

19th IEEE International Conference on Micro Electro Mechanical Systems

# FINAL PROGRAM

ISTANBUL, TURKEY 🗪 22 - 26 JANUARY 2006









### PROGRAM AT A GLANCE

	Sunday, 22 JAN	Monday, 23 JAN	Tuesday, 24 JAN	Wednesday, 25 JAN	Thursday, 26 JAN
7		7:00	7:30	7:30	7:30
7:30		Registration	Registration	Registration	Registration
8		8:30-8:50	8:10-8:50 Invited Speaker	8:10-8:50 Invited Speaker	8:10-8:50 <b>SESSION 9</b>
8:30		Welcome Address	B.J. Feenstra	K. Suzuki	Nano
9		8:50-9:30 Invited Speaker - M. Meyyappan	8:50-9:50 SESSION 4	8:50-9:50 SESSION 6	8:50-9:30 SESSION 10 Wireless
9:30		9:30-10:30 SESSION 1	Particles I	Power MEMS	9:30-9:50 SESSION 11 Non Optical
10		Cells I	9:50-10:20 Exhibit Inspection & Break	9:50-10:20 Exhibit Inspection & Break	9:50-10:20 Exhibit Inspection & Break
10:30		10:30-11:00 Exhibit Inspection & Break			10:20-12:00
11		11,00 10,20	10:20-12:20 SESSION 5	10:20-12:20 SESSION 7	SESSION 12 Actuators
11:30		11:00-12:20 SESSION 2 Cells II	Physical Sensors	Fabrication & Packaging	
12			12:20 MEMS 2007 Announcement		12:00 Conference Adjourns
12:30					
13		12:20-13:40 <b>Lunch</b>	12:30-13:40 <b>Lunch</b>	12:20-13:40 <b>Lunch</b>	
13:30					
14		13:40-15:40	12:40 15:40	13:40-15:40	
14:30		POSTER/ORAL Session I	13:40-15:40 POSTER/ORAL Session II	POSTER/ORAL Session IV	
15		003310111	Jessiuli II		
15:30		15:40-16:10 Exhibit Inspection & Break		15:40-16:10 Exhibit Inspection & Break	
16		40:40 47:00	15:40-17:40 <b>POSTER/ORAL</b>	16:10-17:10 SESSION 8	
16:30		16:10-17:30 SESSION 3 Optical	Session III	Particles II	
17	16:00 - 19:00	opasa.		17:10 Adjourn for the Day	
17:30	Registration	17:30 Adjourn for the Day	17:40 Adjourn for the Day		
18					
18:30					
19	18:30 - 20:30 Welcome Reception				
19:30	Busses leave 18:00 from ICEC Last Bus leaves at 21:00			18:30-22:00	
20				Gala Banquet Busses leave 18:00 from Hilton Istanbul	
20:30				Last Bus leaves at 22:30	
21					

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### FROM THE CO-CHAIRS

We would like to welcome you to Istanbul, TURKEY for the 19th IEEE International Micro Electro Mechanical Systems (MEMS) Conference!

Since the beginning of this Conference series in 1987, the MEMS community has experienced significant growth in various areas such as environmental sensors, inertial sensors, optical MEMS, RF devices, microfluidics, bioanalytical microsystems, PowerMEMS, NEMS and many more interesting fields. Great strides have been made in approaches to making MEMS, including self assembly, integration of nano-scale features and use of materials new to MEMS. The enthusiasm of this community is evident from the creativity and speed shown in both research and product development.

It is our great pleasure to announce that this year we received a record high of 789 abstracts. A total of 236 papers were judiciously selected by the 24 member Technical Program Committee (TPC). The presentations are arranged in a single-session format, which consists of 3 invited talks, 42 oral presentations, and 194 posters. We are continuing the successful poster presentation format pioneered in 2004. Poster presentations are divided into four sessions to facilitate interaction with authors, who will have their posters on display throughout the Conference. During their designated poster session, authors will be asked to give a short presentation once every 30 minutes to those present next to their poster. All Conference papers, oral and poster, will be available both in paper form and on a CD ROM and will be distributed at the Conference to all attendees.

We'd like to specially thank all the authors of the submitted abstracts. It is their highest quality work that serves as the foundation for the success of this Conference. The best abstracts have been selected by the TPC, made up with equal representation from the three regional sub-divisions, which include the American sub-continents, Europe and Africa, and Asia and Australia. To facilitate review of the large number of abstracts, four sub-committees were formed to examine abstracts in different categories. The committee recommendations on the acceptance and declination of papers were taken as binding and resulted in an overall acceptance ratio of thirty percent. We are greatly indebted to the TPC members, who volunteered their valuable time, including participation in a two-day on-site meeting, for paper selection. We are also indebted to the International Steering Committee and the Advisory Co-Chairs, Victor M. Bright and Gary K. Fedder, for their guidance and advice. We gratefully acknowledge the industrial support groups and exhibitors for their involvement in this Conference and are very thankful to the IEEE Robotics and Automation Society for their continued support of this meeting. Once again, welcome to Istanbul and we hope you enjoy the Conference!

Tayfun Akin, Ph.D. General Co-Chair

Roland Zengerle, Ph.D General Co-Chair

### **GENERAL INFORMATION**

#### **Conference Location**

All sessions will be held at the Istanbul Convention & Exhibition Centre (ICEC)

Harbiye 80230 | Tel +90 (212) 296 3071 (Conference Registration Desk)

Istanbul, TURKEY | Fax +90 (212) 224 08 78

### **Dialing Codes**

Turkey's International Country code: +90 • Istanbul's Local Area Codes: 212 and 216

### **Registration & Information Desk**

The Registration and Information desk will be open during the following times:

Sunday, January 22nd . 16:00 - 19:00 Wednesday, January 25th 7:30 - 17:10

Monday, January 23rd . . 7:00 - 17:30 Thursday, January 26th 7:30 - 12:00

Tuesday, January 24th. . 7:30 - 17:40

#### Lunches

To reduce long lines, we suggest that you visit the posters and exhibits before visiting the buffet line.

#### Name Badges

All attendees must wear their name badge at all times to gain addmission to all sessions, exhibits, lunches and receptions.

#### Technical Digest and CD-ROM Sets

One copy of the Technical Digest and CD-ROM set is included in your bag. Additional copies may be purchased at the Registration Desk. Purchase price of the Technical Digest set will increase after the conference. Be sure to order your additional copies in advance. IEEE Member.........€100 (each) Non-Member.......€125 (each)

#### Wireless Internet Service

Wireless Internet is available in the Exhibit Hall, Poster Area, Lunch Area, and General Session Room. There is no fee to connect to this service.

### Cloak Area

The Cloak Area to hang your coat is located in the Exhibit Hall. The MEMS 2006 Conference and the ICEC are not responsible for any items left in the Cloak Area.

#### Cellular Phones, Pagers and Watch Alarms

Out of courtesy to our speakers and other attendees, please turn off any cellular phones, pagers and watch alarms during sessions.

#### Cameras and Video Tape Recorders

Cameras and video tape recorders are strictly prohibited in the sessions, poster presentations and the exhibit area. Film or video will be confiscated.

### **Smoking**

All meeting rooms and seated functions are smoke free. Please adhere to the smoking policy of the ICEC.

### Message and Job Market Board

Please visit the Message and Job Market Boards located near the Conference Registration Desk.

#### **Currency Exchange**

The unit of currency in Turkey is the New Turkish Lira (TRY) and it is acceptable at regular stores and restaurants. The exchange rate fluctuates daily. US dollars, Euro, Credit cards (MasterCard® and Visa®), and traveler's checks are accepted at most hotels, restaurants, and stores.

### **Tipping Standards**

10% is standard for meals. For porters and bellman, 2% of the nightly room rate is standard and rounding off metered taxi rates is common.

#### Electricity

Electricity throughout Turkey is 220V, 50 cycles, as in Europe. Plugs are also of the European variety with two round prongs.

#### **Shipping Service**

Shipping Service for the Technical Digest is available by visiting the Business Center located at the Hilton Hotel.

The Business Center hours are Monday-Thursday 8:00 to 22:00

### **SOCIAL EVENTS**

#### **Sunday Welcome Reception**

The Welcome Reception will begin at 18:30 on Sunday evening in conjunction with Registration. The reception will be held at the Esma Sultan Palace. Buses will depart from the convention center starting at 18:00. The last return bus will leave at 21:00.

Istanbul still has many enigmatic ruins, rarely explained in guidebooks, and often almost impossible to date unless you are a real expert: is it sixteenth century or eighteenth, or even basically Byzantine? Until recently, Esma Sultan Palace was one of these. In the old fishing village of Ortakoy on the Bosporus, the late eighteenth-century brick palace was a summer retreat for Esma Sultan, the daughter of a Sultan Abdulhamit. She was one of the most intellectual women of her time and was reputed to be a very active socialite. It burned down about 100 years ago, and became a useless but picturesque shell.

Now, Ortakoy is almost under the shadow of the Bosporous suspension bridge, and is very much part of the great city. Yet it still retains a good deal of its village atmosphere, with colorful houses that surround a gem of a seaside Baroque mosque. The area has become popular as a focus of entertainment, artistic life and a slightly recherche tourist centre. The views over the Bosporus and the beautiful mosque next door make this a truly spectacular venue for the Welcome Reception.

#### Gala Banquet

No conference is complete without a banquet! Join us at the Ciragan Palace Kempinski Istanbul for a night of food and entertainment that you will not forget. The entertainment program includes Golden Girls performing classical Turkish music, a Whirling Dervish Ceremony, a folk dancing show, and more!!!

#### **About The Palace**

In the second half of the 16th century, High Admiral Kilic Ali Pasha had a waterfront house in the area where Ciragan Palace Hotel Kempinski Istanbul now stands, and in the 17th century (1648) Sultan Murat IV gave the imperial garden to his daughter, Kaya Sultan, and her husband, Grand Vizier Melek Ahmet Pasha. They had a small wooden mansion built here in which they would spend the summer months. At the beginning of the 18th century, Ahmet III presented the house and grounds to his son-in-law, Grand Vizier Ibrahim Pasha of Nevsehir, who organized torchlight festivities known as Ciragan Senlikleri (Ciragan Festivals) with his wife, Fatma Sultan. It was then that the area became known as Ciragan.

Buses will depart from the Hilton Hotel starting at 18:00. The last return bus will leave at 22:30.

Registration includes 1 ticket. Additional Guest Ticket: €80



### ORGANIZING COMMITTEE

### **Executive Organizing Committee**

**General Co-Chairs** 

Designate Co-Chairs 2007

Jong-Uk Bu. LG Electronics Institute of Technology, KOREA

Satoshi Konishi ...... Ritsumeikan, JAPAN

**Advisory Co-Chairs** 

Technical Program Committee

Lionel Buchaillot ...... IEMN/ISEN, FRANCE

Mitsuhiro Shikida. Nagoya University, JAPAN Yuji Suzuki. University of Tokyo, JAPAN

### **International Steering Committee**

**Co-Chairs** 

**Members** 

Jong-Uk Bu. . . . . LG Electronics Institute of Technology, KOREA

Satoshi Konishi ...... Ritsumeikan University, JAPAN

### INDUSTRIAL SUPPORT GROUP

We gratefully acknowledge, at the time of printing this brochure the financial support of this Conference from the following:

### **Gold Level**



Silver Level

## **OLYMPUS**

### Special Acknowledgment





### Media Support









### **EXHIBITORS**

Exhibit Hours:	
Monday, January 23	10:30 - 17:30
Tuesday, January 24	9:00 - 16:00
Wednesday, January 24	9:00 - 16:10

Please refer to the floorplans on page 15 and 36.

**EXHIBITOR** BOOTH

98 Avenue de Brogny Anneey 74000 FRANCE Phone: 33-450-65-7777 Fax: 33-450-65-7789 Website: www.adixen.com

Adixen Micro Machining Systems (MMS) is a business unit within Alcatel Vacuum Technology located in Annecy, France. Adixen MMS is specialised in designing, manufacturing, marketing and servicing deep plasma etching systems for the fabrication of Micro Electro Mechanical Systems and Micro Optical Electro Mechanical Systems. Its main application markets are the telecommunications, automotive, aerospace, computer peripherals, biomedical industries, power devices and wafer level packaging.

Adixen MMS is committed to support its customers through an international network of sales & service offices. Three applications laboratories in France, the USA and Japan provide our customers with process development & process demonstration. At the end of 2004, Adixen MMS had a world-wide ICP etching tool installation base of more than 150 sites in the United States, Europe and Asia.

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4425 Fortran Drive San Jose, CA 95134 USA Phone: 1-408-907-2822 Fax: 1-408-719-9102

Website: www.appliedmst.com

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Ringland Way

Newport, South Wales NP18 2TA UK

Phone: 44-1633-414000 Fax: 44-1633-414141

Website: www.avizatechnology.com

Aviza Technology was formed through the merger of Aviza Technology Inc and Trikon Technologies Inc in December 2005. Aviza offers process applications including Atomic Layer Deposition (ALD), diffusion and low pressure chemical vapor deposition (LPCVD) furnaces, atmospheric pressure CVD (APCVD), DCVD, etch and physical vapor deposition (PVD). At MEMS 2006, Aviza will be exhibiting its MEMS deep Silicon etch processes on the Omega dry etch system, and its thin film deposition solutions by PVD for Bulk Acoustic Wave resonators on the Sigma fxP cluster system.

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Carl-Scheele-Str. 14 Berlin, 12489 GERMANY Phone: 49-30-670992-11 Fax: 49-30-677 5718 Website: www.bestec.de

BESTEC is specialized in design and manufacturing of vacuum systems for applications in surface analysis & deposition techniques and is also a supplier of equipment to the high energy physics community. All systems are tailored according to the customer,s needs. We satisfy high-end requirements for vacuum physics, precision mechanics, optics/laserphysics and automation.

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Brewer Science is an integrated, global company that manufactures chemicals and equipment for the optoelectronic, microelectronics, and MEMS industries. Materials include lift-off layers, temporary etch protective coatings, optical coatings, electron beam resists, and anti-reflective coatings (ARC) for advanced lithography processes. Equipment includes spin coaters, bake and cure equipment, wafer processing systems and contact planarization technology. Prototype coating services are also offered.

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Website: www.coventor.com

Coventor is the industry-leader in MEMS design software tools. For more than nine years, Coventor has developed leading-edge expertise in the optimization and analysis of micro-scale devices, such as micro-electro-mechanical systems (MEMS), integrated ICs and fluidic components and subsystems. The company's device design software can be found in more than 200 commercial institutions, including the worlds leading micro system Research and Developers. Coventor also hosts the most successful University program with more than 2000 seats installed worldwide for the training and development of MEMS engineers. Serving RF, Optical, Sensor, Microfluidic and mixed applications, Coventor can help you design your device, on demand.

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92 Madison Avenue

Hempstead, NY 11550 USA Phone: 516-481-7990 Fax: 516-481-7320

Website: www.galvanics.com

Digital Matrix Corp. designs and manufactures galvanic equipment used in theelectroforming and plating of MEMS parts. We have developed non organic plating processes with Cu, Au, NiCo, Ni & NiP chemistries achieving high Vickers hardness and negligible stress. Plating sizes range from 2" wafers to 1.5 meter shims with exact thickness and flatness as required and high-speed plating times. Equipment manufactured range from 1 to 4 cell plating systems, Electroclean systems, Thickness profiler/gauge, silver spray system, Waste Treatment and DI Pure Water systems, spin coaters, spin dryers and many more. Two other specialties are: R&D projects and custom plating systems.

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Doejeon 305-701 KOREA Phone: 82-42-869-4314 Fax: 82-42-869-8690

Website: www.mems.kaist.ac.kr

Digital Nanolocomotion Center (DNC) is a National Creative Research Center funded by the Ministry of Science and Technology. Since its foundation in 2000, DNC has been devoted to the research on the bio-inspired digital nanolocomotion systems, whose major functions are the high-precision control and the cost-effective manipulation of a new class of information carriers, including mechanical, optical, biochemical and thermofluidic signals or nanosubstances. Total 21 people are currently working for DNC, either in research division or in service division. Major activity and mission of DNC include research and development, advanced education and training, exchange and collaboration in the area of bio-inspired Nano/Micro ElectroMechanics Systems (N/MEMS) for non-electrical nano information carriers.

DI Erich Thallner Strasse 1

St. Florian/Inn, Schärding, 4782 AUSTRIA

Phone: 43-7712-5311-0 Fax: 43-7712-5311-4600 Website: www.evgroup.com

EV Group provides leading-edge wafer processing equipment for MEMS and Microfluidies, Advanced Packaging, Compound Semiconductor/MOEMS, SOI, Power Devices and Nanotechnology applications: Double side mask/bond aligners. Wafer bonders for anodic, silicon fusion, thermo compression and LowTemp plasma bonding. Wafer/mask cleaning systems. Temporary bonders and debonders. Resist processing systems, photoresist spin/spray coaters and developers. Hot embossing and nanoimprinting systems. Optical test and inspection systems. EV Group holds the dominant share of the market for wafer bonding equipment (especially SOI bonding) and is a leader in lithography for advanced packag-

**EXHIBITOR** 

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With an installation base in over 30 countries, Heidelberg Instruments is a world leader in production of high precision laser lithography systems. These systems are used for direct writing and photomask production in research and industry. Applications include: MEMS, BioMEMS, Nano Technology, ASICS, TFT, Plasma Displays, Micro Optics, and many other exciting applications. Please visit us at: www.himt.de

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Villingen-Schwenningen, D-78052 GERMANY

Phone: +49-7721-943-232 Fax: +49-7721-943-210 Website: www.hsg-imit.de

HSG-IMIT is a leading R&D provider in Baden-Württemberg for Microsystems Technology in the fields of microfluidics, sensors and information technologies. Promoting awareness of and facilitating access to this new technologies are the main tasks of HSG-IMIT acting as a service centre providing specific consulting, advanced training, technological services, feasibility studies, prototyping, small scale production as well as serial production in co-operation with industrial companies. About 80 employees are working on system solutions in the areas of microfluidics and physical sensors. HSG-IMIT will be one of the first institutions dedicated to industrial research which will be certified after the new process oriented management system ISO 9001:2000.

75 Robin Hill Road

Santa Barbara, CA 93117 USA Phone: 1-805-681-2800 Fax: 1-805-967-2677

Website: www.imtmems.com

IMT was formed in 2000, specifically to produce MEMS (micro-electromechanical systems) devices. IMT's 130,000 sq ft facility contains a 30,000 sq ft clean room/fab, the largest and best-equipped independent MEMS fab in the world. The company was built for high-volume manufacturing, and provides complete foundry services from design through production. IMT currently has >100 employees and >20 customers in diverse applications, including relays and relay arrays, drug discovery, drug delivery, biomedical implants and cell purifiers, microfluidics, displays, inertial navigation, optical telecommunications, printing, various sensors, night vision, IR emitters, telephone/DSL switching, RF devices, power management, and others. IMT's overriding goal is to partner with companies to develop and manufacturer products based on MEMS technology.

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Website: www.intellisense.com

IntelliSense is the leading supplier of solutions for the MEMS industry. Its IntelliSuite family of CAD tools ignited the MEMS industry in the 90's and is now used by universities and corporations worldwide. IntelliSense offers software tools and custom turnkey solutions ranging from concept through finished production units world wide. With customers in over 25 countries, and partnerships with dozens of leading corporations, IntelliSense is recognized as the leading innovator in MEMS design, development and complete solutions. For further information please visit http://www.intellisense.com

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Website: www.microsystems.metu.edu.tr

METU-MEMS is an R&D and low volume production facility for Micro-Electro-Mechanical Systems. The facility allows 4" and 6" wafer processing and has 1000 sq. meters of class 100 and class 1000 clean room area for fabrication and 300 sq. meters of class 10000 clean room area for testing. The facility is supported by 25 technical personnel and 20 researchers and provides services for prototype development and low volume production of MEMS components. The current activities include development of MEMS components for commercial applications, including very low cost uncooled infrared detector arrays, surface and bulk micromachined gyroscopes and accelerometers, RF MEMS components, piezoresistive pressure sensors, and humidity sensors.

1254 Chestnut Street Newton, MA 02464 USA Phone: 1-925-485-3205 Fax: 1-925-846-8509

Website: www.microchem.com

NanoAndMore GmbH. 43

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Website: www.nanoandmore.com

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Ankara, 06680 TURKEY Phone: 90-312-441-8839 Fax: 90-312-438-64-95

Website: www.normtest.com.tr

Normtest Dis Ticaret Ltd Sti is the market leader Distributor Company in Turkey, that covers Nanotechnology, MEMS, Material Sciences, Physics, Electronics, Micro Mechanics, Bio-Technology and Surface Technologies Markets.

Metrology Systems are one of the major area of interest for existing 10,000 + contacts of Normtest in the Turkish Market.

Specialized and Highly Trained staff of Normtest is constantly in contact with the market with solutions in Photonics, Topology, Profiles, Properties of the surfaces and materials.

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Website: www.normtest.com.tr

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Phone: 31-55-540-2565 Fax: 31-55-540-2566 Website: www.ntmdt.com

NTI sells a broad spectrum of Scanning Probe Microscopes and accessories. The SPM's are NT-MDT branded and cover a large number of applications. There are models for biomedical applications, for the research of magnetic materials, for the semiconductor and CD industry, for chemistry and high throughput experimentation and many more.

NTI sells the SPM's directly as well as through a network of distributors and agents to European and some Asian countries. For an overview of distributors go to http://www.ntmdt.com/Distributors Consumables, such as cantilevers, silicon calibration gratings, DNA test monsters and Highly Oriented Pyrolytic Graphite, are sold worldwide from NTI. They are often delivered within 1 day. Visit our online consumables shop for an overview of the products and prices. NTI is the EU representation of NT-MDT, which is established in Zelenograd, close to Moscow. NTI takes care of the after-sales service to European customers.

Training in the use of an SPM is generally given at the customer's site, but it's also possible to get an additional training at our facilities. NTI can be contracted for conducting measurements on samples with the SPM's at the facilities in Apeldoorn.

Nano Technology Instruments – Europe B.V. was established in on June 6, 2002 as a Private Limited Liability Company. It is a Dutch company. Other legal names are: NTI and NTI – Europe B.V.

685 River Oaks Parkway San Jose, CA 95134 USA Phone: 408-232-0600 Fax: 408-433-9904 Website: www.oainet.com

OAI manufactures precision lithography equipment for MEMS, Microfluidics, and Semiconductors industries. The equipment is engineered to the highest specifications, is budget friendly and can take the customer from design, R&D through to production. Products include: mask aligners, bonders, light sources, and UV Ozone surface treatment. OAI maintains worldwide sales, service and engineering support.

Olympus Partnership Development Group 6

180 Baytech Drive San Jose, CA 95134 USA Phone: 1-408-514-3900 Fax: 1-408-946-3836

Website: www.olympus-pdg.com

Olympus Partnership Development Group (PDG) is part of the R&D division of Olympus Corporation. Our mission is to establish partnerships with companies by leveraging our MEMS and Optical foundry services, and extensive experience with MEMS chips, micro-optics, and optical subsystems. Olympus offers complete module solutions for combining MEMS, optics and electronics to accelerate design, development, production, and time-to-market of new products and technologies. Olympus has innovative technology, a global brand, world-class precision manufacturing, world-wide distribution, a marketing and sales infrastructure, and investment capability.

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The PhoeniX provides customers integrated software solutions for Micro and Nano technologies. PhoeniX bridges the gap between design team and the real cleanroom environment, facilitating communication from design to production and back. Re-usability, validation, and quality improvement of information, from research to volume production, are the key factors for efficient MNT product development. With solutions for Mask Design (CleWin3, MaskEngineer), Process Flow Design (FlowDesigner, FlowDB) and Integrated Optics Simulation (FieldDesigner, OptoDesigner) PhoeniX sets new standards in MEMSLand.

Polytec - Platz 1 - 7 Waldbronn, 76337 GERMANY

Phone: 49-7243-6040 Fax: 49-7243-69944 Website: www.polytec.com

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Website: www.softmems.com

SoftMEMS is the creator of the popular, powerful, easy-to-use CAD tool suites MEMS Pro, MEMS Master and MEMS Xplorer for the design and analysis of MEMS. Software functionalities encompass mixed MEMS/IC schematic capture, simulation, design optimization, statistical analysis, and full custom mask layout supporting popular mask formats. Also included are manufacturing and design rule verification, 3D model generation and visualization from manufacturing process descriptions, behavioral model creation and links to 3D analysis packages. A variety of foundry-specific modules are fully integrated with SoftMEMS' tool suites to ensure process compatibility and manufacturability with the world's leading MEMS foundries. We will be showing our MEMS Pro and MemsMaster tools at MEMS 2006. Please visit us at our booth for a live demonstration.

Tiergarteustr. 17

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- 7 main publishing fields: science, medicine, economics, engineering, architecture, construction and transport

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Established in 1984, STS is a leading supplier of cassette-to-cassette cluster and single/batch loadlocked plasma etch and deposition systems that can be configured with ICP, RIE, XeF2 and CV D sources. Products include the market-leading ASE® deep silicon etch process for MEMS micromachining. The company also offers a complete suite of other enabling process technologies for MEMS device fabrication and packaging applications, including dielectric etch and deposition, metal etch and dry isotropic silicon etch. Serving both R&D and high volume manufacturers, STS is committed to facilitating the transfer of MEMS technology from R&D to full scale production and successful commercialization.

SUSS MicroTec. 9

Schleissheimer Strasse 90

Garching Bei Munchen, 85748 GERMANY

Phone: 49-89-320-070 Fax: 49-89-320-07162 Website: www.suss.com

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TecHarmonic manufactures Point-of-Use dry resin, wet, thermal/wet and thermal catalytic systems to abate the toxic, corrosive, explosive, pyrophoric and GWG emissions from process tools used in the production of MEMs, Solar Cells, IC's, FPD and other devices.

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Swavesey, Cambridge, CB4 5VQ UK

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Website: www.veeco-europe.com

Veeco is the leading supplier of 3D metrology instrumentation for research and production. Veeco's Optical Profilers, Stylus Profilers and Atomic Force Microscopes are critical enabling tools for characterizing MEMS devices. Wyko® NT Series non-contact Optical Profilers provide ultra-fast measurement of static and dynamic devices. Dektak® Stylus Profilers accurately calculate step heights, trench depths, stress and surface roughness.

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XACTIX is the leading supplier of xenon difluoride silicon etch equipment. Isotropic etching using xenon difluoride is being widely adopted as an essential process for releasing MEMS. XeF2 shows nearly infinite selectivity to silicon over almost all standard semiconductor materials including photoresist, silicon dioxide, silicon nitride and aluminum. Being a vapor phase etchant, XeF2 avoids many of the problems typically associated with wet or plasma etch processes.

### 

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Founded in 1998, Yole Developpement is now the world leader in the analysis of the microtechnologies and compound semiconductors markets. Yole Developpement is a market research and strategy consulting company, specialized in:

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- Compound semiconductors & optoelectronics
- Equipment and materials for the production of semiconductor devices
- Life sciences instrumentation

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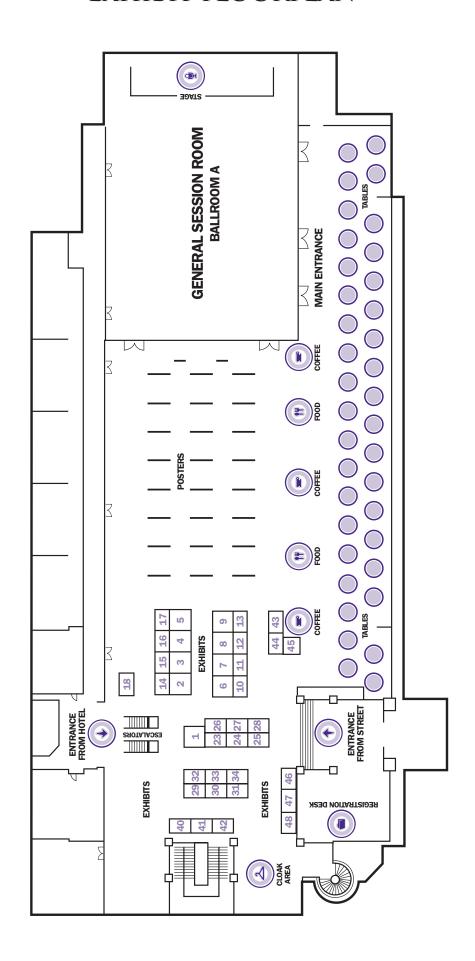
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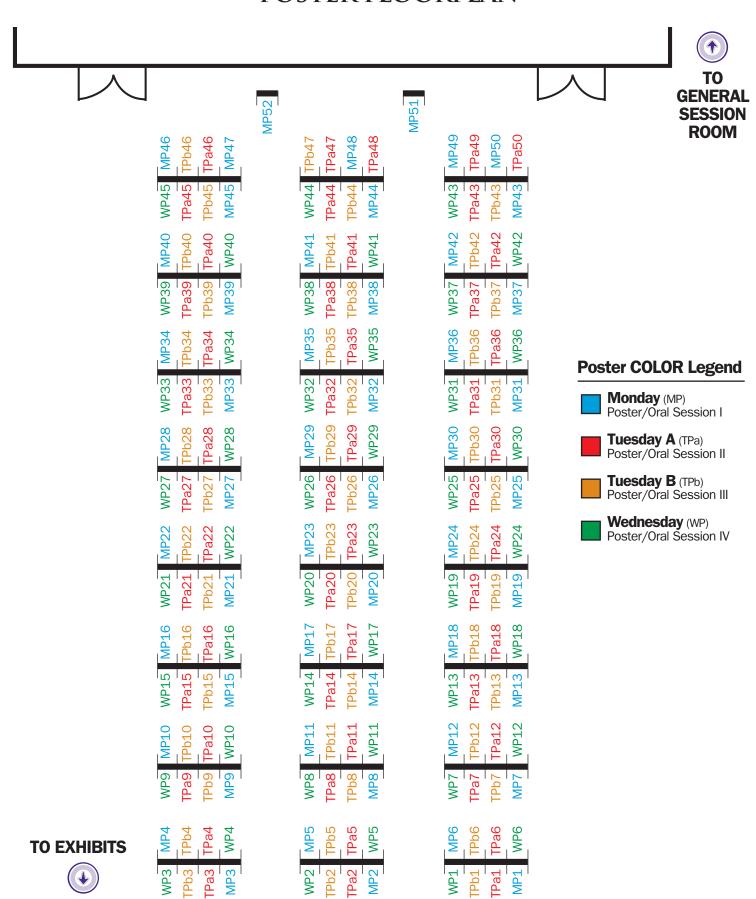




### **EXHIBIT FLOORPLAN**



### POSTER FLOORPLAN



### TECHNICAL PROGRAM INFORMATION

The Technical Program consists of a three invited speaker presentations, a general session of contributed papers and 4 poster/oral sessions.

#### **Oral Sessions**

All oral sessions will be held in the Ballroom A.

#### **Poster/Oral Sessions**

The poster/oral format will consist of three (3) scheduled 10 minute, oral presentations which will be presented in each session on their assigned day in front of each poster. Posters will be on display from Monday at 7:00 through Wednesday at 15:40. All poster papers are listed in this program by topic catagory with their assigned number starting on page 23. Authors will be available for questions throughout the entire assigned session.

#### Session I - MP

*Monday, January 23rd* 13:40 – 15:40

Poster/Oral Presentation 1 – 14:10 Poster/Oral Presentation 2 – 14:40 Poster/Oral Presentation 3 – 15:10

### Session II - TPa

*Tuesday, January 24th* 13:40 – 15:40

Poster/Oral Presentation 1 – 14:10 Poster/Oral Presentation 2 – 14:40

Poster/Oral Presentation 3 – 15:10

### Session III - TPb

*Tuesday, January 24th* 15:40 – 17:40

Poster/Oral Presentation 1 – 16:10 Poster/Oral Presentation 2 – 16:40 Poster/Oral Presentation 3 – 17:10

#### Session IV- WP

Wednesday, January 25th

13:40 – 15:40

Poster/Oral Presentation 1 – 14:10 Poster/Oral Presentation 2 – 14:40

Poster/Oral Presentation 3 – 15:10

### **Guide to Understanding Poster Numbering**

Each poster is assigned a unique number which clearly indicates when and where the poster is presented. The number of each poster is shown on the left-hand side before the title. A typical poster number is shown here: TPb34

The first character (i.e. T) indicates the day of the conference: M = Monday, T = Tuesday, W = Wednesday

The second character "P" indicates that it is a Poster

Tuesday posters have a third character. This character indicate the session time:

a = 13:40 - 15:40 b = 15:40 - 17:40

The number at the end is the assigned poster board position on the floorplan, as shown on page 16.

### Page Numbering

To assist you with finding the paper in the Technical Digest, we have provided the page number for you following each paper title.



### **PROGRAM**

### Sunday, 22 January 2006

16:00 - 19:00 **REGISTRATION** 

18:30 - 20:30 WELCOME RECEPTION

Monday, 23 January 2006  Technical Digest Page Number		
8:30	WELCOME ADDRESS	
8:50	INVITED SPEAKER  NANOTECHNOLOGY: AN OVERVIEW AND INTEGRATION WITH MEMS	
SESSION 1	Cells I Session Chairs: E. Yoon, University of Minnesota, USA Y. Zohar, University of Arizona, USA	
9:30	CMOS BIDIRECTIONAL ELECTRODE ARRAY FOR ELECTROGENIC CELLS	
9:50	ORIENTED AND VECTORIAL PATTERNING OF CARDIAC MYOCYTE USING A MICROFLUIDIC DIELECTROPHORESIS CHIP - TOWARDS ENGINEERED CARDIAC TISSUE WITH CONTROLLED MACROSCOPIC ANISOTROPY.  8 M. Yang¹, C.C. Lim¹, R. Liao², and X. Zhang¹  ¹Boston University, USA and ²Harvard University, USA	
10:10	A BULK PZT MICROSENSOR FOR IN-SITU TISSUE CONTRAST DETECTION DURING FINE NEEDLE ASPIRATION BIOPSY OF THYROID NODULES	
10:30	EXHIBIT INSPECTION AND BREAK	
SESSION 2	CELLS II Session Chairs: Y.B. Gianchandani, University of Michigan, USA A. Hierlemann, ETH Zurich, SWITZERLAND	
11:00	CELL DEFORMABILITY MONITORING CHIPS BASED ON ORIFICE-LENGTH-DEPENDENT DIGITAL LYSIS RATES	
11:20	MEMS BASED SENSORS FOR THE STUDY OF INDENTATION RESPONSE OF SINGLE CELLS	
11:40	STUDY OF THE FLIGHT OF SMALL LIQUID DROPLETS THROUGH A THIN LIQUID FILM FOR PICOLITRE LIQUID TRANSFER	
12:00	DISCRETE CHEMICAL RELEASE FROM A MICROFLUIDIC CHIP	
12:20	LUNCH	
13:40 - 15:40	POSTER/ORAL SESSION I	
15:40	EXHIBIT INSPECTION AND BREAK	

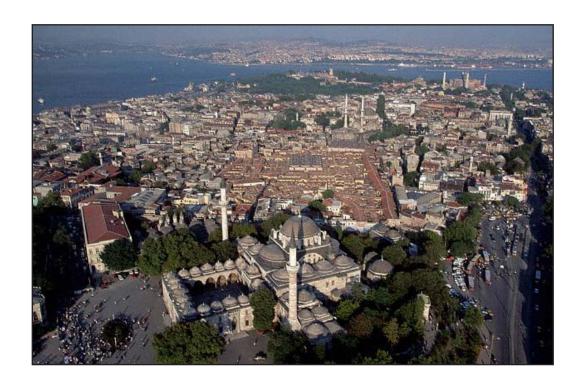
SESSION 3	Optical Session Chairs: O. Brand, Georgia Institute of Technology, USA JU. Bu, LG Electronics Institute of Technology, KOREA
16:10	DUAL-AXIS ELECTROMAGNETIC SCANNING MICROMIRROR USING RADIAL MAGNETIC FIELD
16:30	ANGLE TUNABLE LIQUID WEDGE PRISM DRIVEN BY ELECTRO-WETTING
16:50	TRANSMISSIVE SCANNING MICROMIRRORS FOR AUTOSTEREOSCOPIC DISPLAY
17:10	MANUALLY RE-WRITABLE PANEL FOR LARGE AREA MEMS
17:30	ADJOURN FOR THE DAY
Tuesday, 2	24 January 2006
8:10	INVITED SPEAKER ELECTROWETTING-BASED DISPLAYS: BRINGING MICROFLUIDICS ALIVE ON-SCREEN
SESSION 4	Particles I Session Chairs: Y. Suzuki, University of Tokyo, JAPAN B. Ziaie, Purdue University, USA
8:50	BIO-PARTICLE SORTING EMPLOYING HYDRODYNAMIC RECTIFICATION IN A MICROFLUIDIC CIRCUIT 54 M. Yamada <sup>1</sup> and M. Seki <sup>2</sup> <sup>1</sup> University of Tokyo, JAPAN and <sup>2</sup> Osaka Prefecture University, JAPAN
9:10	HIGH SPEED PARTICLES AND BIOMOLECULES SORTING MICROSYSTEM USING THERMOSENSITIVE HYDROGEL AND WATER TWO-PHASE FLOW
9:30	MEMS BASED INTEGRATED PARTICLE DETECTION CHIP FOR REAL TIME ENVIRONMENTAL MONITORING 62 H.H. Lim, D. Park, J.Y. Maeng, J. Hwang, and Y.J. Kim Yonsei University, KOREA
9:50	EXHIBIT INSPECTION AND BREAK
SESSION 5	Physical Sensors Session Chairs: V.M. Bright, University of Colorado, USA G.K. Fedder, Carnegie Mellon University, USA
10:20	HIGH PERFORMANCE MATCHED-MODE TUNING FORK GYROSCOPE
10:40	HIGH-PERFORMANCE SOI-MEMS GYROSCOPE WITH DECOUPLED OSCILLATION MODES
11:00	SELF-MAGNETIC EXCITATION FOR IN-PLANE MODE RESONANT MICROSENSOR
11:20	ULTRASENSITIVE MASS SENSOR BASED ON LATERAL EXTENSIONAL MODE (LEM) PIEZOELECTRIC RESONATOR

11:40	MICROMACHINED SU-8 PROBE INTEGRATED WITH FILM-BULK-ACOUSTIC RESONANT MASS SENSOR
12:00	A MEMS CONDENSER MICROPHONE FOR CONSUMER APPLICATIONS
12:20	MEMS 2007 ANNOUNCEMENT
12:30	LUNCH
13:40 - 15:40	POSTER/ORAL SESSION II
15:40 - 17:40	POSTER/ORAL SESSION III
17:40	ADJOURN FOR THE DAY
Wednesda	y, 25 January 2006
8:10	INVITED SPEAKER  KEY TECHNOLOGIES FOR HEALTHCARE SENSOR-NET SERVICES - THE NEXT TECHNOLOGY FRONTIER TOWARDS REAL WORLD IT
SESSION 6	Power MEMS Session Chairs: W. Lang, IMSAS, GERMANY M. Wong, Hong Kong University of Science and Technology, HONG KONG
8:50	MEMS RADIOISOTOPE-POWERED PIEZEOELECTRIC μ-POWER GENERATOR (RPG)
9:10	SEISMIC POWER GENERATOR USING HIGH-PERFORMANCE POLYMER ELECTRET
9:30	NOVEL STRUCTURE FOR PASSIVE CO <sub>2</sub> DEGASSING IN µDMFC
9:50	EXHIBIT INSPECTION AND BREAK
SESSION 7	Fabrication and Packaging Session Chairs: S. Konishi, Ritsumeikan University, JAPAN L. Sarro, Delft University of Technology, THE NETHERLANDS
10:20	A 32*32 PARYLENE-PYROLYZED CARBON BOLOMETER IMAGER
10:40	A NEW THREE-DIMENSIONAL LITHOGRAPHY USING POLYMER DISPERSED LIQUID CRYSTAL (PDLC) FILMS 110 JW. Jeon, JY. Choi, JB. Yoon, and K.S. Lim Korea Advanced Institute of Science and Technology, REPUBLIC OF KOREA
11:00	ASPECT RATIO DEPENDENT SCALLOPING ATTENUATION IN DRIE AND AN APPLICATION TO LOW-LOSS FIBER-OPTICAL SWITCHES
11:20	3D NANOHELIX FABRICATION AND 3D NANOMETER ASSEMBLY BY FOCUSED ION BEAM STRESS-INTRODUCING TECHNIQUE
11:40	FABRICATION OF THE FLEXIBLE SENSOR USING SOI WAFER BY REMOVING THE THICK SILICON LAYER

12:00	A LOW TEMPERATURE VACUUM PACKAGE UTILIZING POROUS ALUMINA THIN FILM ENCAPSULATION 126 R. He and CJ. Kim  University of California at Los Angeles, USA
12:20	LUNCH
13:40 - 15:40	POSTER/ORAL SESSION IV
15:40	EXHIBIT INSPECTION AND BREAK
SESSION 8	Particles II Session Chairs: L. Lin, University of California at Berkeley, USA M. Shikida, Nagoya University, JAPAN
16:10	INTEGRATING OPTOELECTRONIC TWEEZERS FOR INDIVIDUAL PARTICLE MANIPULATION WITH DIGITAL MICROFLUIDICS USING ELECTROWETTING-ON-DIELECTRIC (EWOD). 130 G.J. Shah <sup>1</sup> , PY. Chiou <sup>2</sup> , J. Gong <sup>1</sup> , A.T. Ohta <sup>2</sup> , J.B. Chou <sup>2</sup> , M.C. Wu <sup>2</sup> , and CJ. Kim <sup>1</sup> <sup>1</sup> University of California at Los Angeles, USA and <sup>2</sup> University of California at Berkeley, USA
16:30	MUSCLE PROTEINS AS HIGH SPEED NANO TRANSPORTERS ON MICRO PATTERNS
16:50	A NEW BIO-MOLECULES DECRYPTION PROTOCOL USING SHAPE ENCODED PARTICLES (SEP)
17:10	Session Adjourns
18:30 - 22:00	GALA BANQUET
SESSION 9	26 January 2006  Nano Session Chairs: JH. Lee, Gwangju Institute of Science and Technology, KOREA H.A.C. Tilmans, IMEC, BELGIUM
8:10	3-D MAGNETIC TWEEZERS FOR INVESTIGATION OF MECHANICAL PROPERTIES OF SINGLE DNA MOLECULES
8:30	MODULAR MEMS EXPERIMENTAL PLATFORM FOR TRANSMISSION ELECTRON MICROSCOPY
SESSION 10	Wireless Session Chairs: JH. Lee, Gwangju Institute of Science and Technology, KOREA H.A.C. Tilmans, IMEC, BELGIUM
8:50	SIMULTANEOUS AND INDEPENDENT MEASUREMENT OF STRESS AND TEMPERATURE USING A SINGLE FIELD EFFECT TRANSISITOR BASED SENSOR
9:10	EFFECTS OF MECHANICAL VIBRATIONS AND BIAS VOLTAGE NOISE ON PHASE NOISE OF MEMS RESONATOR BASED OSCILLATORS



SESSION 11	Wireless Communication Micro Devices and Systems (Non-Optical) Session Chairs:
	JH. Lee, Gwangju Institute of Science and Technology, KOREA H.A.C. Tilmans, IMEC, BELGIUM
9:30	DIGITALLY FREQUENCY-CONTROLLABLE DUAL-BAND WLAN FILTERS USING MICROMACHINED FREQUENCY-TUNING ELEMENTS
9:50	EXHIBIT INSPECTION AND BREAK
SESSION 12	Actuators Session Chairs: L. Buchaillot, IEMN/ISEN, FRANCE LS. Fan, National Tsing Hua University, TAIWAN
10:20	PASSIVE CONTACT FORCE AND ACTIVE OPENING FORCE ELECTROSTATIC SWITCHES FOR SOFT METAL CONTACT MATERIALS.  J. Oberhammer and G. Stemme Royal Institute of Technology, SWEDEN
10:40	A CENTRIFUGO-MAGNETICALLY ACTUATED GAS MICROPUMP
11:00	ACOUSTIC EJECTOR WITH NOVEL LENS EMPLOYING AIR-REFLECTORS
11:20	DROPLETS OSCILLATION AND CONTINUOUS PUMPING BY ASYMMETRIC ELECTROWETTING
11:40	A WETTABILITY SWITCHABLE SURFACE DRIVEN BY ELECTROSTATIC INDUCED SURFACE MORPHOLOGY CHANGE WITHOUT ENERGY INTERFERENCE ON REAGENTS IN DROPLETS
12:00	CONFERENCE ADJOURNS



### POSTER/ORAL PRESENTATIONS

Please refer to the poster floorplan on page 16.

DESIGN,	, ANALYSIS AND THEORETICAL CONCEPTS	
MP1	DYNAMICS OF SILICON MICRO-HEATERS: MODELLING AND EXPERIMENTAL IDENTIFICATION  D. Wiesmann and A. Sebastian IBM Zurich Laboratory, SWITZERLAND	182
MP2	PREDICTION METHOD OF 3-D SHAPE FABRICATED BY DOUBLE EXPOSURE TECHNIQUE IN DEEP X-RAY LITHOGRAPHY (D <sup>2</sup> XRL)	186
TPa1	UNIFORM NANOLITER SOLUTE DEPOSITION BY THE CONTROL OF DROPLET PROFILE DURING EVAPORATION WITH MICRO WELL CT. Chen, FG. Tseng, and CC. Chieng National Tsing Hua University, TAIWAN	190
TPa2	MODELING OF FLUIDIC SELF-ASSEMBLY FOR INTEGRATION OF SILICON COMPONENTS ON PLASTIC	194
TPb1	A LOW-TEMPERATURE THERMOPNEUMATIC GAS BUBBLE VALVE	198
TPb2	SPRING-ON-TIP NANOLITHOGRAPHY PROBES X. Wang, L. Vincent, and C. Liu University of Illinois at Urbana-Champaign, USA	202
WP1	CONTINUOUS PARTICLE SORTING UTILIZING CASCADE SQUEEZE-JUMPING EFFECT UNDER MICROFLUIDIC CONFIGURATION  CH. Lin <sup>1</sup> , CY. Lee <sup>1</sup> , and L.M. Fu <sup>2</sup> <sup>1</sup> National Sun Yat-Sen University, TAIWAN and <sup>2</sup> National Pingtung University of Science and Technology, TAIWAN	206
WP2	NOVEL MEASUREMENT SYSTEM OF THE FRICTION COEFFICIENTS FOR THE DRIE SIDEWALLSIH. Hwang and JH. Lee Gwangju Institute of Science and Technology, KOREA	210
MATERL	ALS AND DEVICE CHARACTERIZATION	
MP3	HIGH-RATE SPUTTERING OF THICK PZT LAYERS FOR MEMS ACTUATORS  H. Jacobsen <sup>1</sup> , HJ. Quenzer <sup>1</sup> , B. Wagner <sup>1</sup> , K. Ortner <sup>2</sup> , and Th. Jung <sup>2</sup> <sup>1</sup> Fraunhofer ISIT, GERMANY and <sup>2</sup> Fraunhofer IST, GERMANY	214
MP4	MULTI-FUNCTIONING AFM CANTILEVER FOR MECHANICAL TESTS: INDENTATION, STRIP BENDING AND ADHESION TESTS. HJ. Lee <sup>1</sup> , K. Cho <sup>1</sup> , JH. Kim <sup>1</sup> , JM. Kim <sup>2</sup> , YK. Kim <sup>2</sup> , and CW. Baek <sup>3</sup> <sup>1</sup> Korea Institute of Machinery and Materials, REPUBLIC OF KOREA, <sup>2</sup> Seoul National University, REPUBLIC OF KOREA, and <sup>3</sup> Chung-Ang University, REPUBLIC OF KOREA	218
MP5	TEMPERATURE COMPENSATION OF A MEMS RESONATOR USING QUALITY FACTOR AS A THERMOMETER M.A. Hopcroft <sup>1</sup> , M. Agarwal <sup>1</sup> , K.K. Park <sup>1</sup> , B. Kim <sup>1</sup> , C.M. Jha <sup>1</sup> , R.N. Candler <sup>1</sup> , G. Yama <sup>2</sup> , B. Murmann <sup>1</sup> , and T.W. Kenny <sup>1</sup> <sup>1</sup> Stanford University, USA and <sup>2</sup> Robert Bosch Corporation North American Research and Technology Center, USA	222
TPa3	SPIDER SILK AS A NEW BIOMATERIAL FOR MEMS	226
TPa4	MECHANICAL, THERMAL, AND MATERIAL INFLUENCES ON OHMIC-CONTACT-TYPE MEMS SWITCH OPERATION N.E. McGruer, G.G. Adams, L. Chen, Z.J. Guo, and Y. Du Northeastern University, USA	230
TPb3	BACK-END-OF-LINE POLY-SIGE DISK RESONATORS  E.P. Quévy <sup>1</sup> , A. San Paulo <sup>1</sup> , E. Basol <sup>1</sup> , R.T. Howe <sup>2</sup> , TJ. King <sup>1</sup> , and J. Bokor <sup>1</sup> <sup>1</sup> University of California at Berkeley, USA and <sup>2</sup> Stanford University, USA	234

TPb4	POLYCRYSTALLINE DIAMOND RF MEMS RESONATORS WITH THE HIGHEST QUALITY FACTORS
WP3	IMAGING OF ACOUSTIC EMISSION FROM VIBRATING MICRO/NANO STRUCTURES
WP4	MULTI-WALLED CARBON NANOTUBE FILLED CONDUCTIVE ELASTOMERS:  MATERIALS AND APPLICATION TO MICRO TRANSDUCERS
FABRIC	CATION AND PACKAGING TECHNOLOGIES
MP6	VERTICAL AND HORIZONTAL PARALLEL MOUNTING OF MICRO COMPONENTS ON A SUBSTRATE WITH HIGH SURFACE COVERAGE J. Fang and K.F. Böhringer University of Washington, USA
MP7	NEW RESIST-COATING TECHNIQUE USING FINE MIST FOR THREE-DIMENSIONAL NANOTECHNOLOGY
MP8	FABRICATION OF MICROSPRING PROBES USING CONDUCTIVE PASTE DISPENSING
MP9	IN-PLANE, HOLLOW MICRONEEDLES VIA POLYMER INVESTMENT MOLDING
MP10	ON-CHIP 2-AXIS OPTICAL FIBER ACTUATOR USING GRAY-SCALE TECHNOLOGY
MP11	INTERCONNECTION AND PACKAGING FOR 2D CAPACITIVE MICROMACHINED ULTRASONIC TRANSDUCER ARRAYS BASED ON THROUGH-WAFER TRENCH ISOLATION
TPa5	3D LITHOGRAPHY AND DEPOSITION ON HIGHLY STRUCTURED SURFACES USING PLASMA SURFACE MODIFICATION, SAM COATING, AND CONTACT DISPLACEMENT ELECTROLESS PLATING
TPa6	LOCAL HEATING OF PYROLYZED POLYMER HEATERS FOR FURTHER CARBONIZATION AT HIGHER TEMPERATURE
TPa7	STUDY AND APPLICATIONS OF A PARYLENE SELF-SEALING STRUCTURE
TPa8	SELF-PROPAGATING EXPLOSIVE REACTIONS IN NANOSTRUCTURED AL/NI MULTILAYER FILMS AS A LOCALIZED HEAT PROCESS TECHNIQUE FOR MEMS
TPa9	SELECTIVE AND DIRECT GOLD ELECTROPLATING ON SILICON SURFACE FOR MEMS APPLICATIONS
TPa10	THE PATTERNING OF ELECTRIC CIRCUITS FOR MASK-DEPOSITION TECHNOLOGY
TPa11	SUPERPLASTIC FORMING OF BULK METALLIC GLASS – A TECHNOLOGY FOR MEMS AND MICROSTRUCTURE FABRICATION
TPb5	RECONSTITUTED WAFER TECHNOLOGY FOR HETEROGENEOUS INTEGRATION



MP15	MICROFABRICATION OF HELMHOLTZ COILS WITH INTEGRATED  CHANNELS FOR NMR SPECTROSCOPY
MP16	AUTONOMOUS METAL ION SENSORS
MP17	MICROMACHINED FLOW-THROUGH POLYMERASE CHAIN REACTION CHIP UTILIZING MULTIPLE MEMBRANE-ACTIVATED MICROPUMPS
MP18	ATMOSPHERIC PRESSURE AIR MICROPLASMA IONIZATION SOURCE FOR CHEMICAL ANALYSIS APPLICATIONS
MP19	DIRECT ELECTROSTATIC TRANSPORTATION OF FROZEN DROPLETS IN LIQUID NITROGEN
MP20	PASSIVE MAGNETIC SEPERATOR INTEGRATED WITH MICROFLUIDIC MIXER:  DEMONSTRATION OF ENHANCED CAPTURE EFFICIENCY
MP21	OPTICAL TEMPERATURE CONTROL OF MULTIPLE MICROHEATERS USING DIGITAL MICROMIRROR DEVICE $\dots$ 390 A. Ichikawa, F. Arai, and T. Fukuda Nagoya University, JAPAN
MP22	PNEUMATIC PARTICLE MANIPULATOR WITH VIBRATOR MATRIX  O.C. Jeong and S. Konishi  Ritsumeikan University, JAPAN
MP23	OPTIMAL DESIGN OF MICRO RAYLEIGH-BÉNARD CONVECTION POLYMERASE CHAIN REACTION SYSTEM
MP24	CELL ADHESIONS ON NANOTURF SURFACES
MP25	ELECTRO-OSMOTIC FLOW THROUGH CLOSED-OPEN-CLOSED MICROCHANNELS: AN APPROACH TO HYPHENATION OF CAPILLARY ELECTROPHORESIS AND MALDI406 V. Parmar, T. Redeby, W. van der Wijngaart, A. Emmer, and G. Stemme Royal Institute of Technology, SWEDEN
TPa12	NEEDLE MICRO-COILS FOR MRS
TPa13	COMPACT, SEAMLESS INTEGRATION OF ACTIVE DOSING AND ACTUATION WITH MICRONEEDLES FOR TRANSDERMAL DRUG DELIVERY
TPa14	DESIGN AND FABRICATION OF A CENTRIFUGALLY DRIVEN MICROFLUIDIC DISK FOR FULLY INTEGRATED METOBOLIC ASSAYS ON WHOLE BLOOD
TPa15	IMPLANTABLE ULTRASOUND EMITTER ARRAY FOR MEDICAL APPLICATIONS
TPa16	A CONTINUOUS CELL LYSIS DEVICE USING FOCUSED HIGH ELECTRIC FIELD AND SELF-GENERATED ELECTROOSMOTIC FLOW



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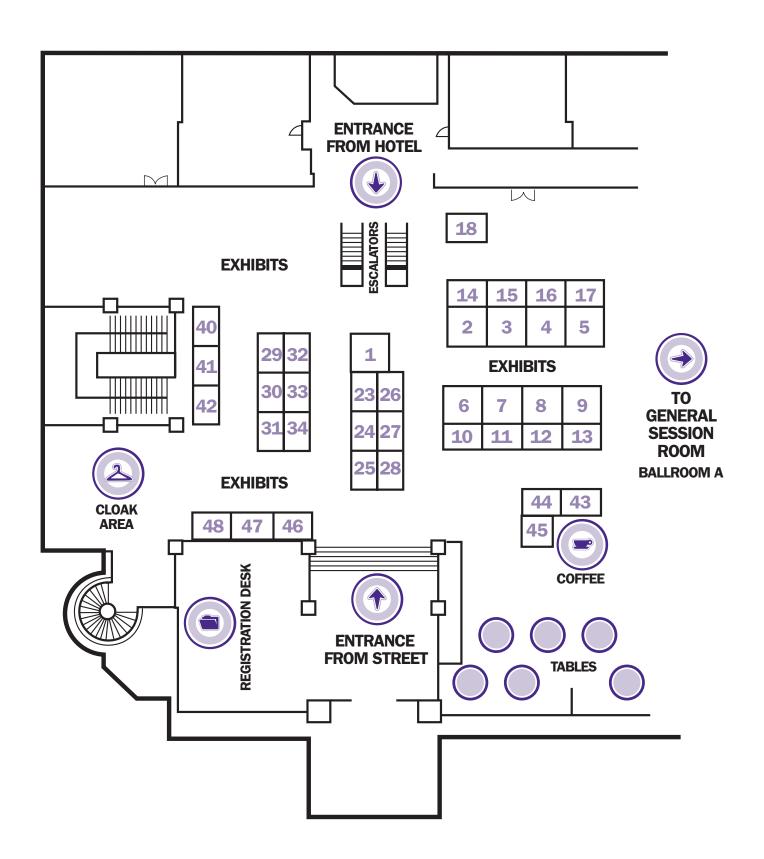
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Hagia Sophia

### **EXHIBIT FLOORPLAN**



### POSTER FLOORPLAN

