

CMORE SiGeMEMS マルチプロジェクトウェハ

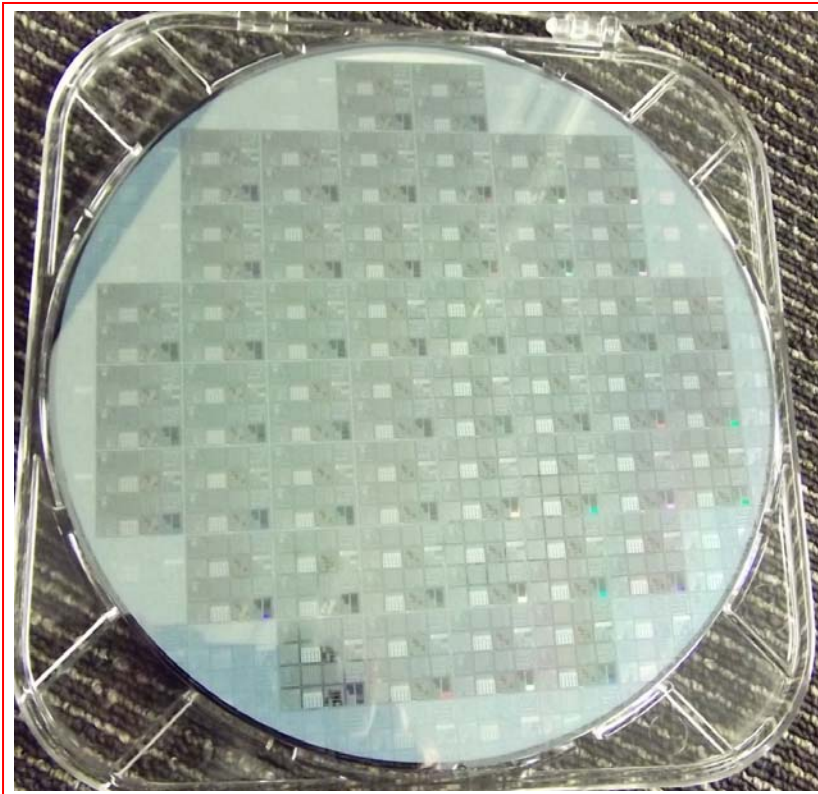


Exhibit #4: Poly-SiGe MEMS MultiProject Wafer (MPW) from the first SiGeMEMS MPW run organized by Europractice in 2011.



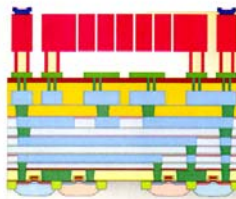
imec CMORE SiGeMEMS MPW

EUROPRACTICE IC Service offers Multi-Project Wafer Services in imec's CMORE SiGeMEMS standalone and SiGeMEMS/CMOS integrated technology:

Imec's **CMORE Silicon Germanium MEMS** platform technology, referred to as **SiGeMEMS**, is developed to enable monolithic integration of CMOS and MEMS. Systems integrating MEMS devices with the driving and readout electronics on the same die lead to better performances in terms of signal to noise ratio through reduced interconnect parasitic resistance and capacitance, allow for smaller die size and package, and also for lower power consumption. SiGeMEMS is based on a MEMS-last approach which allows state-of-the-art CMOS foundries to be employed.

Technology

The **SiGeMEMS** process, belonging to imec's CMORE service platform, is very versatile. Thanks to its flexible and modular approach, allowing application-specific tuning and optimization, it addresses a large number of applications like gyro's, switches, microphones, speakers, CMUTs, T-sensors, P-sensors, ... and array type devices like μ mirrors, probe-based memories, and arrays for fluidics and upower generation...



EUROPRACTICE now offers a fixed baseline **SiGeMEMS** process in a Multi-Project Wafer Service. This unique baseline process consists of MEMS structures defined by an electrode layer and a 4 μ m-thick SiGe-mechanical layer on top of a TSMC 0.18 μ m CMOS wafer. Nanogaps of 500nm will allow fabrication of extremely small features. A standalone MEMS version, identical but processed on a wafer with a single metal layer, will be available for initial prototyping.

Europractice-imec SiGeMEMS MPW runs in 2012

| Imec CMORE | 2012 | | | | | | | | | | | |
|---|------|---|---|---|---|----|---|---|---|----|------------------|---|
| | J | F | M | A | M | J | J | A | S | O | N | D |
| SiGeMEMS MEMS-only | | | | | | | | | | 20 | | |
| SiGeMEMS/TSMC 0.18 μ m CMOS (CV018LD1 8/3 302V) | | | | | | 10 | | | | | 25 ¹⁾ | |

Note: 1) This run is preliminary and can be updated during 2012.



Price

| Technology Version | Standard Price | EU-Discounted Price |
|--------------------|----------------|---------------------|
| MEMS-only | 4250 € | 4000 € |
| CMOS integrated | 28500 € | 27000 € |

EU-Discounted Price only applies to EUROPRACTICE registered (who paid their annual full membership fee) Academic and Research Members from all 27 EU countries and Norway, Iceland, Liechtenstein, Israel, Croatia, Serbia, Macedonia, Albania, Montenegro, Bosnia-Herzegovina, Switzerland, Turkey who submit designs for educational or publicly funded research use only.

Standard Price normal price for universities and research institutes not belonging to previous category. Companies should contact imec CMORE at www.imec.be/cmcore to take advantage of additional extensions and services.

Prices and conditions may change any time without prior notice.



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Principle

Imec's CMORE SiGeMEMS technology offered through the EUROPRACTICE IC MPW service is aimed at creating, characterizing and evaluating test structures prior to further specific development and production projects. By gathering the designs of multiple customers on the same masks set, MPWs allow to fabricate test structures and prototypes of devices at a low cost.



Advantages of SiGeMEMS

Monolithic integration with IC :

- Very compact
- Best solution for applications that are very sensitive to parasitics
- High intrinsic system reliability: less components, less interconnections.

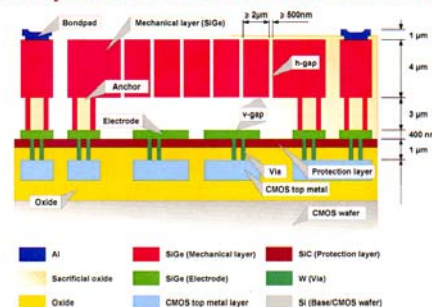
MEMS last above CMOS :

- Most flexible with respect to choice of CMOS technology
- Extremely well suited for MEMS array applications
 - very high-density and massively parallel interconnections possible
 - large arrays of MEMS (e.g. μ mirror arrays)

Poly-SiGe :

- High performance: low parasitics
- Good mechanical properties & reliability
 - better than Al: higher strength and Q factor
 - better than Al: less creep and fatigue

Summary of SiGeMEMS main features and dimensions



Legend: Blue: Al, Red: SiGe (Mechanical layer), Red: SiC (Protection layer), Yellow: Sacrificial oxide, Green: SiGe (Electrode), Green: W (Via), Yellow: Oxide, Blue: CMOS top metal layer, Grey: Si (Base/CMOS wafer)

General conditions :

EUROPRACTICE SiGeMEMS MPW Service is accessible for universities and research institutes. (EUROPRACTICE registered members) → more info at www.europractice-ic.com

Companies can have additional extensions to take advantage of the versatile, flexible and modular technology:

- Variable layer thicknesses
- Application-specific optimization of layer & material properties
- Application-specific functional add-on layers

Companies should contact imec CMORE at www.imec.be/cmcore

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