

4 Research activities of ZfM in cooperation with the FhG-IZM-branchlab Chemnitz

Fields of research

- Design and fabrication of microelectrical and micromechanical elements and arrays
- ULSI metallization
- High temperature stable metallization
- Analysis of micromechanical systems
- Development and application of design tools and methods for micromechanical components and systems & coupled field analysis
- Coupling of microsystems and instrumentation (mechanical, electrical, thermal and substantial interfaces)
- Function, principles and modelling of electronic devices (test structures, parameter extraction, model building)
- Microelectronic circuit design (read out- and controlling circuits for sensors and actuators)
- MIS – solar cells (manufacturing, analysis, measuring and modelling) & multicrystalline solar cells
- Electronics for micro-electromechanical systems (MEMS)
- Development of infrared measurement systems
- Nanoelectronics
- Integrated Optics
- Colour measurement

Subjects of research

- Microfabricated scanner arrays
- Acceleration sensors
- Electrostatically driven torsion actuators with one or two DOF
- AIM technology
- High temperature applications of MEMS, e.g. gas sensor for exhaust measurement
- Vibration monitoring based on Si-sensor arrays
- Sensor / actuator systems for high precision scanning with a large vertical range
- Gyroscopes
- Wafer bond techniques / SOI – substrat fabrication / MEMS wafer level packaging
- Simulation of micromechanical and microelectrical components, materials databases
- Design tools for microsystems and microelectronics
- Macromodels for simulation of micromechanical components using PSpice
- Design and fabrication of integrated optical waveguides on silicon
- Fiber-optical communication systems
- Single Electron Tunnelling Technologies
- Colour measurement and sensors
- Orientation dependent etching of silicon: Development of etchants and determination of etch rates, design of etch masks and simulation of etch process, development of new structures by multi-step etch processes
- Geometrical measurement on microstructures
- Plastic deformation of silicon-microstructures
- Copper metallization
- Low k dielectrics
- Equipment and process simulation for microelectronics
- Development of probing equipment for 1/f measurements
- Microwave Device and Circuit Design and Simulation
- Reliability analyses

4.1 Current research projects

BMBF Project „Verbesserung der Performance von IC’s durch Integration von Kupfer und low-k Dielektrika - PERFECT“

Project Manager: Prof. T. Gessner
Partners: Infineon Technologies AG Munich, DaimlerChrysler AG Ulm, Dresden University of Technology, University of Hannover
Project duration: 01.11.2000 - 28.02.2004
Project goal: Application of Copper interconnects for mobile communication IC’s, power devices and micrometer wave devices; Integration of organic low k dielectrics into Copper Damascene metallization

BMBF Project „Modular Optical Analyser System (MOPAL)“

Project manager: Prof. T. Geßner
Partners: Endress+Hauser Conducta GmbH & Co. KG, COLOUR CONTROL Farbmestechnik GmbH, SENTECH GmbH, Micro System Research Center of Chongqing University (VR China)
Project duration: 01. 08. 2004 - 31. 07. 2007
Project goal: Development and realization of an economical, efficient and universally applicable modular optical miniature analysis system for the spectral range from 300 nm – 10 µm.

BMBF Project "New printing technologies: Development and characterization of technological and electrical parameters for polymer-based printed electronics (PEP)"

Project leader: Prof. A. Hübler, TU Chemnitz, Lehrstuhl PMT
Partners: BTU Cottbus; Universität Potsdam
Project duration: 01. 01. 2002 - 31. 12. 2004
Project goal: Development of high-volume printing technologies and characterization of printed electronic devices.

BMBF Project "Entwicklung von Technologieplattformen von Silizium-Mikrosystemen im Netzwerkverbund (InnoRegio)"

Project leader: Mr. M. Krusche, AMTEC GmbH Chemnitz
Partners: GEMAC mbH Chemnitz; FhG-IZM Chemnitz, FhG-IWU Chemnitz
Project duration: 01. 05. 2002 - 30. 06. 2004
Project goal: Development of technology platforms for silicon microsystems in a regional network.

BMBF Project "Silicon igniter (SilAnz): Preparation of HfH_x-based igniter chips"

Project leader: Dr. Laucht, TRW Airbag Systems GmbH Aschau/Inn
Partners: CiS Institut für Mikrosensorik gGmbH Erfurt; Siegert TFT GmbH Hermsdorf; TU München; ZfM-TU Chemnitz
Project duration: 01. 01. 2003 - 31. 01. 2006
Project goal: The goal of the project is the preparation of HfH_x thin films for igniter chips.

BMBF Project „IPQ (IP Qualification)“

Project manager: Prof. D. Müller
Project duration: 01.07.2001 - 31.03.2004
Project goal: The methodologies and tools developed in the project IPQ are targeted on significant improvements in quality assurance in the development and application of Intellectual Property (IP). This includes the development of new methods for IP specification, intelligent IP retrieval, techniques for (semi)-automatic IP adaptation as well as contributions to IP standardisation activities.

BMBF Project "Visualisierung mit halbleiter-basierten RGB Lasern im Automobil- und Consumerbereich - VISULASE"

Project leader: OSRAM Opto Semiconductors GmbH
Partners: FhG-IZM Chemnitz, ZfM, FhG-IOF Jena, Robert Bosch GmbH, ELOVIS GmbH
Project duration: 01. 10. 2004 - 30. 09. 2007
Project goal: The goal of the project is the development of a complex micromechanical system for a head-up display in a car.

BMW Projekt „Optimization of the multicrystalline solar cell process by means of RTP and RIE“

Project manager: Prof. G. Ebest
Partners: RWE Schott Solar, Alzenau
Project duration: 01. 04. 2001 – 30. 04. 2004
Project goal: Proof of rapid thermal processing and reactive ion etching for solar cell fabrication

BMBF Project „Electronic compensation of fabrication tolerances of microsystem products demonstrated for a multi sensor for navigation (EKOFEM)“

Project manager: Prof. T. Gessner
Partners: LITEF GmbH Freiburg, GEMAC mbH Chemnitz, FhG IZM, Department Chemnitz
Project duration: 01. 10. 2001 – 31. 12. 2004
Project goal: Development of electronic compensation methods of fabrication tolerances and their application for a high precision silicon multisensor (acceleration and angular rate measurement)

BMBF Project „Isolation schemes for ultra high RF-circuits“ (Isosurf)

Project manager: Dr. B. Trui, Atmel Germany GmbH
Partners: Atmel Germany GmbH, IMS chips Stuttgart, FZ ISG Jülich, FhG IZM Department Chemnitz, TU Ilmenau, TU Ulm
Project duration: 04/2003 – 04/2006
Project goal: Fabrication of new transistor structures based on SOI-substrates with buried silicides layers

BMBF Project „Design und Technologie für SOI-CMOS Bauelemente mit Gatelängen kleiner 50nm (MOSTEDE)“

Project manager: Prof. C. Radehaus
Partners: AMD Saxony, HTW Dresden
Project duration: 01. 04. 2004 – 31. 03. 2007
Project goal: Atomic scale modelling of new dielectrics for CMOS technologies

SMWA Project „Mikroelektronisches Zündelement für Insassen - Sicherheitssysteme“

Project manager: Prof. T. Gessner
Partners: Flexiva automation & Anlagenbau GmbH, Amtsberg; Fahrzeugelektrik Pirna GmbH
Project duration: 01.10. 2003 – 31.12. 2004
Project goal: Development of a new airbag igniter

SMWA Project „Modular measurement system consisting of a tunable FPI and IR sensor - MODUL“

Project manager: Prof. T. Gessner
Partners: Infra Tec GmbH Dresden, GEMAC mbH Chemnitz
Project duration: 01.09.2003 – 31.08.2005
Project goal: Development of layout and technology for a micromachined Fabry-Perot-Interferometer; Fabrication of prototypes

DFG Project „Polymere als low-k Dielektrika für Metallisierungssysteme in der Mikroelektronik“ – Polymers as low-k dielectrics for microelectronic metallization schemes

Project manager: Prof. T. Gessner
Partners: Prof. M. Bauer, BTU Cottbus
Project duration: 01.02.2002 – 31.01.2004
01.12.2004 – 30.11.2006
Project goal: Development and characterization of organic ultra low k material with reduced density; Patterning process development and compatibility with copper interconnect processing.

DFG Project „Heißprägen multifunktionaler Kalibriernormale für bildverarbeitende Mikroskope zum Messen von Mikrosystemen und Nanostrukturen“

Project manager: Prof. J. Frühauf
Partners: Prof. E. Reithmeier, Universität Hannover
Project duration: 01.10.2004 – 30.09.2005
Project goal: Hot pressing of calibration standards

DFG Project „Bestimmung und Optimierung des mechanischen Verhaltens von Schichtstapeln mit porösen low-k-Dielektrika“ – Evaluation and Optimization of mechanical behavior of film stacks containing porous low-k dielectrics

Project manager: Prof. T. Gessner
Partners: Prof. F. Richter, Chair Solid-State Physics, Chemnitz University of Technology
Project duration: 01.11.2004 - 31.10.2006
Project goal: Development of fundamental models and software for mechanical characterization technique based on nanoindentation of porous low-k dielectrics. Correlation with CMP loads on porous materials.

Integrated Project (IST) “NANOCMOS”: CMOS backbone for 2010 e- Europe. From the 45 nm node down to the limits

Project leader: ST Microelectronics SA (F)
Project manager: Prof. T. Gessner / Dr. S. E. Schulz
Partners: Infineon Technologies AG (D), Philips Electronics Nederland B.V. (NL), Philips Semiconductors R&D France (F), Philips Innovative Technology Solutions NV (B), IMEC Leuven (B), ST Microelectronics Srl. (I), CNRS (F), CEA-LETI Grenoble (F), Fraunhofer (D), isiltec GmbH (D), Ion Beam Services (F), Magwell (B), ACIES Europe (F)
Project duration: 01.03.2004 – 31.05.2006
Project goal: NANOCMOS is a project integrating in a coherent structure, activities that in the past have been the object of ESPRIT/IST, JESSI/MEDEA projects in the field of CMOS technologies. It focuses on the RTD activities necessary to develop the 45nm, 32nm and below CMOS technologies. From these technology nodes it will be mandatory to introduce revolutionary changes in the materials, process modules, device and metallization architectures and all related characterization, test, modelling and simulation technologies, to keep the scaling trends viable and make all future IST applications possible. NANOCMOS covers all these aspects. The first objective of the project is the demonstration of feasibility of Front-End and Back-End process modules of the 45nm node CMOS logic technology. The project intends to process as demonstrator a very aggressive SRAM chip displaying worldwide best characteristics. The second objective of the project is to realize exploratory research on critical issues of the materials, devices, interconnect and related characterization and modelling to start preparing the 32/22 nodes considered to be within the limits of the CMOS technologies. The third objective of the project is to prepare the take up of results described in the Objective I and implement a 45nm Full Logic CMOS Process Integration in 300 mm wafers

by the end of 2007. This integration will be part of a separate MEDEA+ project.

Website: www.nanocmos-eu.com

SEA-Project "ACTION : Advanced CVD tool for integration of organosilicated nanoporous films"

Project manager: Prof. T. Gessner / Dr. S. E. Schulz
Project leader: ST Microelectronics, Crolles (F)
Partners: AMD Saxony LLC & Co KG (D), Philips Res. Leuven (B), LETI Grenoble (F), Sematech (USA), TRIKON Technologies (UK)
Project duration: 01.05.2002 – 31.01.2004
Project goal: Provide organosilicated glass (OSG) material with a k-value of 2.2 for interconnect applications for the 90 nm node; Prove cluster tool for full inter metal dielectric (IMD) stack; Demonstrate flexibility for customized dual-damascene stack architectures; Show Cost-effectiveness compared to multi-tool Spin-on Dielectrics (SOD) methods; Demonstrate performance within a 300 mm production environment. Website: www.sea.rl.ac.uk

AIF Projekt "Entwicklung von Siliziumaktoren mit lasertrimmbaren Feder-Masse-Strukturen"

Project manager: Prof. T. Gessner
Partners: 3D-Micromac AG
Projekt duration: 01.05.2004 - 31.10.2006
Projekt goal: Aim of the collaboration is to investigate achievable accuracy and efficiency as well as developing new laser systems and equipment for in-line laser treatment of MEMS.

EU-Project Intelligent Manufacturing Systems: "Optical Characterisation Methods for MEMS Manufacturing - OCMMM"

Project manager: Prof. T. Gessner
Partners: GF Messtechnik GmbH (GFM), FhG.IWU, University of Twente-MESA, Thales Avionique (TH-AV), Yole Développement (YOLE), LioniX (LION), Warsaw University of Technology (WUT)
Project duration: 01. 01. 2001 – 31. 08. 2004
Project goal: Optical Characterisation Methods for MEMS Manufacturing

Industrial Research Contract „Development of precursors for copper deposition “

Project manager: Prof. T. Gessner, Dr. S. E. Schulz
Partners: BASF Ludwigshafen; Prof. Lang, TU Chemnitz , Chair Inorg. Chemistry
Projekt duration: 01.04.2003 - 31.12.2004
Project goal: Development of precursors and deposition processes for copper.

Industrial Research Contract „Fabrication of multi-use acceleration sensors“

Project manager: Prof. T. Gessner
Partners: Fara New Technologies, Xi'an, China, GEMAC mbH Chemnitz
Project goal: Development of an high precision acceleration sensor system and its fabrication technology; Fabrication of prototypes

Industrial Research Contract „Development of silicon gratings for the assessment of optical and tactile surface measuring instruments“

Project manager: Prof. J. Frühauf
Partners: GEMAC mbH Chemnitz
Project duration: 15. 09. 2003 – 31. 01. 2004
Project goal: Etching of silicon gratings with trapezoidal, triangular, rectangular and arched profiles

Stiftung Industrieforschung : „Kalibrierung von Geräten zur registrierenden Härteprüfung mittels mikrotechnisch gefertigter Si-Federkörper als Kalibriernormale“

Project manager: Prof. Dr. J. Frühauf
Project duration: 01. 10. 2003 – 31. 03. 2005
Project goal: Si force standards

DFG Project „VIVA – Low Power System Bus Encoding“

Project manager: Prof. D. Müller
Project duration: 01.07.1999 - 31.03.2005
Project goal: Development and implementation of coder-decoder systems for SOC system busses which minimize under a set of constraints the total power dissipation on a system bus with its coder and decoder implementation through reduction of switching activity on this bus.

Project „Solutions in the field of color image processing“

Project manager: Prof. D. Müller
Partners: Siemens A&D Nürnberg, Sächsisches Textilforschungsinstitut STFI Chemnitz
Project duration: 01.02.2004 - 30.06.2004
Project goal: Evaluation of new algorithms in the field of image processing by using FPGAs and realtime processing, investigation of color spaces and classification for color image analysis.

Service order No. 5 and 6 for master agreement research and development, entered by AMD and Technische Universität Chemnitz

Project manager: Prof. C. Radehaus
Project duration: 01. 08. 2003 - 30. 09. 2004
Project goal: Automation of the software system GOPI modelling CV-characteristics of gate-oxide-structures – within the framework of the GOPI model – to estimate the parameters

Project: "Entwicklung von Packagingtechnologien für Bauelemente in Oberflächen-technologie"

Project manager: M. Krusche, Amtec GmbH
Partners: FhG IWU, TU Chemnitz, Gemac GmbH, Amtec GmbH
Project duration: 05/2002 – 04/2004
Project goal: MEMS packaging for surface micro machined devices

Project: „Prüf- und Qualitätssicherungssystem für die industrielle Fertigung von wafer-gebondeten Mikrosystemen“ (Mikroprüf)

Project manager: Dr. H. Reinecke, Steag microParts GmbH
Partners: FhG IWM Halle, ZfM - TU Chemnitz, X-Fab GmbH, Robert Bosch GmbH, Hegewald & Peschke Mess- und Prüftechnik GmbH
Project duration: 11/2002 – 10/2005
Project goal: Evaluation of different wafer bond techniques and optimization of wafer bond processes.