

A person wearing a white cleanroom suit, a blue surgical mask, and safety glasses is holding a petri dish with a green sample. The background is a blurred cleanroom environment.

Microdevice innovation without limitations

Developing your customized silicon microdevices at imec

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Don't let complexity slow down your creativity

Innovation often comes from simple ideas. But its realization can be a complicated matter. Especially in the case of customized silicon microdevices such as sensors and MEMS whose conception requires the integration of several technologies, such as photonics and 3D integration. And whose commercial success depends on a reliable manufacturing process.

Is that complexity slowing down your innovation?

Do you have trouble finding a partner who can deal with advanced technologies, intricate designs and numerous processing steps? Talk to imec.

From our position as an R&D center with strong industry connections, we offer you:

- a 200mm (8-inch) silicon pilot line that's on a par with those in major foundries
- a 300mm (12-inch) cleanroom with the most advanced semiconductor equipment and processes
- a toolbox of advanced technologies: Si processing, 3D integration, photonics, GaN processing, ...
- a team of technical experts ready to tackle any challenge you give them

Browse this booklet for an introduction to imec's infrastructure and technology portfolio, and a quick overview of the development trajectory we offer you – from idea to manufacturable prototype and low-volume manufacturing.

Are you ready to talk about your customized microdevice challenge with us?

Reach out to us via microdevices@imec.be.



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State-of-the-art infrastructure for multi-layered microdevices

The birth of a new idea requires no other tools than a piece of paper and a pen. But as your microdevice project grows, you need a more and more advanced infrastructure.

A university lab takes you no further than proving the validity of your concept. For the development of a manufacturable device and its production, you must get access to the equipment that you find in leading foundries.

In imec's cleanrooms, you can bring your microdevice to maturity. The 300mm cleanroom is uniquely equipped for concept and process development of highly advanced technologies, while the 200mm cleanroom also allows the prototyping and low-volume manufacturing of complex devices. Even the ones that need a large amount of complicated processing steps. And because of the compatibility of imec's tools with those in major foundries, your manufacturing process can be effortlessly transferred to high-volume fabrication.

***Bring your
device
to maturity
in imec's
cleanrooms.***



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1 Full set of CMOS-compatible flow capabilities:

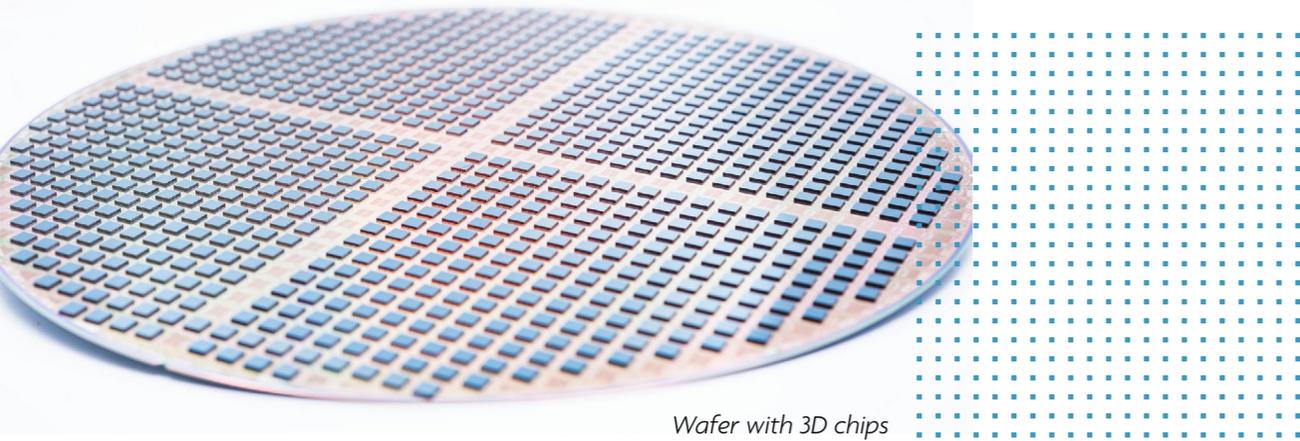
- 193nm ASML DUV stepper (65nm line resolution)
- 248nm ASML DUV stepper (150nm line resolution)
- 365nm ASML I-line stepper (350nm line resolution)
- EVG Hercules 300/200mm nano-imprint track (40nm line resolution)

2 Wide substrate choice

- Processing on Si, SOI, fused silica or quartz
- Wafer-to-wafer bonding: silicon or quartz
- Wafer-level bonding of MEMS on CMOS substrates
- Custom post-processing on (CMOS) wafers from other foundries



200mm cleanroom lithography



Wafer with 3D chips

3

Wide choice of materials

- Variety of polymers for wafer-scale integration
- Low-impedance, corrosion-resistant electrode materials
- ALD with sub-nm thickness control, high-k dielectrics
- Electroplating of Cu, Sn, Ni, ...

Do you want to introduce even more exotic materials into a silicon CMOS environment?
Or does your concept require the development of a new method for material deposition?
Then don't hesitate to present your challenge to our experts.

4

Versatile MEMS & 3D integration platform

- SOI for very large membrane devices such as microphones and pressure sensors
- SOI bonded on CMOS for monolithic integrations between MEMS and ASICs
- Advanced integration features:
 - Integrated passive device interposer
 - TSV 'middle'
 - TSV 'last'
 - Direct low-temperature bonding (e.g. sensor on read-out IC)
 - Micro-bumps chip assembly
 - Advanced active chip cooling (microfluidics)



200mm cleanroom

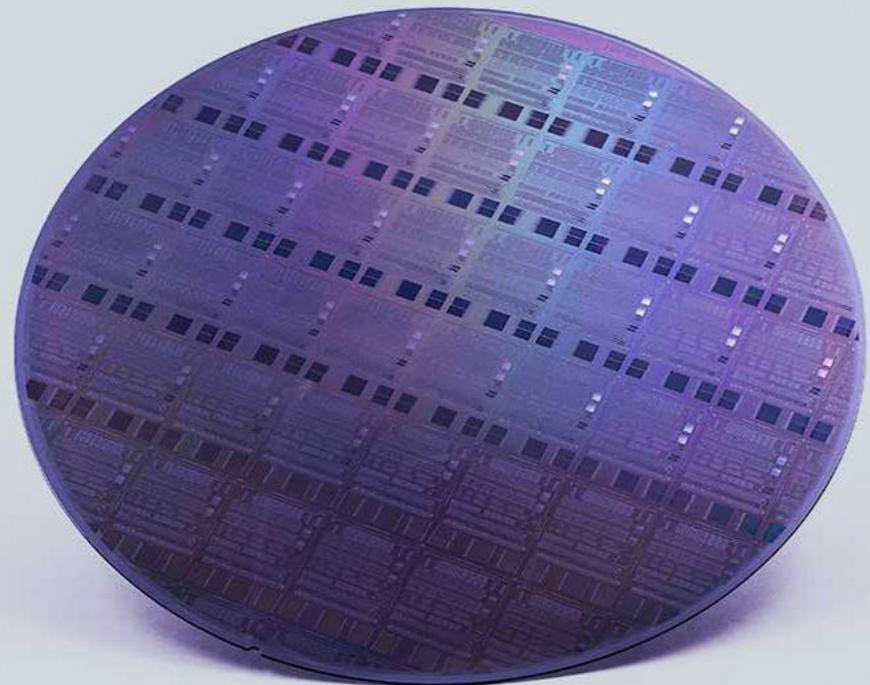
Special features

- Through-silicon wafer etching capability
- Bumping and through-silicon via (TSV) integration
- Extensive in-line metrology and defect characterization of features down to 50nm
- State-of-the-art optical waveguide performance for visible light, NIR and IR
- Integrated optical filter stacks
- Gallium nitride (GaN) processing

Advanced labs

In addition to the cleanroom, the imec facilities also host several labs – for instance for material and device characterization and photonics. Here, our experts can perform further in-depth research to accelerate your innovation.

For a full overview of the imec infrastructure, visit www.imec-int.com/infrastructure.



Silicon nitride photonics wafer

Toolbox of innovative technologies

Imec offers you a vast technology portfolio from which you can draw to enable your microdevice application or tackle the challenges that come with manufacturing your unique device.

1 Customized CMOS imaging

By processing CMOS imagers with specific modules, you can tune them to specialized applications such as imaging beyond the visible spectrum.

www.imec-int.com/cmoss-imaging

2 Silicon photonics

Imec's iSiPP50G and iSiPP200G silicon photonics platforms co-integrate a wide variety of passive and active components to enable photonic chips.

www.imec-int.com/photonics

3 Silicon nitride-based photonics

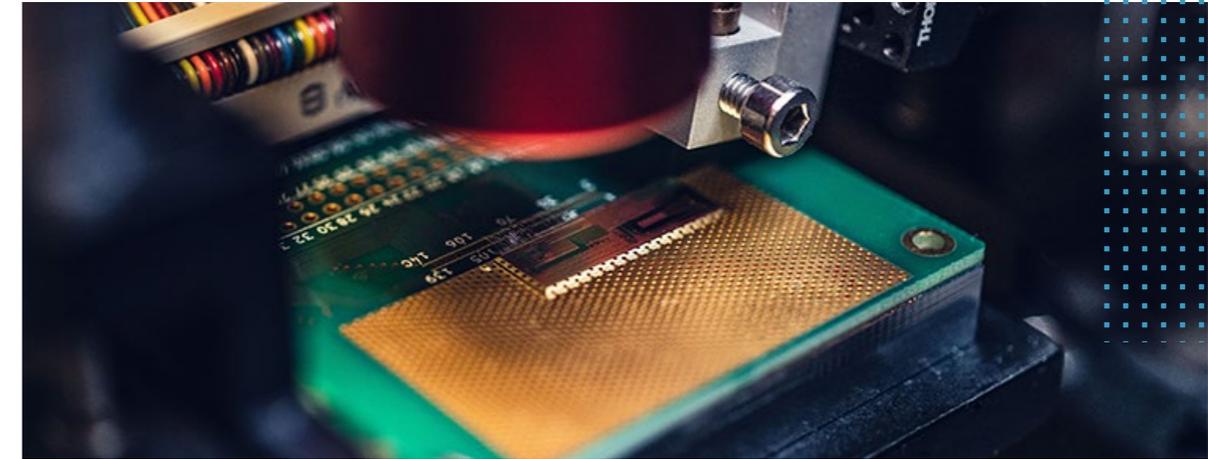
Imec offers you access to LPCVD, PECVD and co-integrated SiN technologies for the development of photonic integrated circuits.

www.imec-int.com/sinphotonics

4 Solid-state optical beamforming

Imec's optical beamforming platform uses both SiN photonics and silicon photonics. The result is a high-performance, low-power and self-calibrating device.

www.imec-int.com/beamforming



Imec's optical beamforming platform combines silicon and SiN photonics.

5 Ultrasound transducers

Use imec's PMUT platform for developing MEMS-based transducers that enable compact form factors, a wide range of frequencies and co-integration with a CMOS driver.

www.imec-int.com/ultrasound



Wafer with cell sorter chip

6 Flat optics

Imec supports the development of nanostructures that fulfill optical functions and are compact, affordable to manufacture at scale and easy to integrate.

www.imec-int.com/flatoptics

7 Silicon microfluidics

Compared to glass or plastic structures, silicon microfluidics allows smaller dimensions and high-level integration with other components.

www.imec-int.com/microfluidics

From idea to product: how imec tackles your microdevice challenge

How far are you from a manufacturable product? Do you already have a functioning prototype? Or only a rough idea? Whatever the distance to your goal, imec supports you the rest of the way.

Let's say you have a clear idea of what your device should do, but only a vague sense about how you can achieve that. In that case, we take your idea through all the steps to realize it:

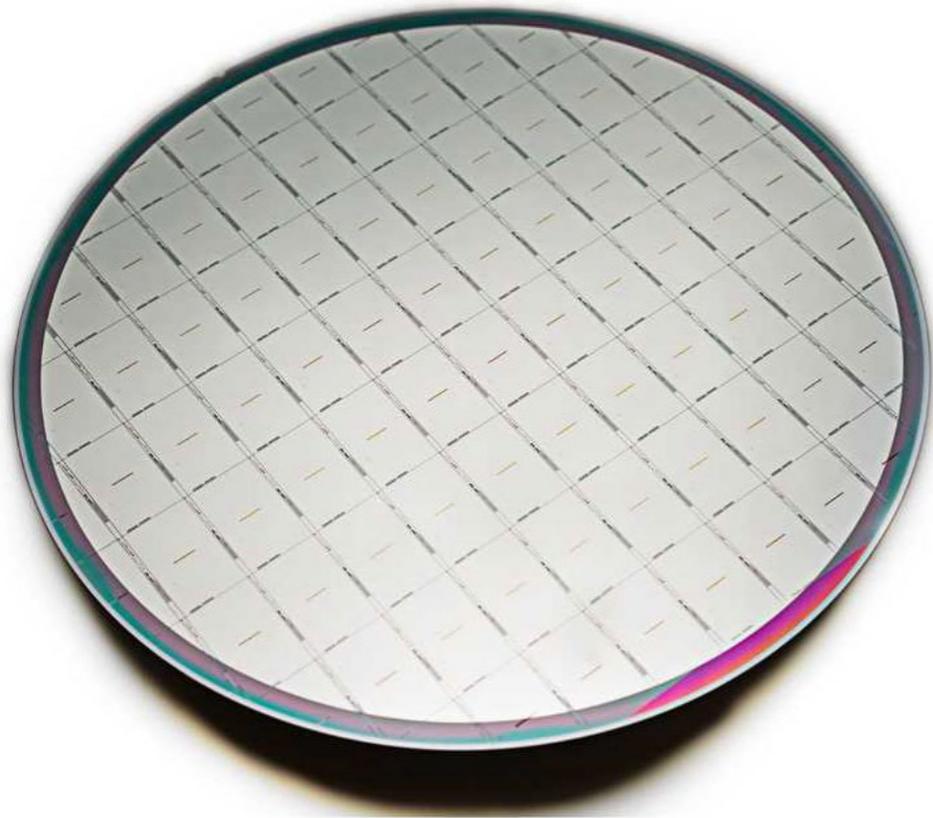
- Our multidisciplinary team of experts looks at your challenge from different angles to come up with a solution that meets your specifications and that's manufacturable.
- If needed, we carry out a feasibility study.
- If needed, we design your device.
- We develop the process.
- We realize a first prototype to show the device functionality.
- We optimize the design and process technology to make sure your device meets the agreed specifications.
- We perform a process macro qualification to assure the reproducibility and uniformity of the device.

After this, your device is ready for production:

- Below 1,000 wafers per year, your device can be manufactured in the imec cleanroom
- Above 1,000 wafers per year, the process developed at imec can be easily transferred to a foundry.



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Wafer with EUV sensors developed and manufactured in imec's 200mm cleanroom for ASML

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**Imec's experts are world-class.
They can make it happen.**

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ASML supplies the world's leading chipmakers with the tools to mass-produce ever-smaller patterns on silicon. Their harnessing of EUV (extreme ultraviolet) light for mass manufacturing proved a gamechanger for the industry – supporting volume production at 7 and 5nm nodes.

Their EUV scanner consists of over 100,000 unique components, one of which is an EUV image sensor that was developed into a manufacturable device in imec's cleanroom.

The challenge that ASML gave imec was to transform a complex non-standard design into a stable, high-yielding manufacturing process. By combining their CMOS processing expertise with materials knowledge, imec's experts were able to fit the pieces of the puzzle.

Watch a short movie about this exciting collaboration on www.imec-int.com/microdevices.



About imec

We all share the same vision: a connected, sustainable future for everyone. And imec believes technology will help us to reach that goal.

That's why we strive to be the world-leading innovation hub in nanoelectronics and digital technologies. By providing brilliant minds from all over the world with a stimulating environment. By leveraging a world-class infrastructure. And by bringing together a local and global ecosystem of partners from a multitude of industries.

Imec employs more than 4,000 highly skilled researchers. They make use of world-class infrastructure, including more than 12,000 square meters of 200mm and 300mm cleanroom capacity containing the most advanced collection of microchip processing tools in the world, and state-of-the-art (bio, wireless, imaging, ...) labs.

Imec is headquartered in Leuven, Belgium, and has offices and research facilities around the world.

www.imec-int.com

Are you ready to talk about your customized MEMS or microdevice challenge with us?
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For more info about our offering,
visit **www.imec-int.com/microdevices**.