**21st Sensor Symposium**
**on Sensors, Micromachines and Applied Systems**
**October 14 - 15, 2004 Kyoto, Japan**

Thursday, October 14

| | Rm A | Rm B | Rm C |
|---|---|---|---|
| 10:00-11:50 | **Opening Session**<br>**Invited Talk 1**<br>**Invited Talk 2** | | |
| 11:50-13:00 | | | |
| 13:00-15:30 | **Session A1 Actuators** | **Session B1 Multi-Ferroic Materials: Fusion of Ferroelectric and Ferromagnetic** | **Session C1 Bio-Chemical Sensors** |
| 15:30-17:00 | **Poster Session** | | |
| 17:00-18:00 | **Session A2 Actuators and Power MEMS** | **Session B2 Biometrics and Sensor Systems** | **Session C2 Odor and Gas Sensors** |
| 18:00-18:20 | | | |
| 18:30-20:00 | | | |

Friday, October 15

| | Rm A | Rm B | Rm C |
|---|---|---|---|
| 9:00-10:00 | **Session A3 Optical MEMS** | **Session B3 MEMS Foundry** | **Session C3 Materials** |
| 10:00-10:10 | | | |
| 10:10-10:40 | | **Session B4 Nano-Technology and Emerging Technologies Sensing Systems 1** | |
| 10:40-10:50 | | | |
| 10:50-12:30 | **Session A4 Physical Sensors 1** | | **Session C4 Processing Technology** |
| 12:30-13:30 | | | |
| 13:30-15:20 | **Session A5 Physical Sensors 2** | **Session B5 Sensing Systems 2** | **Session C5 Nano-Bio Fusion** |
| 15:20-15:40 | | | |
| 15:40-15:50 | | | |
| 15:50-17:00 | **Closing Session** | | |

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## Opening Session

**PL-1 AmbientRT – Real Time, Data Centric System Software for Wireless Sensor Networks**

S. Dulman, P. Havinga (University of Twente), T. Hofmeijer (Ambient Systems)

**PL-2 MEMS Technology for Ubiquitous Sensor Network**
K. Chun (Seoul National University)

## Session A1 Actuators

**A1-1 Monolithic PZT Microstage**
H. G. Xu, T. Ono, M. Esashi (Tohoku University), K. Okamoto (NEC Tokin Corporation) and D. Y. Zhang (Beihang University)

**A1-2 Microfabricated Quartz Crystal Resonator Array Developed for Measuring in Viscoelastic Liquids**
L. Li, E. Sakata, M. Esashi, M. Nishizawa and T. Abe (Tohoku University)

**A1-3 AlN Based Thin Film Bulk Acoustic Resonator with an Energy-Trapping Structure**
M. Hara, T. Abe and M. Esashi (Tohoku University)

**A1-4 High-Resolution Multi-View Stereoscopic Display with Vibrating Micromirrors**
A. Nakai, K. Hoshino, K. Matsumoto and I. Shimoyama (The University of Tokyo)

**A1-5 Applications of a Sequential Magnetic Self-Assembly**
E. Iwase and I. Shimoyama (The University of Tokyo)

**A1-6 Instability Analysis of Electrostatic Vertical Comb Drive Actuators**
T. Takahashi, H. Fujita and H. Toshiyoshi (The University of Tokyo)

**A1-7 Fabrication of Microactuator for Active Catheter from SMA Thin Film Tube**
H. Kubo, M. Abe, T. Mineta, E. Makino (Hirosaki University) and T. Shibata (Ibaraki University)

## Session A2 Actuators and Power MEMS

**A2-1 Electrostatic Microactuator with Au/Poly-Si Bimorph Structure**
Y. Kawamoto, T. Matsuda and T. Yasuda (Kyushu Institute of Technology)

**A2-2 Fabrication of a Micro Reciprocating Engine for Power Generation**
J. Ogawa, Y. Okada, T. Toriyama and S. Sugiyama (Ritsumeikan University)

**A2-3 Development of MEMS-Based Ejectors and Their Application to Butane Combustion**
D. Satoh, S. Tanaka and M. Esashi (Tohoku University)

**A2-4 Fabrication of Flexible Thermopile Generator Sheet**
M. Shiozaki, J. Ogawa, S. Hasebe, T. Toriyama, S. Sugiyama (Ritsumeikan University), H. Ueno and K. Itoigawa (Tokai Rika Co., Ltd.)

## Session B1 Multi-Ferroic Materials: Fusion of Ferroelectric and Ferromagnetic

**B1-1 Control of Ferroelectric Property of $YMnO_3$ Epitaxial Films by Magnetic Field**

N. Fujimura, N. Shigemitsu, T. Yoshimura and A. Ashida (Osaka Prefecture University)

**B1-2 Ferroelectric Properties and Related Microstructure in Multi-Ferroic Materials $YMnO_3$**

S. Mori, Y. Horibe (Osaka Prefecture University), Y. Aikawa and
T. Katsufuji (Waseda University)

**B1-3 Magnetic and Electric Properties of $BaMO_3$ (M: Co, Mn, Fe) Oxide**
T. Inoue, T. Matsui, M. Miyai, N. Fujimura and K. Morii (Osaka Prefecture University)

**B1-4 Preparation and Characterization of Multiferroic $BiFeO_3$ Thin Films Prepared by Pulsed Laser Deposition**
K. Y. Yun, D. Ricinschi, M. Noda, S. Nasu and M. Okuyama (Osaka University)

**B1-5 Structural Phase Transitions and Dielectric Anomaly in $YFe_2O_{4-}$**
S. Mori, K. Kishimoto, Y. Horibe (Osaka Prefecture University) and N. Ikeda (Spring-8)

**B1-6 Preparation of Self-Assembled $PbTiO_3$ Nanostructures by Metalorganic Chemical Vapor Deposition and Their Ferro- and Piezo-Electric Properties**
H. Fujisawa, M. Nagata, M. Shimizu, H. Niu (University of Hyogo),
H. Nonomura (Himeji Institute of Technology) and K. Honda (Fujitsu Laboratory Ltd.)

**B1-7 Formation of Two-Dimensional Electron Gas and the Magnetotransport Behavior of ZnMnO/ZnO Heterostructure**
A. Ashida, T. Edahiro, K. Masuko, T. Oshio and N. Fujimura (Osaka Prefecture University)

## Session B2 Biometrics and Sensor Systems

**B2-1 Face Understanding in the Ubiquitous Network Society**
M. Sakuragi, Y. Ijiri, S. Hosoi and M. Kawade (Omron Corporation)

**B2-2 A Cordless IrDA Fingerprint Identification Module for User Authentication Systems**
T. Hatano, H. Morimura, S. Shigematsu, C. Yamaguchi, K. Machida and
Y. Okazaki (NTT Microsystem Integration Laboratories)

**B2-3 Highly Sensitive CMOS MEMS Fingerprint Sensor**
N. Sato, S. Shigematsu, H. Morimura, K. Machida (NTT Microsystem Integration Laboratories),
M. Yano, K. Kudou and T. Kamei (NTT Advanced Technology Corporation)

## Session C1 Bio-Chemical Sensors

**C1-1 Detection of Single Nucleotide Polymorphism Using Genetic Field Effect Transistor**
T. Sakata and Y. Miyahara (National Institute for Materials Science)

**C1-2 A Novel Filter-Less Fluorescence Detection Sensor Array for DNA Micro Chip**
Y. Maruyama, K. Sawada, H. Takao and M. Ishida (Toyohashi University of Technology)

**C1-3 Fluorescent Measurement of Nerve Cells by Using a Sub-Micron Aperture Plate**
T. Kan, T. Kazawa, K. Matsumoto and I. Shimoyama (The University of Tokyo)

**C1-4 Fabrication of pH Image Sensor for Biochemical Sensing**
T. Hizawa, K. Sawada, H. Takao and M. Ishida (Toyohashi University of Technology)

**C1-5 Dependence of Amperometric Biosensor Output on Structural and Conditional Parameters**

M. Hashimoto, S. Upadhyay and H. Suzuki (University of Tsukuba)

**C1-6 Detection of Heavy Metals by Evaporative Concentration Using Super Hydrophobicity**

N. Nashida, I. Yanagimachi and H. Suzuki (University of Tsukuba)

**C1-7 A New QCM Sensor Using Thickness-Twist-Mode**
N. Okada, T. Kikuchi and Y. Osugi (NGK Insulators, Ltd.)

### Session C2 Odor and Gas Sensors

**C2-1 High Temperature and High Sensitivity NOx Gas Sensor with Pt/$SnO_2$/SiC/Ni Hetero-Junction Devices**
W. Gao, S. A. Khan, Y. Hasegawa, L. Shi and T. Katsube (Saitama University)

**C2-2 Integrated Ammonia Sensing System with a Microfluidic Transport System Based on Electrowetting**
W. Satoh and H. Suzuki (University of Tsukuba)

**C2-3 Study of Halitosis-Substance Sensing Using Electrochemical Sensor Array Combined with a Preconcentrator**
T. Nakamoto, K. Kobayashi (Tokyo Institute of Technology) and
J. Ito (Tokyo Medical and Dental University)

**C2-4 Sensing Probe for Three-Dimensional Gas-Source Localization Using Ultrasonic Anemometer**
K. Yoshikawa, T. Moriizumi (Tokyo Institute of Technology) and
H. Ishida (Tokyo University of Agriculture and Technology)

### Poster Session

**P-1 Selective Growth of Carbon Nanotubes by Self-Assembled Monolayer Patterning**
Y. Takei, K. Hoshino, K. Matsumoto and I. Shimoyama (The University of Tokyo)

**P-2 Fabrication of a Micro Fluidic Sensor System for the Determination of GOT and GPT Activities**
N. Ohgami, S. Upadhyay, H. Suzuki (University of Tsukuba) and
H. Kusakabe (Yamasa Corporation)

**P-3 The Measurement of the Aquatic Environment by Using Surfactant Sensor**
M. Matsushita, M. Kikuchi (Keio University) and S. Shiratori (SNT Co., Ltd.)

**P-4 Observation of the Surface of Lipid/Polymer Membrane of Taste Sensor**
H. Shimakawa, M. Habara and K. Toko (Kyushu University)

**P-5 Hierarchical Signal Processing for Flavor Taste Sensor**
S. Umetani, Y. Hasegawa and T. Katsube (Saitama University)

**P-6 Compensating Method for the Output of QCM Gas Sensor**
M. Kikuchi, T. Ito (Keio University) and S. Shiratori (SNT Co., Ltd.)

**P-7 Analysis of Bioelectrical Potential of Plants: Environmental Influence**
Y. Hasegawa, T. Yamanaka and T. Katsube (Saitama University)

**P-8 Micropatterning and Micromolding by Using Sputter Deposited Photocatalytic Film**

E. Sakata, M. Esashi, M. Nishizawa and T. Abe (Tohoku University)

**P-9** **Fabrication of Single-Sided Gate JFET for Sensor Interface Circuit on Si (111)**
Y. Kato, T. Hashimoto, Y. C. Liew, H. Takao, K. Sawada and
M. Ishida (Toyohashi University of Technology)

**P-10** **3-D Micro-Machining Technique by Double Exposure in Normal Deep X-ray Lithography**
N. Matsuzuka (Ritsumeikan University), Y. Hirai and O. Tabata (Kyoto University)

**P-11** **Anisotropic Etching Simulation of Silicon Using Interatomic Bond Cutting Probability**

T. Kakinaga, N. Baba, Y. Isono (Ritsumeikan University),
O. Tabata (Kyoto University) and J. G. Korvink (University of Freiburg)

**P-12** **Electrodeposition Technology of Organic Films with Selective Coating for MEMS Structure**
T. Sakata, H. Ishii, Y. Okabe, N. Sato, K. Machida (NTT Microsystem Integration Laboratories),
M. Yano, K. Kudou and T. Kamei (NTT Advanced Technology Corporation)

**P-13** **A Study for Surface Roughness Modification of Three Dimensional Structures Fabricated by Emulsion Gray-Scale Mask**
R. Mori, K. Hanai and Y. Matsumoto (Keio University)

**P-14** **Local Machining with nm Order Precision by Using FIB**
S. Ogura, J. Makinodan, S. Konishi (Ritsumeikan University),
Y. Nakashima and T. Yasuda (Kyushu Institute of Technology)

**P-15** **A Water-Repellent Silanization Coating Technique for MEMS**
K. Shimaoka, H. Hosokawa, H. Funabashi and Y. Mitsushima
(Toyota Central Research and Development Laboratories, Inc.)

**P-16** **Fabrication of Plastic Microneedle Array Using Laser Micromachining of Nanoparticles Dispersed Polymer and Micromolding**
H. Yagyu, S. Hayashi (Mitsuboshi Belting Ltd.) and O. Tabata (Kyoto University)

**P-17** **Characterizations of the Shocked-BPSCCO (Bi-Pb-Sr-Ca-Cu-O) Superconducting Particles for Making a Magnetic Sensor**
K. Yamagata, Y. Maeji, T. Yamada, M. Itoh (Kinki University),
H. Kezuka (Tokyo University of Technology), M. Kikuchi (Tohoku Fukushi University),
T. Atou, M. Kawasaki, K. Fukuoka (Tohoku University) and T. Suzuki (Tokai University)

**P-18** **Mechanical Strength of Quartz Micromechanical Devices**
F. Kohsaka, J. Liang and T. Ueda (Waseda University)

**P-19** **Young's Modulus Control of the Micro Cantilever Made by Micro-Stereolithography**
M. Miwa, K. Douoka, S. Tuchitani, Y. Koshimoto, R. Kaneko (Wakayama University) and
S. Yoneyama (Osaka Prefecture University)

**P-20** **Synthesis and Properties of $Bi(Fe_xAl_{1-x})O_3$ Multi-Ferroic Thin Films**
N. Fujimura, M. Okada, A. Ashida and T. Yoshimura (Osaka Prefecture University)

**P-21** **XY Surface Acoustic Wave Motor with Nanometer Resolution**
T. Shigematsu and M. K. Kurosawa (Tokyo Institute of Technology)

**P-23** **Simple Fabrication Process for Surface Micromachining Using Sputtered Oxide as Sacrificial Layer and Its Application**
N. Shimamoto, S. Okamoto, Y. Matsushita, T. Fujita, K. Maenaka and Y. Takayama (University of Hyogo)

**P-24** **A New Thermal Isolation Structure by a Surface Bulk Micromachining for Dielectric Bolometer Mode IR Sensor**
M. Matsumoto, S. Murakami (Technology Research Institute of Osaka Prefecture), D. Popovici, M. Noda and M. Okuyama (Osaka University)

**P-25** **Fabrication of Submicron-Scale MEMS Switch by Using Silicon Process**
K. Yamanaka and Y. Goto (Hitachi Ltd.)

**P-27** **Research on Development of Tactile Sensor for Clinical Application**
K. Sakamoto and S. Omata (Nihon University)

**P-28** **Designing Structures of Sensor Networks by the Highly Optimized Tolerance Model**
T. Miyano (Ritsumeikan University) and M. Yamakoshi (Hokkaido University)

**P-29** **Micro Wind Tunnel Type Anemometer Using a Micro-Air-Bridge Heater**
S. Yasaka, M. Mitsuhashi, S. Kaneko, K. Ito, S. Ohya (Kanagawa Industrial Technology Research Institute), Y. Kanno (I Denshi Giken Co., Ltd.), Y. Aikyo, S. Komuro, K. Ohbayashi (Flat Electronics Co., Ltd.) and M. Kimura (Tohoku Gakuin University)

**P-30** **Remote Sensing of Strain Using Passive SAW Devices**
T. Nomura and A. Saitoh (Shibaura Institute of Technology)

**P-31** **Proposal of Injected Carrier Transport-Modulation Type Magneto-Transistor**
S. Takahashi and M. Kimura (Tohoku Gakuin University)

**P-32** **Surface Acoustic Wave Optical Deflector for Surface Plasmon Resonance Sensor**
T. Takahata, K. Hoshino, K. Matsumoto and I. Shimoyama (The University of Tokyo)

**P-33** **Optimal Design of a Small Position Sensor with Low Temperature Drift**
K. Nagai, S. Nakanishi (Ritsumeikan University), R. Fujimoto (Matsushita Electric Inc.), N. Oshie and S. Hatakeyama (LEVEX Inc.)

**P-34** **Noise Squeezed Resonant Infrared Sensor**
H. Wakamatsu, T. Ono and M. Esashi (Tohoku University)

**P-35** **Drag Force Flow Sensor Using Micro Laser Interferometer**
Z. Yang (Tokyo Metropolitan Industrial Technology Research Institute), S. Matsumoto, J. Tsaur and R. Maeda (The National Institute of Advanced Industrial Science and Technology)

**P-36** **Characterization of Native-Substrate MAGFETs for a CMOS Smart Rotary Encoder**
T. Takahashi (NTN Corporation), K. Nakano and S. Kawahito (Shizuoka University)

**P-37 Sensitivity Optimization of the Micro Tactile Sensor**
Y. Murayama and S. Omata (Nihon University)

**P-38 High Sensitive Silicon Mass Sensor in Viscous Environment**
S. J. Kim, T. Ono and M. Esashi (Tohoku University)

**P-39 Early Fire Detection Using Gas Sensing Array and Its Application to Mobile Robot**
T. Tashiro, Y. Takei, T. Misawa, H. Nanto (Kanazawa Institute of Technology),
H. Kasahara (New Cosmos Electric Co., Ltd.) and Y. Iwasaki (tmsuk Co., Ltd.)

## Session A3 Optical MEMS

**A3-1 Resolution Improvement of Absorption Photometry Microchip with Optical Path Using 45° Mirrors**
T. Noda, H. Takao, M. Ashiki, K. Sawada and M. Ishida (Toyohashi University of Technology)

**A3-2 Measurement of the Blood Absorbance Using a Micro Fabry-Perot Interferometer**
T. Dohi, K. Matsumoto and I. Shimoyama (The University of Tokyo)

**A3-3 Low-Insertion-Loss and Compact 3D-MEMS Optical Matrix Switch with Flexible Configuration within 18 Input/Output Ports**
A. Kazama, M. Horino, K. Fukuda, M. Kanamaru, T. Akashi, T. Ishikawa, T. Harada,
R. Okada (Hitachi, Ltd.) and Y. Itou (Hitachi Metals, Ltd.)

**A3-4 A Fabrication Process and Design of High-Yield and Low-Voltage-Operation Micromirror for Optical MEMS Switches**
M. Urano, H. Ishii, T. Minotani, T. Shimamura, T. Sakata, Y. Tanabe, K. Machida
(NTT Microsystem Integration Laboratories),
T. Kamei, K. Kudou and M. Yano (NTT Advanced Technology Corporation)

**A3-5 Ultra Compact Optical Subassembly Using Silicon Microlens**
Y. Maeno, H. Sasaki, D. Shimura, M. Uekawa, K. Kotani, R. Sekikawa and T. Takamori
(Oki Electric Industry Co., Ltd.)

## Session A4 Physical Sensors 1

**A4-1 Properties and Applications of Sn-Doped InSb Single Crystal Thin Film Magnetoresistance Elements**
K. Nishimura, H. Goto, S. Yamada, H. Geka, A. Okamoto and I. Shibasaki
(Asahikasei Corporation)

**A4-2 Improvement of Electron-Emission-Type Infrared Sensor Using Ferrolectric Materials**

D. Takamuro, H. Takao, K. Sawada and M. Ishida (Toyohashi University of Technology)

**A4-3 Silicon-MEMS Smart Tactile Image Sensor with Device Flexibility and Wide Input-Force Range**
H. Takao, K. Sawada and M. Ishida (Toyohashi University of Technology)

**A4-4 Sensitivity Change Induced by Static Deflection of Diaphragm in Piezoelectric Ultrasonic Microsensor**
H. Nishimoto, K. Yamashita and M. Okuyama (Osaka University)

**A4-5 Force Measurement System Using Piezoresistive Force-Sensing Cantilevers for**

**Evaluating Binding Force between Micro-Scale Flat Surfaces in Aqueous Soluion**
H. Onoe, M. Gel, K. Hoshino, K. Matsumoto and I. Shimoyama (The University of Tokyo)

## Session A5 Physical Sensors 2

**A5-1 Bulk-Micromachined Vibratory Accelerometer and Their Peripheral Circuitry**
K. Maenaka, N. Sawai, M. Kozuki, S. Ioku, T. Fujita and Y. Takayama
(Himeji Institute of Technology)

**A5-2 Design & Fabrication of Miniaturized Piezoresistive Six-Degree of Freedom Accelerometer**
R. Amarasinghe, D. V. Dao, T. Toriyama and S. Sugiyama (Ritsumeikan University)

**A5-3 Study on Resonant Frequency of an Accelerometer Utilizing a Parylene Suspended Structure**
D. Yoshikawa, S. Aoyagi, K. Makihira, M. Takano (Kansai University) and
Y.-C. Tai (California Institute of Technology)

**A5-4 Bulk MEMS Gyroscope with Tuning Fork Structure**
S. Ioku, H. Araki, H. Kohara, T. Fujita, K. Maenaka and Y. Takayama (University of Hyogo)

**A5-5 5-Axis Motion Sensor with SOI Structure Using Resonant Drive and Non-Resonant Detection Mode**
Y. Watanabe, T. Mitsui (Yamagata Research Institute of Technology) and
T. Mineta (Hirosaki University)

**A5-6 Development of 6-Axis Motion Sensors Using Piezoelectric Elements**
K. Okada, T. Kakutani, H. Itano, Y. Matsu (Wacoh Corporation) and
S. Sugiyama (Ritsumeikan University)

## Session B3 MEMS Foundry

**B3-1 Current Issues of MEMS Foundry Network in Japan (Introduction of MEMS Foundry Service Industry Committee)**
T. Mihara (Olympus Corporation)

**B3-2 MEMS Foundry in AIST -Speedy Realization of New Ideas-**
R. Maeda, M. Takahashi and T. Eiju (National Institute of Industrial Advanced Science and Technology)

**B3-3 Bulk-MicroMachining Multichip Project (BM$^3$P)**
T. Fujita, S. Ioku, K. Maenaka and Y. Takayama (University of Hyogo)

## Session B4 Nano-Technology and Emerging Technologies Sensing Systems 1

**B4-1 Fabrication of a Microfluidic Device for Axonal Guidance**
Y. Nakashima and T. Yasuda (Kyushu Institute of Technology)

**B4-2 Development of Multi-Probe Cantilever for Scanning Probe Nanolithography**
Y. Takagi, T. Watanabe and Y. Isono (Ritsumeikan University)

**B4-3 Diamond Films for FED Fabricated by Using Spin Coat Seeding**
Y. Matsuba, S. Tezuka and K. Takahashi (Saitama University)

**B4-4 Transmission Electron Microscope Observation and Measurement of Tunnel Current between Opposing Electrodes**
T. Ishida, K. Kakushima and H. Fujita (The University of Tokyo)

**B4-5 Fundamental Study of Remote Stiffness Testing in an Application for Intravascular Tactile Sensor**
M. Haruta and S. Omata (Nihon University)

**B4-6 Research for Hardness Measurements Using X-ray Computed Tomography**
T. Nomura and S. Omata (Nihon University)

**B4-7 Development of Breast Cancer Checker Using New Tactile Sensors**
S. Omata, Y. Murayama (Nihon University) and C. E. Constantinou (Stanford University)

## Session B5 Sensing Systems 2

**B5-1 Real-Time 3D Imager Using Spatio-Temporal Phase Unwrapping**
N. Ono, T. Shimizu, T. Kurihara and S. Ando (The University of Tokyo)

**B5-2 Real-Time En-face Optical Coherence Tomography Using Correlation Image Sensor**
T. Shimizu, T. Kurihara, N. Ono, S. Ando (The University of Tokyo) and
K. Kitagawa (Toray Engineering Co., Ltd.)

**B5-3 Equi-Distance Tracking of a Preceding Target by Using a Monocular Active Camera**
Y. Makino and W. Mitsuhashi (The University of Electro-Communications)

**B5-4 The Ground Temperature Distribution in Water Drip Measured by Infrared Camera**
D. Noda, K. Sawada, M. Ishida (Toyohashi University of Technology) and
T. Itoh (Japan Operator Co., Ltd.)

**B5-5 Magnetically Driven Active Tactile Sensor for Hardness Detection**
Y. Hasegawa, H. Sasaki, M. Shikida, S. Kuriyama, K. Sato (Nagoya University) and
K. Itoigawa (Tokai Rika Co., Ltd.)

## Session C3 Materials

**C3-1 Fatigue Damage Evaluation of MEMS Materials Using Full-Reversed Bending Fatigue Tester**
H. Kito, T. Kikuchi and Y. Isono (Ritsumeikan University)

**C3-2 Pyrolyzed-Polyimide for MEMS Application**
K. Naka, H. Nagae, M. Ichiyanagi and S. Konishi (Ritsumeikan University)

**C3-3 Ferroelectrics Properties of Epitaxial $Pb(Zr_x, Ti_{1-x})O_3$ Thin Films on Epitaxial Pt/ _ -$Al_2O_3$/Si Substrates**
D. Akai, M. Yokawa, K. Hirabayashi, K. Matsushita, K. Sawada and M. Ishida
(Toyohashi University of Technology)

**C3-4 Microbonding of $Pb(Zr,Ti)O_3$ Bulk Ceramics to Si Single Crystals**
K. Tanaka, W. Kuze, T. Konishi, A. Shimazu and S. Sugiyama (Ritsumeikan University)

**C3-5 Glass Press Mold Fabricated by SiC APCVD, SiC-SiC Bonding and Silicon Lost Molding**
K.-O. Min, S. Tanaka and M. Esashi (Tohoku University)

**Session C4 Processing Technology**

**C4-1 Characteristics of Silicon Nitride Reaction to Anhydrous HF Gas Treatment**
K. Shimaoka, H. Funabashi and Y. Mitsushima
(Toyota Central Research and Development Laboratories, Inc.)

**C4-2 Simulation of Surface Roughness in Si Etching with $XeF_2$**
K. Sugano and O. Tabata (Kyoto University)

**C4-3 Controlling of Isotropic and Anisotropic Etchings in KOH Solution by Applying Voltage**

S. Yamashita, H. Tanaka, Y. Abe (Denso Corporation) and
K. Inoue (Toyota Central Research and Development Laboratories, Inc.)

**C4-4 Improvement in Smoothness of Anisotropically Etched Silicon Surface: Effects of Surfactant and TMAH Concentration**
D. Cheng, T. Hori, K. Sato and M. Shikida (Nagoya University)

**C4-5 Alignment X-ray Lithography for Hole Perforating through PCT-Microneedle**
S. Khumpuang, M. Horade, K. Fujioka and S. Sugiyama (Ritsumeikan University)

**Session C5 Nano-Bio Fusion**

**C5-1 Reversing Single $F_1$-Motor Protein in Micro Chambers**
H. Noji, Y. Rondelez, G. Tresset, Y. H. Arata, H. Fujita and S. Takeuchi
(The University of Tokyo)

**C5-2 Planar Lipid Bilayer Array Chip Using Micro Fluidic System**
H. Suzuki, K. Tabata, H. Noji and S. Takeuchi (The University of Tokyo)

**C5-3 Electrostatic Immobilization of Biomolecules with an Array of 3D Nano-Electrodes**
T. Yamamoto and T. Fujii (The University of Tokyo)

**C5-4 Narrow Gap DNA Tweezers for Retrieval of Short Strand DNAs**
J. Yamamoto, M. Hosogi, G. Hashiguchi (Kagawa University),
K. Tamura, K. Kakushima and H. Fujita (The University of Tokyo)

**C5-5 Towards Sensing and Imaging with a Photothermally Actuated Cantilever Array**
T. Nakazawa, T. Mutsuo, S. Kawai, Y. Hoshi, H. Toshiyoshi, H. Kawakatsu
(The University of Tokyo), D. Kobayashi (Japan Science and Technology Agency),
K. Nakagawa, M. Miyake and G. Hashiguchi (Kagawa University)

**C5-6 Fabrication of Twin Microcantilever Array for Measurement of Red Blood Cell Deformability and Electrical Impedance**
Y. Cho, N. Takama and B. J. Kim (The University of Tokyo)

**Closing Session**