

## 5 Cooperations with industry and universities

**Partnerships with the following institutes and companies were continued and / or established in 2004:**

- Advanced Micro Devices (AMD), Sunnyvale & Austin, USA and Dresden, Germany
- Aktiv Sensor GmbH, Stahnsdorf, Germany
- Alpha Microelectronics GmbH, Frankfurt (Oder), Germany
- AMTEC GmbH, Chemnitz, Germany
- Applied Materials, Santa Clara, USA and Dresden, Germany
- Atmel Design Center, Dresden, Germany
- BASF AG, Ludwigshafen, Germany
- BMW AG München, Germany
- Robert Bosch GmbH, Reutlingen & Stuttgart, Germany
- CAD-FEM GmbH Grafing, Germany
- CiS Institut für Mikrosensorik gGmbH, Erfurt, Germany
- Colour Control Farbmeßtechnik GmbH, Chemnitz, Germany
- DaimlerCrysler Research Lab Ulm, Germany
- Danfoss Silicon Power, Schleswig, Germany
- Digital Instruments – Veeco Instruments, Mannheim, Germany
- DILAS Diodenlaser GmbH
- Endress und Hauser Conducta GmbH & Co. KG, Germany
- Eupec GmbH Warstein, Germany
- FACRI , Research Institute, Xi'an, China
- Fahrzeugelektrik Pirna GmbH, Pirna, Germany
- FHR Anlagenbau GmbH, Ottendorf-Okrilla, Germany
- First Sensor Technology GmbH, Berlin, Germany
- FLEXIVA automation & robotics, Amtsberg, Germany
- Forschungszentrum Rossendorf, Germany
- Fujitsu Microelectronic GmbH, Dreieich-Buchsschlag, Germany
- GEMAC mbH Chemnitz, Germany
- GF Messtechnik Teltow, Germany
- Gesellschaft für Prozeßrechnerprogrammierung mbH (GPP) Chemnitz, Germany
- GHF IWM Halle
- Heinrich-Hertz-Institut Berlin, Germany
- Hitachi Ltd., Japan
- Institut für Festkörper- und Werkstoffforschung e.V. IFW Dresden, Germany
- IMEC, Leuven, Belgium
- Infineon Technologies AG, Munich and Dresden, Germany
- InfraTec GmbH, Dresden
- ITIM International Training Center for Material Science, Vietnam
- IXYS Semiconductor GmbH, Lampertheim, Germany
- Jenoptik-LDT GmbH, Gera , Germany
- Kyocera Fineceramics GmbH
- L.A.A.S-C.N.R.S Toulouse, Prof. Dr. D. Esteve, France
- LETI, Grenoble, France
- LG Thermo Technologies GmbH
- Lionix, Enschede, Netherlands
- LITEF GmbH, Freiburg, Germany
- Massachusetts Institute of Technology, Cambridge / Boston, Mass., USA
- Max-Planck-Institut (MPI) für Mikrostrukturphysik Halle, Germany

- Mechanical Engineering Laboratory AIST, MITI, Dr. Mitsuro Hattori and Chisato Tsutsumi, Tsukuba, Ibaraki, Japan
- memsfab GmbH, Chemnitz, Germany
- Merck KGaA, Darmstadt, Germany
- Mesa Research Institute, Prof. J. Fluitman, Twente, The Netherlands
- Microtech GmbH, Gefell, Germany
- Mitsui Engineering and Shipbuilding Co. Ltd., Japan
- Motorola, Phoenix, Arizona ,USA / Munich, Germany
- Nex Systems, Wilmington, MA. , USA and Berlin, Germany
- NICO Pyrotechnik, Trittau, Germany
- OEC GmbH, Germany
- PANALYTIK GmbH, Dresden, Germany
- Physikalisch-Technische Bundesanstalt Braunschweig (PTB), Germany
- PLASMACO Inc. Highland, New York, USA
- Raytek GmbH Berlin, Germany
- Rohm and Haas Electronic Materials, Marlborough, USA
- Roth & Rau Oberflächentechnik GmbH, Wüstenbrand, Germany
- RWE Schott Solar GmbH, Alzenau, Germany
- Schott Mainz & Schott Glas Landshut, Germany
- Seiko Epson, Japan
- Sentech Instruments GmbH, Berlin, Germany
- SICK AG, Waldkirch & Ottendorf-Okrilla, Germany
- SF Automotive GmbH, Freiberg, Germany
- Siegert TFT GmbH, Hermsdorf, Germany
- Siemens A&D ATS2 Nürnberg und AT Regensburg, Germany
- Institut für Solarenergieforschung Hameln-Emmerthal, Germany
- Solid State Measurements, Pittsburgh, PA., USA
- ST Microelectronics, Crolles, France
- Suss Microtec AG Vaihingen, Munich and Sacka, Germany
- Dr. Teschauer AG, Chemnitz, Germany
- Thales-Avionics, Valence and Orsay, France
- Trikon Technologies, UK
- TRW Airbag Systems GmbH & Co. KG, Aschau/Inn, Germany
- X-Fab Gesellschaft zur Fertigung von Wafern mbH, Erfurt, Germany
- Yole Developpement, Lyon, France
- ZMD Dresden, Germany
- 3D-Micromac AG, Chemnitz, Germany

#### **Universities:**

- Johannes Kepler Universität Linz, Austria
- Atominstitut Universität Wien, Austria
- Chongqing University, Chongqing, China
- Fudan University, Shanghai, China
- TSINGHUA University, Beijing, China
- Xiamen University, Xiamen, China
- University of West Bohemia, Pilsen , Czech Republic
- Technische Universität Braunschweig, Germany
- Universität Bremen, Germany
- HTW Mittweida, Laserapplikationszentrum, Germany
- TU Dresden, Germany
- Universität Erlangen, Germany
- Universität Essen, Institut für anorganische Chemie, Germany

- Universität Hannover, Germany
- Westsächsische Hochschule Zwickau (FH), Zwickau, Germany
- TU Budapest, Hungary
- University of Tokyo, Res. Ctr. for Adv. Science & Technology (RCAST), Japan
- University of Delft, Netherlands
- University of Twente – MESA, Netherlands
- Warsaw University of Technology (WUT), Warsaw, Poland
- Nowosibirsk State University, Russia
- Technological University Singapore, Singapore
- Royal Institute of Technology, Stockholm, Sweden
- University of Hertfordshire, UK
- State University of New York at Binghamton, USA
- Portland State University, Portland, Oregon, USA
- Rensselaer Polytechnic Institute (RPI), Troy, N.Y., USA
- University of Nevada, Reno, USA
- University of California at Berkeley, Berkeley Sensor and Actuator Center, USA
- Case Western Reserve University, Cleveland, Ohio, USA
- University of Colorado at Boulder, USA
- University of Delaware, Newark, USA
- Hanoi University of Technology, Vietnam

## 6 Equipment and service offer

The ZfM facilities include 1000m<sup>2</sup> of clean rooms (about 30% of them class 10 to 100). Modern equipments were installed for processing of 100 mm and 150 mm wafers as well as design and testing laboratories providing the basis for the following processes, partly in cooperation with the Fraunhofer Institute IZM, branchlab Chemnitz:

- Design (Workstations)
- Mask fabrication 3" ... 7" / Electron beam lithography / Proximity and contact double-side lithography
- High temperature processes: Diffusion / Thermal oxidation / Annealing / RTP
- Etching (dry: Plasma- and RIE-mode & wet: isotropic / anisotropic)  
( Alcatel MCM, SECON XPL 251, STS Multiplex ICP-ASE, Metal Etch DPS Centura)
- Chemical vapor deposition MOCVD (Precision 5000 [Cu, WN, TiN])
- Chemical vapor deposition PECVD (Precision 5000 [SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, CF-Polymer, SiCH, SiCOH, SiCNH])
- Physical vapor deposition PVD (MRC 643, FHR 150x4, CLC 9000, ... )
- Chemical mechanical polishing CMP
- Wafer bonding: silicon direct, anodic, eutectic, glass frit
- Testing (SEM, AFM, electrical, mechanical ...)

### The ZfM provides the following services :

#### R & D

- (e.g. Si processes, technology, development of sensors and actuators, metallization)
- Thermal oxidation of silicon wafers
- PVD (Cr, Au, TiN, Cu, Pt, Al, W, TiW, AlSi<sub>x</sub>, CrNi, Pyrex )
- CVD: PECVD / LPCVD (600° C ... 900° C)  
(SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, Polysilicon, Si<sub>x</sub>O<sub>y</sub>N<sub>z</sub>, Cu-MOCVD, TiN-MOCVD, SiCOH, SiCH)
- PECVD (diamond-like Carbon films, a-C:H)
- Dry etching (Si, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, Polysilicon, Silicides, Al, Cu, refr. metals, TiN, Cr, DLC)
- Wet etching (SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, Si, Polysilicon, Al, Cr, Au, Pt, Cu, Ti, W )