imec
embracing a better life

FROM SAMPLE TO RESULT IN ONE CHIP

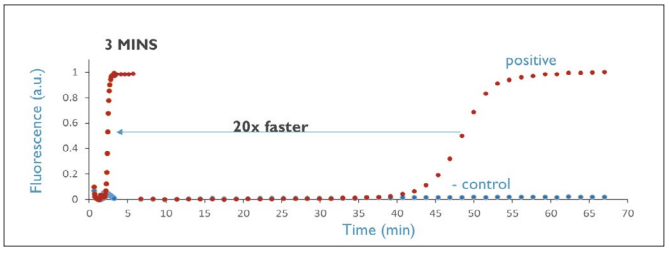
A typical DNA sample preparation and workflow still faces many challenges before it can move to a clinical setting. The tests developed in specialized labs often have a complex workflow with manual steps, are difficult to reproduce which has an impact on regulatory accreditation and have a low diagnostic accuracy. Furthermore, with reagents of over 200 euro per sample preparation this increases the cost per genome.

HOW IMEC CHIP TECHNOLOGY ENABLES CLINICAL-GRADE SAMPLE PREPARATION:

- Extreme miniaturization and parallelization,
- Full workflow via on-chip integration of filters, mixers, lysis, extraction, enrichment, droplet handling in one chip,
- Automated workflow in a disposable chip,
- Lower cost per patient and higher turnaround time.

SILICON CHIPS FOR SAMPLE PREPARATION

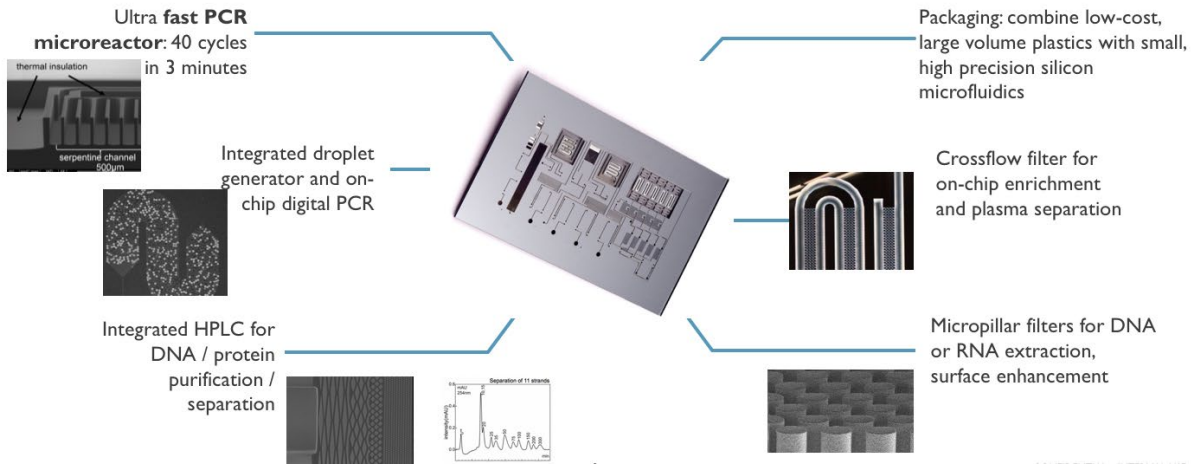
Imec develops integrated sample-to-result chips to perform PCR-based tests. With silicon-based microfluidics, these enable fast, simple and sensitive detection of genetic markers (e.g. in blood).



Ultra-fast DNA-amplification: 40 cycles in 3 minutes.

1. PCR-ON-CHIP IN LESS THAN 10 MINUTES

In our silicon chips DNA is amplified 20 times faster than in a standard assay. This shortens the reaction time and reduces reagent cost. The PCR-on-chip also allows for quantification of the molecule of interest without the need for calibration through digital droplet PCR.

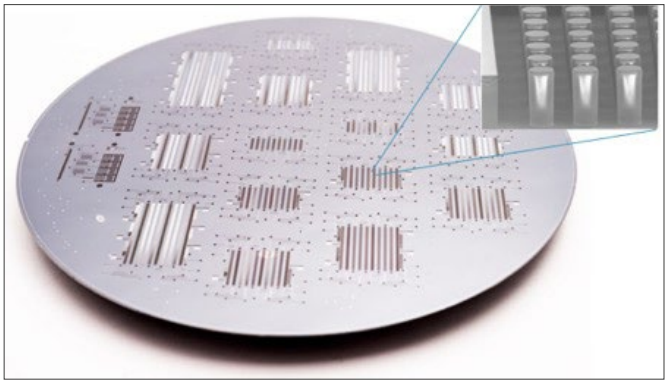


2. DNA SEPARATION WITH MICRO-PILLAR ARRAY COLUMNS

Silicon micropillar-based ion-pair reversed-phase chromatography using gradient mode has been proven to be a promising miniaturized format for the separation of relatively short double-stranded DNA, RNA and proteins.

Key benefits:

- Thanks to the high retention, reproducibility and the high detection sensitivity, separations can be used for the determination of sample length and concentration.
- PCR amplified DNA fragments can be quickly separated from the other reaction components, identified and quantified in a single step.
- The very high aspect ratio (1:25) makes a large sample loading volume possible on a small chip size.



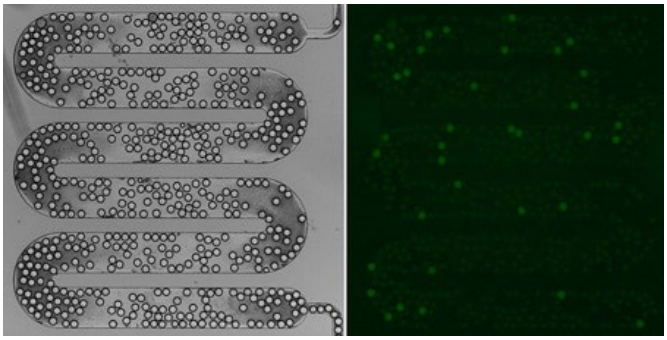
Micro-pillar arrays on a wafer.

3. SILICON MICROFLUIDICS

All applications that require the transport and manipulation of fluid in compact devices (such as lab-on-chip) make use of microfluidics. Silicon microfluidics (instead of glass or plastic microfluidics) enables smaller dimensions and a high-level integration with the device's electronics. For example, for rapid on-chip DNA amplification, silicon microfluidics are implemented for droplet sorting, monolithically integrated with other active components such as heaters.

Key benefits:

- A single integrated solution, complete with pumps, incubator chambers, ultra-fast microscopes and microprocessors for data-processing,
- Improved throughput and accuracy,
- Disposable,
- Microfluidics integration resulting in small sample volumes, reduced reagent cost, and higher analysis speed,
- Droplet PCR allowing precise isolation of substances and rapid reaction.



Microfluidic chip reactor of the digital droplet-based PCR chip. The illuminated droplets contain the DNA-molecule of interest.

HOW IMEC CAN HELP YOU

Imec enables complete lab-on-chip solutions. This allows you to improve throughput and accuracy while reducing system cost and size. As experts in hybrid design of silicon and polymer microfluidics, we can support you in R&D, process development and low-volume production. Through monolithic integration of microfluidic structures, micro-optics, photonic components and silicon electronics we can create for you a whole lab in one cm^2.

CONTACT US

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