



Department Micromechanics, Actuators and Fluidics



Fraunhofer Institut
Zuverlässigkeit und
Mikrointegration

Munich branch of the institute

Fraunhofer Institute for Reliability and Microintegration IZM

With more than 250 scientists working at 6 locations, the Fraunhofer Institute for Reliability and Microintegration IZM, with its head office in Berlin, is one of the leading institutes in the field of microelectronics and microsystem packaging worldwide.

The institute's main competencies lie in the fields of Material Science and Characterization, Electrical Design and Simulation, High Density Interconnect and Waferlevel Packaging, Chip and Board Interconnection Technologies, Si Technologies, 3D-Packaging and Vertical Chip Integration, Mechatronics, Micromechanical Systems, Reliability and Failure Analysis, Environmental Engineering, Polymer Materials and Composites, Polytronic and Flexible

Systems, Production Technologies (i.e. reel-to-reel) and the development of Microfluidic Actuators and Bio-analytical Sensors and Systems.

Our constant emphasis is on the transfer of research results into practical application and to this end we offer custom-made packaging solutions for small and medium-sized companies as well as large firms. In particular, Fraunhofer IZM know-how contributes to new developments in information and communication (e.g. mobile phones) and automotive technologies (e.g. airbag sensors).

Fraunhofer IZM works together in a close alliance with the Research Center for Microperipherics at the Technical University Berlin.



The Fraunhofer IZM in Berlin



The Fraunhofer IZM, Munich branch of the institute

Fraunhofer Institute for Reliability and Microintegration IZM
Munich branch of the institute

»Ubiquitous Systems«

The Munich branch of the institute develops components and technologies to realize ubiquitous systems.

Ubiquitous systems are defined by mobility, easy adaptability, potential for mass and low cost production as well as correlated IT services.

This means communication is integrated in any shape and manner into anything in our working and living environment.

Because also the human-machine interface plays a significant role the spectrum of departments within the Munich branch of the institute is represented as follows:

- Si Technology and Vertical System Integration
- Polytronic Systems
- Analysis and Test of Integrated Systems
- Chemical Sensor Systems and Bioanalytics
- Micromechanics, Actuators and Fluidics

Our supplies are samples of technology demonstrators, small scale production and finally technology transfer to all sizes of commercial users. On special agreement we can extend our services up to prototype fabrication.

Micromechanics, Actuators and Fluidics

Intelligent solutions for the active handling of small quantities of liquids and gases

Micro devices especially for microfluidic applications can be applied to a wide variety of industrial solutions. Fifteen experts of the department Micromechanics, Actuators and Fluidics undertake design, simulation manufacturing and prototyping of microfluidic components. The department has more than 10 years experience in the fields of active handling of small quantities of liquids and gases and guarantees optimal solution for the realization of individual applications.

Key competencies of the department are the development of micropumps, microdosing systems, micromixers, microreactors and flow sensors and their combination for the use in biotechnology, chemistry and medicine.

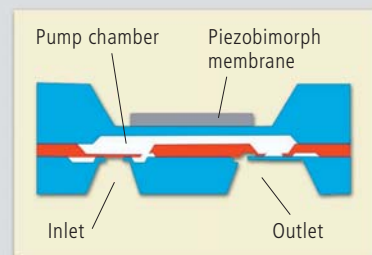
The development of the above mentioned microfluidic devices is carrying out in the framework of a platform for manufacturing the microfluidic components from silicon. The platform includes simulation, design, manufacturing, housing and end-test of the components. The benefits of the use of standardised manufacturing modules (double sided wafer structuring, silicon deep etching, wafer bonding and piezo mounting) for all components are low technology risk, short development time as well as the continuous increase of quality and yield.

Furthermore, a new platform to manufacture plastic devices is currently built-up to address low-cost applications.

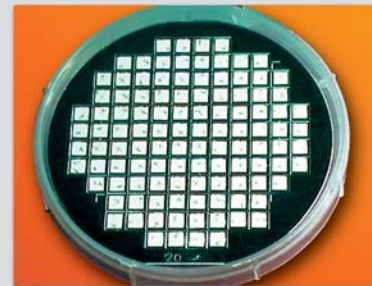
From the idea to a new product

Innovative components for new applications:

Main idea – silicon micropump



Cross-sectional view



4" micropump wafer stack



Micropump prototype

Development Micromechanics, Actuators and Fluidics

The design of new microfluidic components and actuating principles for applications in pneumatics, drug dosing, biotechnology and chemistry are the main competences this development group focuses on.

The simulation is an important instrument during the design of the microfluidic components. Different approaches of the fluid mechanics, elastomechanics and piezoelectricity are used to describe the coupled processes in pump chambers, microchannels etc. The simulation is carried out both on the single component and on the system levels by means of analytical and numerical methods.

The end-test of the developed microfluidic devices after their manufacturing and back-end assembly is carried out on the special developed test equipment by means of the gravimetric, optical and anemometric methods.

Devices

- Micropumps for fluid transportation
- Active microvalves for fluid control: normally open, normally closed
- Silicon jet dispenser
- High precision silicon capillaries
- Active and passive mixers
- Flow sensors for fluid monitoring

These components are key components to be integrated in different complex microfluidic systems such as a pipetting device, a spotter array, a miniaturised mass flow controller, a drug delivery system or a microreactor system.

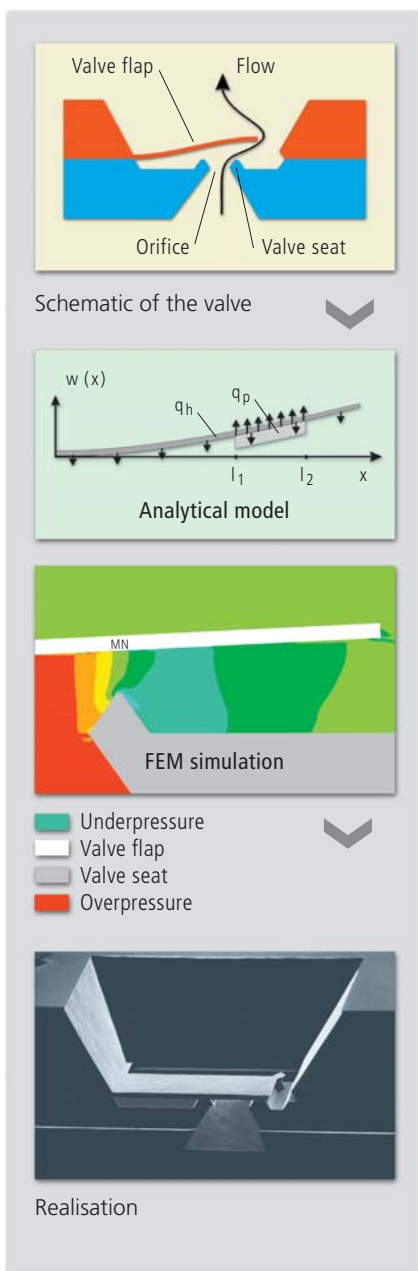
Services

The group offers contract research and development for components and systems, feasibility studies and supply of demonstrators.

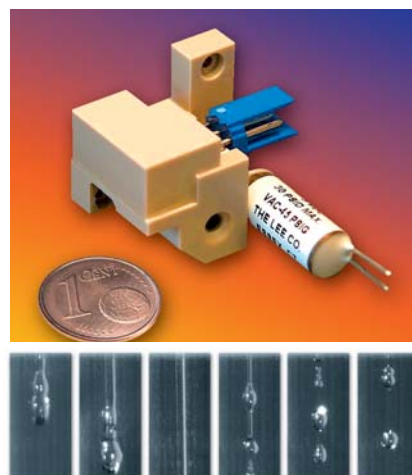
From the idea to a new product

Innovative components for new applications:

Flow control – silicon microvalve



Design flow of a microfluidic component



Free jet dispenser – the ejection of one jet at several time steps

The advantages for customers working with IZM are:

- Broad knowledge concerning all aspects of microfluidic actuators
- Interdisciplinary team of scientists and engineers with long experience
- Broad overview about the trends in the relating science disciplines
- Special expertise concerning bio-analytical sensors and systems in the neighbor department »Chemical Sensor Systems and Bioanalytics«.

We are ready for new challenges provided by you as our customer. We will use our own knowledge and that of our colleagues at IZM and all the resources of IZM to find a solution fulfilling your specific demands. We work quality oriented, confidential and in close cooperation with you as our customer.

Contact

Dr. Martin Richter
 Phone: +49.89.54759-455
 Email: martin.richter@izm-m.fraunhofer.de

MEMS Technologies

There are considerable commercial expectations on microsystem technologies. In fact there are no other technologies, which offer so many applications for so many different products and give rise to reduce manufacturing costs and improved performance. The technology group would like to help you to benefit from these opportunities by providing our core technologies and services. Each cooperation is focused on your product; our experiences and equipment are your resources.

Services

The following services are available:

- Coating/sputtering of Al, Au, Cr, NiCr, TiW; PECVD of SiO₂, Si₃N₄, SiC, a-Si
- Lithography standard processes exposure with backside adjustment
- Silicon deep etching (ASE process): Plasma etching of passivation layers Anisotropic wet etching of Si (KOH)
- Oxidation and anneal: Dry and wet oxidation of silicon (also pre-processed structured wafers)
- Full-wafer bonding techniques: Silicon fusion and anodic bonding (also for structured wafers)
- Processed materials: Silicon and glass wafer with 150mmØ (other sizes and materials on request)

Contact

Dipl.-Ing. Karl Kühn

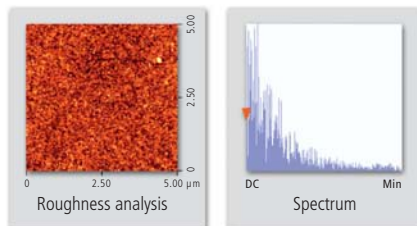
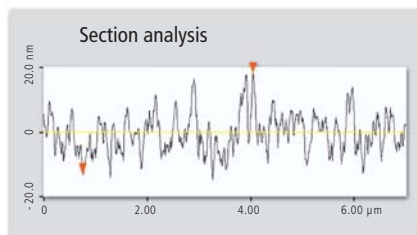
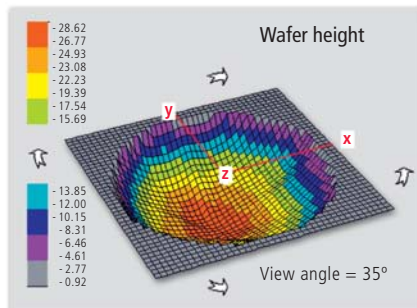
Phone: +49.89.54759-237

Email: karl.kuehl@

izm-m.fraunhofer.de

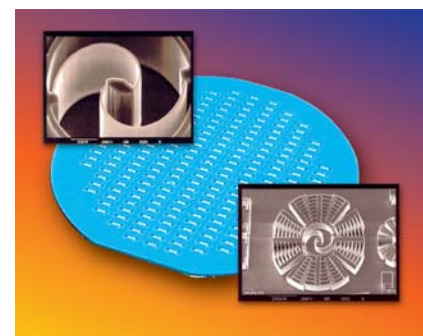
MEMS Cleanroom

- Cleanroom class 100 to 10
- Foto lithography: Karl Suss Maskaligners MA6, MA 150
- Sputter equipment: Balzers LLS801, Nordiko N2550
- Plasma etch tools: STS and Oxford Plasma Technology
- PECVD deposition of Si oxide, Si nitride and Si carbide: Unaxis Quadra D 200
- Si Deep etching (ASE process): STS Clustertool
- Anisotropic wet etching of 6 inch silicon wafers
- Bond equipment: Suss BA6 + SB6
- Wet chemical processing tools
- Metrology equipment suited for MEMS processes



Special Equipment

- Contactless measurement of the surface topologies of the manufactured devices
- Quality control (end-test) of the manufactured microfluidic components
- Measuring station for the characterisation of the micro valves by means of specific features of the climatic conditions like humidity, temperature and pressure
- Optical characterisation of the liquid droplets or jets escaping the microchannels and nozzles by means of the stroboscopic method
- Gravimetric measurements of the small quantities of liquids in nanoliter range
- Piezoelements mounting on the wafer-level by using of the screen-printing
- Equipment for wire bonding
- Injection hot moulding of micro-devices using plastic materials



MEMS technology: ASE sample

Fraunhofer IZM

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Gustav-Meyer-Allee 25
D-13355 Berlin
Phone: +49.30.46403-100
Fax: +49.30.46403-111
http: //www.izm.fhg.de
Email: info@izm.fhg.de

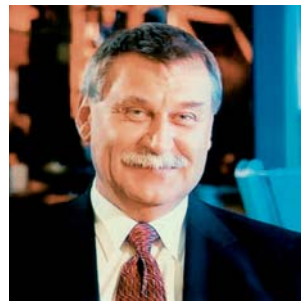
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Munich branch of the institute
Hansastraße 27 d
D-80686 München
Phone: +49.89.54759-0
Fax: +49.89.54759-100
http: //www.izm-m.fhg.de

Marketing:
Dipl.-Päd. Simone Brand
Phone: +49.89.54759-138
Fax: +49.89.54759-196
Email: simone.brand@izm-m.fraunhofer.de

Department
Micromechanics, Actuators and Fluidics

Head of department:
Dr. Martin Richter
Phone: +49.89.54759-455
Fax: +49.89.54759-100
Email: martin.richter@izm-m.fraunhofer.de



Director:
Prof. Dr.-Ing. Dr. E.h. Herbert Reichl

Public Relations:
Ortrud Hinkel M.A.
Phone: +49.30.46403-178
Fax: +49.30.46403-162
Email: ortrud.hinkel@izm.fraunhofer.de



How to find us

From Munich Airport:

- Take local train S8 or S1 to station »Karlsplatz«
- Change to underground lines U4 or U5, direction »Laimer Platz«
- Get off at station »Heimeranplatz«, take escalator at train head
- Use staircase, sign »Hansastraße«
- The IZM is directly on your left
- Your travelling time will be approx. 75 min.

From Munich Central Station:

- Take underground line U4 or U5, direction »Laimer Platz«
- Get off at station »Heimeranplatz«, take escalator at train head
- Use staircase, sign »Hansastraße«
- The IZM is directly on your left
- Your travelling time will be approx. 15 min.

By car from the south:

- Follow signs »Mittlerer Ring« (trunk road around Munich centre)
- Leave »Mittlerer Ring« at »Tübinger Straße«
- Cross »Tübinger Straße« and turn left into »Hansastraße«
- the entrance to the institute is after about 20 m on your right.

By car from the north:

- Follow signs »Mittlerer Ring« (trunk road around Munich centre)
- You will cross railways on »Donnersberger Brücke«
- In the following tunnel take the rightmost lane and leave »Mittlerer Ring« via the first exit after the tunnel, turn right into »Tübinger Straße«, turn right into »Dillwächterstraße«, turn right into »Hansastraße«
- the entrance to the institute is after about 100 m on your left.



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Direction »Heimeranplatz«, underground lines U4 and U5 or local train S7 and S27



»Mittlerer Ring«, exit »Laim« or exit »Sendling«

