the Okmetic's Finland facility. (Image: Okmetic)



Wafer foundries, having clean rooms similar to the one shown here at Teledyne Dalsa's Canadian facility are the heart and soul of the MEMS and semiconductor manufacturing process. (Image: Teledyne Dalsa)

prioritize their business. The posted growth was not enough to fulfill demand.

Price increases contributed to the sales growth. Without disclosing anything specific to Teledyne, several suppliers reported raising prices by as much as 20 percent. Furthermore, the Producer Price Index has posted constant growth through 2021 exceeding 10 percent at year's end.

Path Forward

Pundits are claiming the economic effects of COVID-19 persisting into 2023, thus adding even more credence to the comments made here. While expected challenges exist, including global supply chain shortcomings, workforce supply and diminution of marketing vehicles, several new technologies and applications as well as alternative marketing approaches perfected in 2021 will continue to propel the sensors/MEMS industry forward. Many companies have pivoted and exploited application opportunities created by COVID-19, for example, the medical diagnostics sector enabled by emerging technologies including printed and e-fabric sensors, which are expected to continue into 2022 and beyond.

The best strategy moving forward for the sensors/MEMS community is to stay the course, continue to be resilient, embrace the strategies successfully adopted prior to and during 2021, and to fine tune the lessons learned as well as adapt them to meet the anticipated ever-changing landscape of the new normal marketplace emerging in 2022 and beyond.

This article is written by Roger H. Grace, President, Roger Grace Associates (Bonata Springs, FL). For more info visit <http://info.hotims.com/82322-122>.

References

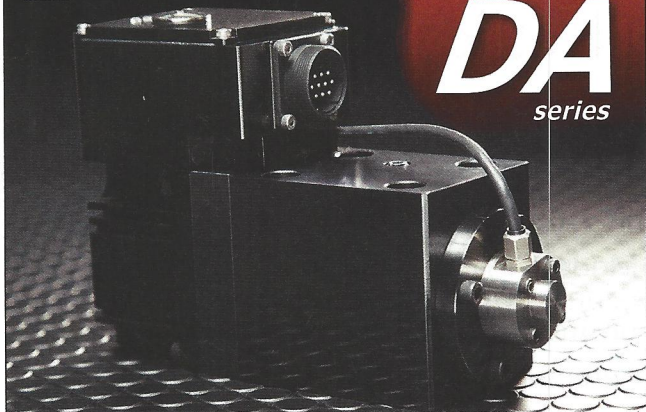
- [1] R. Grace; 2020 MEMS Industry Commercialization Report Card Gets Another B-; Fierce Electronics; July 2021; www.rgrace.com.
- [2] R. Grace; Marketing in a Recession and How to Survive; Sensors Daily; April 8, 2019; www.rgrace.com.

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