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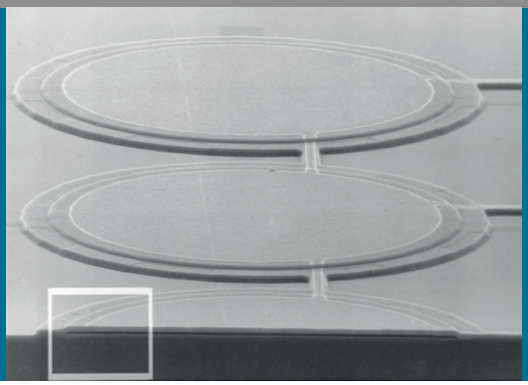

1 *Food with potential allergenic substances*
2 *SEM image of the sensor device*
3 *Image of a test board*
4 *Application-specific integrated circuit of the sensor device*

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UNIVERSAL SENSOR FOR ALLERGENS AND BIOMARKERS

Biosensors

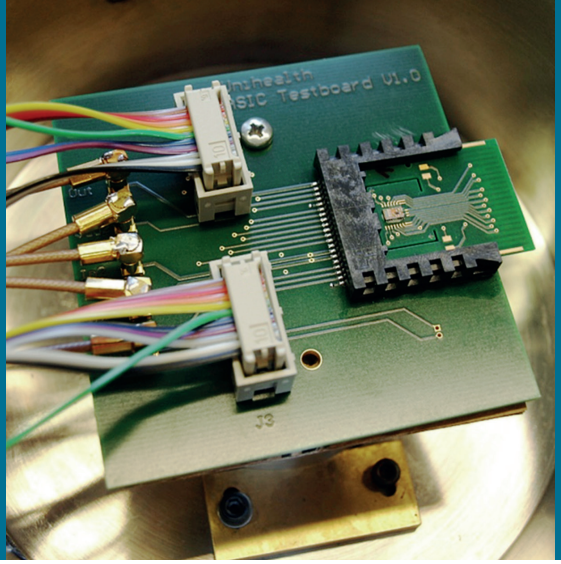
Driven by a continuous product development the sensor market exhibits an enhanced growth. Among the various sensor types, biosensors are one of the most important sensors. Functional and system-integrated sensors exhibit features such as high accuracy, fast response times and a long lifetime at low production costs.

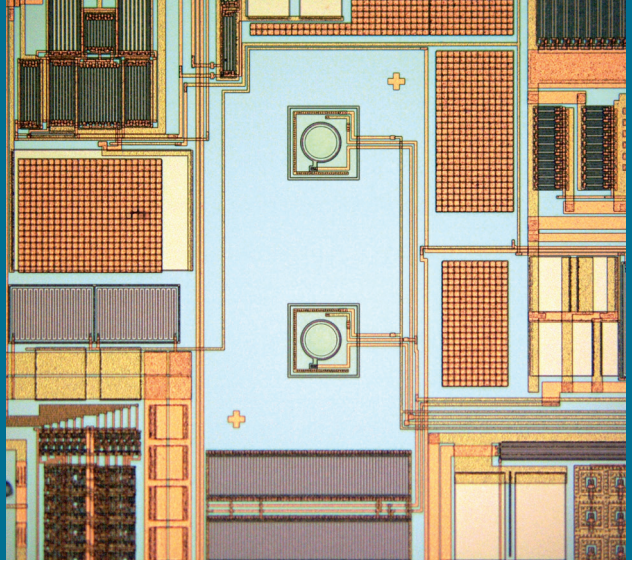
Miniaturized Allergen and Bio-Marker Sensor

Within the biosensor sector, allergen detectors and detectors for e.g. gluten detection *(fig. 1)* are becoming more and more important as approximately 25% of the European population suffers from allergy. For these persons a Point-of-Care-Testing (POCT) of allergen contained matter (food, cosmetics, or textiles) is indispensable for instance in case of breathlessness. Here, integrated Micro-Electro-mechanical Systems (MEMS) offer an excellent solution as they provide high sensitivity, selectivity, and reliability. As the allergic persons know their specific allergens a fully integrated system solution can be offered enabling rapid responses.

The UniHealth Sensor

In the frame of the UniHealth project this goal is sought *(www.unihealth.info)*.
To realize the challenging tasks, the Fraunhofer IMS, the Wageningen University and Research Centre, the Radboud University of Nijmegen, Tweehuysen B.V., Surfix B. V., NanoSens B. V., and SolMateS B.V. have created a consortium. In this highly competent partnership, a specially processed mass sensor was developed. The functional part of this CMOS (complementary metal oxide semiconductor) integrated sensor device is an electrostatically excited circular polysilicon membrane *(fig. 2)*. The working principle of the sensor is based on the shift in the resonance frequency of this oscillator induced by a mass loading onto the membrane surface.
The UniHealth partners have successfully





proven this principle. Furthermore, an application-specific integrated circuit (ASIC) device including the adherent read-out electronics has been realized and experimentally tested *(fig. 3 and 4)*. Moreover, the membrane is bio-functionalized. Currently, the consortium is facing the challenge to produce biotin and BCN functionalized sensors capable of binding streptavidin and other analytes.

Further Field of Applications

The successful proof-of-concept with streptavidin demonstrates that the attachment of any biomolecule of interest can be realized using specific biolayers deposited onto the membrane surface. This opens a huge field of applications. Within the UniHealth project more analytes will be tested.
Beside classical allergens (peanut, hazelnut, exotic fruits) the detection of so-called Anti-Ganglioside antibodies in blood for the detection of the Guillain-Barré syndrome - a neurologic disease is planned. The detection of gluten for sufferers of Celiac disease is aimed as well. As a sensor platform, the UniHealth sensor is easily adaptable to other applications such as pressure sensing gas sensor with different layers. Additionally, the detection of pollen, bacteria, or sooty particles could be a challenging topic of future applications.

The Expertise of the UniHealth Consortium

The Fraunhofer IMS is a competent partner for the development and fabrication of CMOS devices and sensors. The expertise of the Fraunhofer IMS in microsystems technology covers not only the chip design, monolithic integration of sensors, and the readout electronics but also the development of new technologies according to customer specification.

The research conducted within the Laboratory of Organic Chemistry of the Wageningen University and Research Centre and at Surfix B.V., is directed towards the study of organic reactivity, specifically at the overlap of nanotechnology, chemical biology, and organic synthesis. The expertise of the Institute for Molecules and Materials (IMM) at the Radboud University Nijmegen concentrates on the one side on the development of smart hybrid systems, protein engineering, and simulation of reaction environments. On the other side microfluidic technology is developed and continuously improved. Deposition technology for smart material development within the UniHealth project is in the focus of SolMateS B.V., Nanosens B.V. develops and produces various nanostructures for sensor technology.
Last but not least, bringing the UniHealth knowledge and marketing together is the mission of Tweehuysen B.V.

Acknowledgement

Financial support by the INTERREG IV. A Germany-Netherlands programme through the EU funding from the European Regional Development Fund (ERDF), the Ministry for Economic Affairs, Energy, Building, Housing and Transport of the State of North-Rhine Westphalia and the Dutch Ministry of Economic Affairs and the Province of Gelderland accompanied by the program management Euregio Rhein-Waal is gratefully acknowledged.

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Radboud Universiteit Nijmegen
SolMateS Solutions in Material Science
WAGENINGEN UNIVERSITY WAGENINGEN UR
nanosens
Tweehuysen WHERE KNOWLEDGE AND MARKETS MEET
surfix

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Ministerium für Wirtschaft, Energie, Bauen, Wohnen und Verkehr des Landes Nordrhein-Westfalen
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