



## Lab-on-a-chip technology

Lab on a chip systems are increasingly playing a decisive role in personalised medicine. The systems, which only have a small surface area of a few centimetres, are able to perform various functions that until a few years ago could only be carried out in well-equipped laboratories.

With the help of the lab-on-a-chip technology, the smallest amounts of liquid from patient samples can be analysed completely and automatically. Due to the easy handling of the mobile laboratory process, it is hoped that it will also be used for near-patient laboratory diagnostics in the future. One of the biggest challenges that the lab-on-a-chip technology has to overcome is the scaling up of the tests developed on a laboratory scale for mass production. Another hurdle to overcome is keeping the costs of the systems as low as possible despite miniaturisation and application-specific design.

The production of a chip lab is complex and lengthy, as channels must first be dimensioned and connected. Then the chemicals and substances used must be injected into the chip at the correct pressure and further processes such as mixing or heating must be started at the correct time. Since the processes take place in the microlitre range, even the smallest deviations have major effects and lead to faulty, unusable microfluidic chips.

Currently, various institutions such as the Fraunhofer IWS are researching prototypical production processes so that production can also take place in large quantities without any problems in the future. For the production in the laboratory, additive manufacturing or multilayer lamination has been used up to now, in which layers of polymer films are stacked on top of each other and thus prototypes are created. For series production, however, these processes have to be implemented again in injection moulding or roll-to-roll processes. The Fraunhofer IWS research group's upscaling solution now consists of developing special design rules that allow producers to incorporate requirements for various manufacturing processes for prototype development as well as for small and large series into their design as early as the planning phase. The new approach will enable lab-on-a-chip systems to reach market maturity more quickly in the future and thus be made available to the general public more quickly. The research project is scheduled to be completed by the end of 2022.

The technology offers considerable advantages to medicine, because due to the flexible and location-independent laboratory analysis, results are available more quickly and even with less personnel than usual. In the future, further potentials are to be exploited through the use of new markers so that the laboratory-analytical statements can be further specified. Lab-on-a-chip technology can revolutionise medical practice by providing reliable laboratory diagnostics in the shortest possible time in situations where central labs are not available or cannot guarantee the speed of results.

### PROJECTS TO LOOK AT:

#### SIMPLE-IVD

- ◇ **Research institutions:**  
Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS
- ◇ **Technological basis:**  
Lab-on-a-chip systems
- ◇ **Advantages:**  
Simpler and more cost-effective production from prototype to small series to mass production
- ◇ **Contact person:**  
Dipl.-Ing. Florian Schmieder
- ◇ **Website:**  
<https://www.iws.fraunhofer.de/>

Everyone has been familiar with rapid tests since the pandemic and they represent a classic form of a lab-on-a-chip system. But have you ever asked yourself in which areas these small laboratory systems could be used in the future?

The next step is to move towards diagnostic homecare applications in home care or medical care facilities, where it will support staff in their daily work by providing fast and reliable analyses.

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