

# **2021 21st International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers 2021)**

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# TRANSDUCERS 2021 PROGRAM SCHEDULE

## Block 1 - Monday, 21 June

All times are Universal Time Coordinated (UTC)

### Welcome Address and Technical Program Information

13:00 - 13:30

#### TRANSDUCERS 2021 CONFERENCE CHAIRS

Jürgen Brugger, *École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND*

Amy Duwel, *Draper Laboratory, USA*

Yoshio Mita, *University of Tokyo, JAPAN*

### Student Event

13:30 - 14:00

### Industry Session 1

14:05 - 14:35

### Invited Speaker I

14:40 - 14:50

- B1-IS1**    **TRANSFORMATION OF 2D PLANES INTO 3D SOFT STRUCTURES WITH ELECTRICAL FUNCTIONS** ..... 1  
Hyunmin Moon, Byungwook Park, and **Sohee Kim**  
*Daegu Gyeongbuk Institute of Science and Technology (DGIST), KOREA*

### Invited Speaker II

14:40 - 14:50

- B1-IS2**    **DEMOCRATIZING DIGITAL MICROFLUIDICS** ..... 4  
**Chang-Jin "CJ" Kim**  
*University of California, Los Angeles, USA*

### Invited Speaker III

14:40 - 14:50

- B1-IS3**    **UBIQUITOUS SENSING WITH MEMS-FTIR SPECTROSCOPY - APPLICATIONS IN AGRI-FOOD AND ENVIRONMENTAL MONITORING** ..... 5  
**Tarik Bourouina**  
*Université Gustave Eiffel and CNRS, FRANCE*

## Invited Speaker IV

14:40 - 14:50

**B1-IS4 PUTTING ELECTRONICS TO WORK: HIGH-FREQUENCY DETECTION WITH CMOS NANOCAPACITOR ARRAYS**

**Serge J.G. Lemay**

*University of Twente, NETHERLANDS*

## Session 1A - Soft Actuators

14:55 - 15:00

**B1-1A1 FABRICATION AND CHARACTERIZATION OF 3D PRINTED OUT-OF-PLANE TORSIONAL COMB-DRIVE ACTUATORS FOR MICROROBOTICS ..... 6**

Sukjun Kim and Sarah Bergbreiter

*Carnegie Mellon University, USA*

15:00 - 15:05

**B1-1A2 BIOINSPIRED LIGHT-DRIVEN SOFT ROBOTS BY A FACILE TWO-MODE LASER ENGRAVING AND CUTTING PROCESS ..... 10**

Yande Peng, Peisheng He, Ruiqi Guo, and Liwei Lin

*University of California, Berkeley, USA*

15:05 - 15:10

**B1-1A3 A POLYMERIC SU-8 MICRO-TWEezer WITH IN-PLANE DOUBLE ACTION BASED ON CHEVRON ACTUATORS ..... 14**

Rodica-Cristina Voicu<sup>1</sup>, Catalin Tibeica<sup>1</sup>, Marius Pustan<sup>2</sup>, Corina Birleanu<sup>2</sup>, and Raluca Muller<sup>1</sup>

<sup>1</sup>National Institute for Research and Development in Microtechnologies, ROMANIA and

<sup>2</sup>Technical University of Cluj-Napoca, ROMANIA

15:10 - 15:15

**B1-1A4 SELF-DEFORMABLE FLEXIBLE MEMS TWEEZER MADE OF POLY (VINYLIDENE FLUORIDE) / IONIC LIQUID GEL WITH ELECTRICAL MEASUREMENT CAPABILITY ..... 18**

Takafumi Yamaguchi<sup>1</sup>, Naoto Usami<sup>1</sup>, Kei Misumi<sup>1</sup>, Atsushi Toyokura<sup>1</sup>, Akio Higo<sup>1</sup>,

Shimpei Ono<sup>2</sup>, Gilgueng Hwang<sup>1,3</sup>, Guilhem Larrieu<sup>1,4</sup>, Yoshiho Ikeuchi<sup>1</sup>, Agnès Tixier-Mita<sup>1</sup>,

Ken Saito<sup>5</sup>, Timothée Lévi<sup>1,6</sup>, and Yoshio Mita<sup>1</sup>

<sup>1</sup>University of Tokyo, JAPAN, <sup>2</sup>Central Research Institute of Electric Power Industry, JAPAN, <sup>3</sup>C2N-CNRS, FRANCE, <sup>4</sup>LAAS-CNRS, FRANCE, <sup>5</sup>Nihon University, JAPAN, and <sup>6</sup>University of Bordeaux, FRANCE

15:15 - 15:20

**B1-1A5 SELF-ACTUATED POLYMER-BASED CANTILEVERS WITH SHARP SILICON TIPS FOR HIGH-SPEED ATOMIC FORCE MICROSCOPY ..... 22**

Matthias Neuenschwander, Santiago H. Andany, Mustafa Kangül, Nahid Hosseini, and Georg E. Fantner

*École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND*

## Session 1B - MEMS Ultrasound Transducers (MUTs)

14:55 - 15:00

**B1-1B1 PISTON-SHAPED CMOS-MEMS CMUT FRONT-END FEATURING FORCE-DISPLACEMENT TRANSDUCTION ENHANCEMENT ..... 26**

Chun-Yu Chou, Po-Chun Chen, Hong-Teng Wu, Tzu-Hsuan Hsu, and Ming-Huang Li

*National Tsing Hua University, TAIWAN*

**15:00 - 15:05**

- B1-1B2 A MULTI-FREQUENCY PMUT ARRAY BASED ON CERAMIC PZT FOR ENDOSCOPIC PHOTOACOUSTIC IMAGING ..... 30**  
Haoran Wang<sup>1</sup>, Hao Yang<sup>2</sup>, Huabei Jiang<sup>2</sup>, Zhenfang Chen<sup>3</sup>, Philip X.-L. Feng<sup>1</sup>, and Huikai Xie<sup>4</sup>  
<sup>1</sup>University of Florida, USA, <sup>2</sup>University of South Florida, USA, <sup>3</sup>MEMS Engineering and Materials Inc., USA, and <sup>4</sup>BIT Chongqing Center for Microelectronics and Microsystems, CHINA

**15:05 - 15:10**

- B1-1B3 A 128x1 PHASED ARRAY PIEZOELECTRIC MICROMACHINED ULTRASOUND TRANSDUCER (PMUT) FOR MEDICAL IMAGING ..... 34**  
Sina Sadeghpour, Marcus Ingram, Chen Wang, Jan D'Hooge, and Michael Kraft  
University of Leuven (KU Leuven), BELGIUM

**15:10 - 15:15**

- B1-1B4 ALSCN PROGRAMMABLE FERROELECTRIC MICROMACHINED ULTRASONIC TRANSDUCER (FMUT) ..... 38**  
Bernard Herrera, Michele Pirro, Gabriel Giribaldi, Luca Colombo, and Matteo Rinaldi  
Northeastern University, USA

**15:15 - 15:20**

- B1-1B5 SOUND PRESSURE AND BANDWIDTH ENHANCED PMUT WITH VOLUME CONTROLLABLE HELMHOLTZ RESONATOR FOR RESPIRATORY MONITORING ..... 42**  
Guo-Hua Feng<sup>1</sup> and Wen-Sheng Chen<sup>2</sup>  
<sup>1</sup>National Tsing Hua University, TAIWAN and <sup>2</sup>National Chung Cheng University, TAIWAN

**15:20 - 15:25**

- B1-1B6 AN ALUMINUM-NITRIDE PMUT WITH PRE-CONCAVED MEMBRANE FOR LARGE DEFORMATION AND HIGH QUALITY-FACTOR PERFORMANCE ..... 46**  
Sheng Wu<sup>1,2,3</sup>, Wei Li<sup>1,3</sup>, Ding Jiao<sup>1,3</sup>, Heng Yang<sup>1,3</sup>, Tao Wu<sup>2</sup>, and Xinxin Li<sup>1,2,3</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>ShanghaiTech University, CHINA, and <sup>3</sup>University of Chinese Academy of Sciences (UCAS), CHINA

**Session 1C - Aerial Sensing and Actuation MEMS**

**14:55 - 15:00**

- B1-1C1 A COMPACT ACOUSTIC PARTICLE VELOCITY GRADIENT SENSOR BASED ON MEMS HOT-WIRE SENSOR CHIPS ..... 50**  
Lingmeng Yang, Zhezheng Zhu, Wenhan Chang, Fanrui Meng, Chengchen Gao, Yilong Hao, and Zhenchuan Yang  
Peking University, CHINA

**15:00 - 15:05**

- B1-1C2 HIGH FORCE DENSITY MULTI-STAGE ELECTROHYDRODYNAMIC JETS USING FOLDED LASER MICROFABRICATED ELECTRODES ..... 54**  
Daniel S. Drew and Sean Follmer  
Stanford University, USA

**15:05 - 15:10**

- B1-1C3 MEMS PRECONCENTRATOR AND GAS CHROMATOGRAPH CHIPS FOR THE SPACECRAFT ATMOSPHERE MONITOR ..... 58**  
Byunghoon Bae, Anton Belousov, Charles P. Malone, Margie L. Homer, Marianne Gonzalez, Jurij Simcic, Richard D. Kidd, Stojan Madzunkov, and Murray R. Darrach  
NASA Jet Propulsion Laboratory, USA

**15:10 - 15:15**

- B1-1C4** **ULTRASOUND IMAGING IN MID-AIR USING PHASED POLYMER PMUT ARRAY** ..... 62  
Pieter Gijzenbergh, Margo Billen, Dominika Wysocka, David Cheyns, and Veronique Rochus  
*IMEC, BELGIUM*

**15:15 - 15:20**

- B1-1C5** **CAPACITIVE CMOS HUMIDITY SENSOR WITH NOVEL FRINGE ELECTRODES AND POLYIMIDE-PILLARS FOR PERFORMANCE ENHANCEMENT** ..... 66  
Chia-Hung Yang, Cheng-Chun Chang, Ya-Chu Lee, Yen-Lin Chen, and Weileun Fang  
*National Tsing Hua University, TAIWAN*

## Session 1D - Pressure Sensors

**14:55 - 15:00**

- B1-1D1** **2000-ATMOSPHERE CHIP-SCALE PACKAGED BULK-TYPE PRESSURE SENSOR WITH DUAL-CAVITY INDUCED STRESS AMPLIFICATION** ..... 70  
Dequan Lin<sup>1</sup>, Man Wong<sup>1</sup>, and Kevin Chau<sup>2</sup>  
<sup>1</sup>*Hong Kong University of Science and Technology, CHINA and*  
<sup>2</sup>*Chinese Academy of Sciences (CAS), CHINA*

**15:00 - 15:05**

- B1-1D2** **A CMOS-MEMS THERMAL-PIEZORESISTIVE OSCILLATOR IMPLEMENTED FOR WIDE-RANGE PRESSURE SENSING APPLICATIONS** ..... 74  
Zhong-Wei Lin, Kalyani Bhosale, and Sheng-Shian Li  
*National Tsing Hua University, TAIWAN*

**15:05 - 15:10**

- B1-1D3** **A RESONANT HIGH-PRESSURE SENSOR WITH HIGH STRENGTH DESIGN** ..... 78  
Jie Yu<sup>1,2</sup>, Yulan Lu<sup>1,2</sup>, Deyong Chen<sup>1,2</sup>, Junbo Wang<sup>1,2</sup>, Jian Chen<sup>1</sup>, and Bo Xie<sup>1</sup>  
<sup>1</sup>*Chinese Academy of Sciences (CAS), CHINA and*  
<sup>2</sup>*University of Chinese Academy of Sciences (UCAS), CHINA*

**15:10 - 15:15**

- B1-1D4** **A FAST AND PRECISE TIME-BASED CHARACTERIZATION METHOD FOR SENSORS** ..... 82  
Chen Wang<sup>1</sup>, Appo van der Wiel<sup>2</sup>, Grim Keulemans<sup>1</sup>, Ben Maes<sup>2</sup>, Maliheh Ramezani<sup>2</sup>, and Michael Kraft<sup>1</sup>  
<sup>1</sup>*University of Leuven (KU Leuven), BELGIUM and* <sup>2</sup>*Melexis, BELGIUM*

**15:15 - 15:20**

- B1-1D5** **A RESONANT MICRO-PRESSURE SENSOR WITH GLASS-ON-SILICON WAFER PACKAGING** ..... 86  
Sen Zhang<sup>1,2</sup>, Yu Zheng<sup>1,2</sup>, Yulan Lu<sup>1,2</sup>, Bo Xie<sup>1,2</sup>, Junbo Wang<sup>1,2</sup>, Deyong Chen<sup>1,2</sup>, and Jian Chen<sup>1,2</sup>  
<sup>1</sup>*Chinese Academy of Sciences (CAS), CHINA and*  
<sup>2</sup>*University of Chinese Academy of Sciences (UCAS), CHINA*

**15:20 - 15:25**

- B1-1D6** **A CMOS-MEMS CAPACITIVE PRESSURE SENSOR WITH DIFFERENTIAL SENSING ELECTRODES AND ON-CHIP FREQUENCY OUTPUT CIRCUITS** ..... 90  
Po-Wei Liao<sup>1,2</sup>, Hao-Chiao Hong<sup>1,2</sup>, and Yi Chiu<sup>1,2</sup>  
<sup>1</sup>*National Chiao Tung University, TAIWAN and* <sup>2</sup>*National Yang Ming Chiao Tung University, TAIWAN*

**Plenary Speaker I Panel Presentation**  
**Opportunities for Transducers in Healthcare**

Moderator:

Ellis Meng, *University of Southern California, USA*

**15:35 - 16:05**

**B1-PS1** **A BAYESIAN FRAMEWORK FOR HEALTH MEASUREMENT ACROSS THE LIFESPAN ..... 94**

**Dan Wattendorf**

*Bill & Melinda Gates Foundation, USA*

**Panelists:** John A. Rogers, *Northwestern University, USA*  
Axel Scherer, *California Institute of Technology, USA*

**16:05** **Conclusion of Block 1**

# Block 2 - Tuesday, 22 June

All times are Universal Time Coordinated (UTC)

## Industry Session 2

07:00 - 07:30

## Invited Speaker V

07:30 - 07:40

- B2-IS5** **AUTOMOTIVE SEMICONDUCTORS IN THE CASE ERA** ..... 95  
**Nobuaki Kawahara**  
*MIRISE Technologies Corporation, JAPAN*

## Invited Speaker VI

07:30 - 07:40

- B2-IS6** **NANOGENERATORS AND SELF-POWERED MICRODEVICES APPLIED TO WIRELESS ELECTRICAL STIMULATION AT CELL LEVEL** ..... 97  
**Gonzalo Murillo**  
*Spanish National Research Council (CSIC), SPAIN*

## Invited Speaker VII

07:30 - 07:40

- B2-IS7** **SMART CARBON SCAFFOLDS FOR ELECTROCHEMICAL MONITORING OF CELL CULTURES** ..... 101  
**Stephan Sylvest Keller**  
*Technical University of Denmark (DTU), DENMARK*

## Invited Speaker VIII

07:30 - 07:40

- B2-IS8** **MICROELECTROMECHANICAL ORGANS-ON-CHIP** ..... 102  
**Massimo Mastrangeli**, Hande Aydogmus, Milica Dostanic, Paul Motreuil-Ragot, Nele Revyn, Bjorn de Wagenaar, Ronald Dekker, and Pasqualina M. Sarro  
*Delft University of Technology (TU Delft), NETHERLANDS*

## Session 2A - Accelerometer, Shock Sensor, and Switch

07:45 - 07:50

- B2-2A1** **A MODE-LOCALIZED MEMS ACCELEROMETER IN THE MODAL OVERLAP REGIME EMPLOYING PARAMETRIC PUMP** ..... 108  
Hemin Zhang<sup>1</sup>, Madan Parajuli<sup>1</sup>, Milind Pandti<sup>2</sup>, Guillermo Sobreviela<sup>2</sup>, Dongyang Chen<sup>1</sup>, Jiangkun Sun<sup>1</sup>, Chun Zhao<sup>3</sup>, and Ashwin A. Seshia<sup>1</sup>  
<sup>1</sup>University of Cambridge, UK, <sup>2</sup>Silicon Microgravity Ltd., UK, and <sup>3</sup>Huazhong University of Science and Technology, UK



**07:50 - 07:55**

- B2-2A2 A MEMS ACCELEROMETER WITH A SINGLE AXIS TWO PROOF  
MASSES FOR A WIDE DETECTION RANGE ..... 112**  
Akihiro Uchiyama<sup>1</sup>, Takashi Ichikawa<sup>1</sup>, Kohei Shibata<sup>1</sup>, Shin-ichi Iida<sup>2</sup>, Sangyeop Lee<sup>1</sup>,  
Noboru Ishihara<sup>1</sup>, Katsuyuki Machida<sup>1</sup>, Kazuya Masu<sup>1</sup>, and Hiroyuki Ito<sup>1</sup>  
<sup>1</sup>Tokyo Institute of Technology, JAPAN and <sup>2</sup>NTT Advanced Technology Corporation, JAPAN

**07:55 - 08:00**

- B2-2A3 A 3 PPM/°C TEMPERATURE COEFFICIENT OF SCALE FACTOR  
FOR A SILICON RESONANT ACCELEROMETER BASED ON  
CRYSTALLOGRAPHIC ORIENTATION OPTIMIZATION ..... 116**  
Mengxia Liu, Jian Cui, Dong Li, and Qiancheng Zhao  
Peking University, CHINA

**08:00 - 08:05**

- B2-2A4 MULTI-THRESHOLD MEMS SHOCK SENSOR FOR  
QUANTITATIVE ACCELERATION MEASUREMENTS ..... 120**  
Qiu Xu, Lvjun Wang, Alhammam Niyazi, and Mohammad I. Younis  
King Abdullah University of Science and Technology (KAUST), SAUDI ARABIA

**08:05 - 08:10**

- B2-2A5 A NOVEL FABRICATION PLATFORM FOR ACCELERATION  
SENSOR SWITCH WITH TOP CONTACTS ..... 124**  
Srinivas Merugu<sup>1</sup>, Jaibir Sharma<sup>1</sup>, Sagnik Ghosh<sup>1</sup>, Yul Koh<sup>1</sup>, Amit Lal<sup>1,2</sup>, and Eldwin J. Ng<sup>1</sup>  
<sup>1</sup>Agency for Science, Technology and Research (A\*STAR), SINGAPORE and <sup>2</sup>Cornell University, USA

**08:10 - 08:15**

- B2-2A6 A PLANAR SINGLE-ACTUATOR BI-STABLE SWITCH  
BASED ON HOOKLESS MECHANISM ..... 128**  
Zehua Lan<sup>1</sup>, Qi Tao<sup>2</sup>, Zili Tang<sup>3</sup>, Toshiyuki Tsuchiya<sup>4</sup>, Man Wong<sup>3</sup>, and Xiaohong Wang<sup>1</sup>  
<sup>1</sup>Tsinghua University, CHINA, <sup>2</sup>China Academy of Engineering Physics, CHINA,  
<sup>3</sup>Hong Kong University of Science and Technology, CHINA, and <sup>4</sup>Kyoto University, JAPAN

**Session 2B - PowerMEMS 1 - Vibrational and Energy Transduction Systems**

**07:45 - 07:50**

- B2-2B1 A SHORT-STROKE ELECTROSTATIC VIBRATIONAL ENERGY  
HARVESTER WITH EXTENDED BANDWIDTH AND SENSITIVITY ..... 132**  
Hiroaki Honma, Yukiya Tohyama, and Hiroshi Toshiyoshi  
University of Tokyo, JAPAN

**07:50 - 07:55**

- B2-2B2 FREQUENCY COMBS: A NEW MECHANISM FOR MEMS  
VIBRATION ENERGY HARVESTERS ..... 136**  
Ling Bu<sup>1,2</sup>, Emmanuelle Arroyo<sup>2</sup>, and Ashwin A. Seshia<sup>2</sup>  
<sup>1</sup>China University of Geosciences, CHINA and <sup>2</sup>University of Cambridge, UK

**07:55 - 08:00**

- B2-2B3 A BISTABLE ENERGY HARVESTER FOR SELF-POWERED SENSING  
IN RAIL TRANSPORT CONDITION MONITORING ..... 140**  
Hailing Fu<sup>1</sup>, Yuan Zhang<sup>2</sup>, Mengzhou Liu<sup>3</sup>, Yong Qin<sup>3</sup>, and Eric M. Yeatman<sup>4</sup>  
<sup>1</sup>Loughborough University, UK, <sup>2</sup>Beijing Institute of Graphic Communication, CHINA,  
<sup>3</sup>Beijing Jiaotong University, CHINA, and <sup>4</sup>Imperial College London, UK

**08:00 - 08:05**

- B2-2B4 DIRECT TRANSDUCTION FROM RADIOFREQUENCY RADIATED POWER TO STATIC AND DYNAMIC FLEXURAL MECHANICAL MODES ..... 144**  
Raul Ruiz and Gabriel Abadal  
*Universitat Autònoma de Barcelona, SPAIN*

**08:05 - 08:10**

- B2-2B5 INTELLIGENT THRUST BEARING BASED ON ELECTRET ROTARY POWER GENERATOR WITH SELF-POWERING AND SELF-SENSING CAPABILITIES ..... 148**  
Zhe Zhao<sup>1</sup>, Yaozheng Wang<sup>1</sup>, Tengfei Sun<sup>1</sup>, Hao Huang<sup>1</sup>, Jin Wu<sup>2</sup>, Kai Tao<sup>1</sup>, Honglong Chang<sup>1</sup>, and Weizheng Yuan<sup>1</sup>  
<sup>1</sup>Northwestern Polytechnical University, CHINA and <sup>2</sup>Sun Yat-sen University, CHINA

**08:10 - 08:15**

- B2-2B6 A NOVEL HYBRID GENERATOR WITH AN EFFICIENT MODIFIED VOLTAGE-MULTIPLYING RECTIFIER CIRCUIT FOR LOW FREQUENCY MOTION ENERGY HARVESTING ..... 152**  
Zibo Wu, Zeyuan Cao, Shiwen Wang, Rong Ding, and Xiongying Ye  
*Tsinghua University, CHINA*

**Session 2C - Gas Sensors**

**07:45 - 07:50**

- B2-2C1 STRETCHABLE OXYGEN SENSOR BASED ON SELF-HEALING AND SELF-ADHESIVE ORGANOHYDROGELS ..... 156**  
Yuning Liang<sup>1</sup>, Zixuan Wu<sup>1</sup>, Yaoming Wei<sup>1</sup>, Zijing Zhou<sup>1</sup>, Wenxi Huang<sup>1</sup>, Bizhang Zhong<sup>1</sup>, Jindong Ye<sup>1</sup>, Yuanqing Lin<sup>1</sup>, Zhenyi Li<sup>1</sup>, Haojun Ding<sup>1</sup>, Xing Yang<sup>1</sup>, Kai Tao<sup>2</sup>, and Jin Wu<sup>1</sup>  
<sup>1</sup>Sun Yat-sen University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA

**07:50 - 07:55**

- B2-2C2 A LOW POWER 4-CHANNEL SINGLE-CANTILEVER METAL-OXIDE GAS SENSOR CELL WITH GAS IDENTIFICATION CAPABILITY ..... 160**  
Dongcheng Xie<sup>1</sup>, Ruichen Liu<sup>1</sup>, George Adedokun<sup>1</sup>, Feng Wu<sup>1</sup>, Qian Rong<sup>2</sup>, and Lei Xu<sup>1</sup>  
<sup>1</sup>University of Science and Technology of China, CHINA and <sup>2</sup>Sun Yat-sen University, CHINA

**07:55 - 08:00**

- B2-2C3 HIGH SENSITIVE NITROGEN DIOXIDE SENSOR BASED ON POLYVINYL ALCOHOL-CELLULOSE NANOFIBRIL ORGANOHYDROGEL WITH REPAIRABILITY, ANTI-FREEZING, STRETCHABILITY, LONG-LASTING MOISTURE, AND HIGH STRENGTH ..... 164**  
Zijing Zhou<sup>1</sup>, Yuning Liang<sup>1</sup>, Wenxi Huang<sup>1</sup>, Bizhang Zhong<sup>1</sup>, Jindong Ye<sup>1</sup>, Kai Tao<sup>2</sup>, and Jin Wu<sup>1</sup>  
<sup>1</sup>Sun Yat-sen University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA

**08:00 - 08:05**

- B2-2C4 A THERMAL-PIEZORESISTIVE SELF-SUSTAINED RESONANT MASS SENSOR WITH HIGH-Q (>95k) IN AIR ..... 168**  
Aojie Quan, Chen Wang, Hemin Zhang, Michel De Cooman, Chenxi Wang, Linlin Wang, Sina Sadeghpour, and Michael Kraft  
*University of Leuven (KU Leuven), BELGIUM*

**08:05 - 08:10**

- B2-2C5 A PMUT INTEGRATED MICROFLUIDIC SYSTEM FOR VOLUMETRIC FLOW RATE SENSING ..... 172**  
Kaustav Roy, Kritank Kalyan, Anuj Ashok, Vijayendra Shastri, and Rudra Pratap  
*Indian Institute of Science, INDIA*

## Session 2D - Cells and Organs on a Chip

07:45 - 07:50

- B2-2D1 MULTILAYERED MICROFLUIDIC DEVICE FOR CONTROLLABLE FLOW PERFUSION OF GUT-LIVER ON A CHIP ..... 176**  
Jiandong Yang<sup>1</sup>, Satoshi Imamura<sup>1</sup>, Yoshikazu Hirai<sup>1</sup>,  
Ken-ichiro Kamei<sup>1</sup>, Toshiyuki Tsuchiya<sup>1</sup>, and Osamu Tabata<sup>1,2</sup>  
<sup>1</sup>Kyoto University, JAPAN and <sup>2</sup>Kyoto University of Advanced Science, JAPAN

07:50 - 07:55

- B2-2D2 DUAL-GATE FET-BASED CHARGE SENSOR ENHANCED BY IN-SITU ELECTRODE DECORATION IN A MEMS ORGANS-ON-CHIP PLATFORM ..... 180**  
Hande Aydogmus<sup>1</sup>, H. Joost van Ginkel<sup>1</sup>, Anna-Danai Galiti<sup>1</sup>, Michel Hu<sup>2</sup>, Jean-Philippe Frimat<sup>2</sup>,  
Arn van den Maagdenberg<sup>2</sup>, GuoQi Zhang<sup>1</sup>, Massimo Mastrangeli<sup>1</sup>, and Pasqualina M. Sarro<sup>1</sup>  
<sup>1</sup>Delft University of Technology (TU Delft), NETHERLANDS and  
<sup>2</sup>Leiden University Medical Centre, NETHERLANDS

07:55 - 08:00

- B2-2D3 REALIZATION OF ON-CHIP MICROFLUIDIC SYSTEM WITH FILTER-FREE FLUORESCENCE SENSOR FOR LENS-LESS FLOWCYTOMETRY ..... 184**  
Tomoya Ide, Yong-Joon Choi, Yasuyuki Kimura, Takeshi Hizawa, Kazuhiro Takahashi, Hiromu Ishii,  
Toshihiko Noda, and Kazuaki Sawada  
Toyoashi University of Technology, JAPAN

08:00 - 08:05

- B2-2D4 MINIATURIZED ELECTROCHEMICAL DEVICE FOR IN-SITU MONITORING OF GLUCOSE, LACTATE, DISSOLVED OXYGEN, PH, AND TEMPERATURE IN YEAST CULTURE ..... 188**  
Nurul Izni Rusli<sup>1,2</sup>, Pablo Lopez Espinar<sup>1</sup>, Frederik Ceysens<sup>1</sup>, Irene Taurino<sup>1</sup>, and Michael Kraft<sup>1</sup>  
<sup>1</sup>University of Leuven (KU Leuven), BELGIUM and <sup>2</sup>Universiti Malaysia Perlis (UniMAP), MALAYSIA

08:05 - 08:10

- B2-2D5 MICROCHIP FOR SURFACE-ENHANCED RAMAN SCATTERING DETECTION OF LIVE SINGLE CELL ..... 192**  
Shengsen Zhang and Rong Zhu  
Tsinghua University, CHINA

08:10 - 08:15

- B2-2D6 A MICROFLUIDIC DEVICE TO STATISTICALLY DETERMINE THE DISTRIBUTION OF SICKLE RED CELL SUBPOPULATIONS USING BIOIMPEDANCE ..... 197**  
Tieying Xu<sup>1</sup>, Maria A. Lizarralde-Iragorri<sup>2</sup>, Jean Roman<sup>1</sup>, Emile Martincic<sup>3</sup>,  
Valentine Brousse<sup>2</sup>, Olivier Français<sup>4</sup>, Wassim El Nemer<sup>2</sup>, and Bruno Le Pioufle<sup>1</sup>  
<sup>1</sup>Université Paris-Saclay, FRANCE, <sup>2</sup>Université de Paris, FRANCE, <sup>3</sup>C2N, CNRS, FRANCE, and  
<sup>4</sup>ESIEE Paris, FRANCE

## Poster Session I and Exhibit Inspection

08:15 – 10:15 Presentations are listed by topic category with their assigned number starting on page 27.

10:15 Conclusion of Block 2

# Block 3 - Wednesday, 23 June

All times are Universal Time Coordinated (UTC)

## Industry Session 3

00:00 - 00:30

## Invited Speaker IX

00:35 - 00:45

- B3-IS9** **ULTRA-HIGH-Q NANOMECHANICS THROUGH DISSIPATION DILUTION: TRENDS AND PERSPECTIVES** ..... 201  
Nils J. Engelsen<sup>1</sup>, Aman R. Agrawal<sup>2</sup>, and **Dalziel J. Wilson**<sup>2</sup>  
<sup>1</sup>*École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND* and <sup>2</sup>*University of Arizona, USA*

## Invited Speaker X

00:35 - 00:45

- B3-IS10** **HIGH THROUGHPUT SIZE CONTROLLED MICRODROPLET GENERATION** ..... 206  
**Shuichi Shoji**, Dong Hyun Yoon, Daiki Tanaka, and Tetsushi Sekiguchi  
*Waseda University, JAPAN*

## Invited Speaker XI

00:35 - 00:45

- B3-IS11** **SPECTROCHIP FOR COVID-19 PANDEMIC** ..... 209  
**Cheng-Hao Ko**  
*National Taiwan University of Science and Technology, TAIWAN*

## Invited Speaker XII

00:35 - 00:45

- B3-IS12** **NEURAL STIMULATION: NEW DESIGNS FOR ENHANCED CONTROL**  
**Shelley I. Fried**  
*Harvard Medical School, USA*

## Session 3A - Force/Tactile Sensors

00:50 - 00:55

- B3-3A1** **A NOVEL CMOS-MEMS TRI-AXIAL TACTILE FORCE SENSOR USING CAPACITIVE AND PIEZORESISTIVE SENSING MECHANISMS** ..... 210  
Yen-Lin Chen, Yu-Cheng Huang, Meng-Lin Hsieh, Sheng-Kai Yeh, and Weileun Fang  
*National Tsing Hua University, TAIWAN*

00:55 - 01:00

- B3-3A2** **WIDE RANGE BRIDGE TYPE 3D TACTILE SENSOR WITH VARIABLE SENSITIVITY THROUGH REPLACEABLE ELASTIC LAYER ATTACHING ON PDMS CAP** ..... 214  
Cheng Hou<sup>1</sup>, Kaiyao Wang<sup>1</sup>, Liang Lou<sup>2</sup>, Songsong Zhang<sup>2</sup>, Huicong Liu<sup>1</sup>, and Lining Sun<sup>1</sup>  
<sup>1</sup>*Soochow University, CHINA* and <sup>2</sup>*Shanghai Industrial  $\mu$ Technology Research Institute (SITRI), CHINA*

**01:00 - 01:05**

- B3-3A3 FLEXIBLE TACTILE SENSING ARRAY FOR ROBUST OBJECT RECOGNITION ..... 218**  
Mengwei Liu<sup>1,2</sup>, Yujia Zhang<sup>1,2</sup>, Jiachuang Wang<sup>1,2</sup>, Heng Yang<sup>1,2</sup>, Nan Qin<sup>1,2</sup>, and Tiger H. Tao<sup>1,2,3,4</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,  
<sup>3</sup>ShanghaiTech University, CHINA, and  
<sup>4</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA

**01:05 - 01:10**

- B3-3A4 SURFACE COVERING STRUCTURE AND ACTIVE SENSING WITH MEMS-CMOS INTEGRATED 3-AXIS TACTILE SENSORS FOR OBJECT SLIP DETECTION AND TEXTURE RECOGNITION ..... 222**  
Sumeyya Javaid<sup>1</sup>, Hideki Hirano<sup>1</sup>, Shuji Tanaka<sup>1</sup>, and Masanori Muroyama<sup>1,2</sup>  
<sup>1</sup>Tohoku University, JAPAN and <sup>2</sup>Tohoku Institute of Technology, JAPAN

**01:10 - 01:15**

- B3-3A5 A HIGH-SENSITIVITY MEMS GRAVIMETER WITHOUT A VACUUM CHAMBER ..... 226**  
XiaoChao Xu<sup>1</sup>, Qian Wang<sup>1</sup>, Ji'ao Tian<sup>1</sup>, YanYan Fang<sup>1</sup>,  
LuJia Yang<sup>1</sup>, Chun Zhao<sup>1</sup>, Fangjing Hu<sup>1</sup>, and Liangcheng Tu<sup>1,2</sup>  
<sup>1</sup>Huazhong University of Science and Technology, CHINA and <sup>2</sup>Sun Yat-sen University, CHINA

**Session 3B - MEMS Acoustic Sensors, Imaging, and Speakers**

**00:50 - 00:55**

- B3-3B1 TWO-WAY PIEZOELECTRIC MEMS MICROSPEAKER WITH NOVEL STRUCTURE AND ELECTRODE DESIGN FOR BANDWIDTH ENHANCEMENT ..... 230**  
Yu-Tzu Lin, Sung-Cheng Lo, and Weileun Fang  
National Tsing Hua University, TAIWAN

**00:55 - 01:00**

- B3-3B2 A MULTI-DIRECTIONAL SINGLE-PROOF-MASS ACCELEROMETER CONTACT MICROPHONE (ACCELOPHONE) WITH 10KHZ OPEN-LOOP BANDWIDTH ..... 234**  
Pranav Gupta, Anosh Daruwalla, Haoran Wen, and Farrokh Ayazi  
Georgia Institute of Technology, USA

**01:00 - 01:05**

- B3-3B3 IMPROVED PIEZOELECTRIC MEMS ACOUSTIC EMISSION SENSORS ..... 238**  
Yongfang Li<sup>1</sup>, Takahiro Omori<sup>1</sup>, Kazuo Watabe<sup>1</sup>, and Hiroshi Toshiyoshi<sup>2</sup>  
<sup>1</sup>Toshiba Corporation, JAPAN and <sup>2</sup>University of Tokyo, JAPAN

**01:05 - 01:10**

- B3-3B4 MEMS MICROPHONE WITH 73dBA SNR IN A 4mm X 3mm X 1.2mm PACKAGE ..... 242**  
Vahid Naderyan, Sung Lee, Ankur Sharma, Nicholas Wakefield, Michael Kuntzman,  
Yunfei Ma, Mark Da Silva, and Michael Pedersen  
Knowles Electronics, USA

**01:10 - 01:15**

- B3-3B5 ATTENUATION OF CURVED STRUCTURAL SURFACES IN PMUT MEASUREMENTS ..... 246**  
Sedat Pala<sup>1</sup>, Yande Peng<sup>1</sup>, Hong Ding<sup>2</sup>, Jin Xie<sup>3</sup>, and Liwei Lin<sup>1</sup>  
<sup>1</sup>University of California, Berkeley, USA, <sup>2</sup>University of California, San Diego, USA, and  
<sup>3</sup>Zhejiang University, CHINA

## Session 3C - MEMS for Environmental Sensing

00:50 - 00:55

- B3-3C1 DEVELOPMENT OF A GAS SENSOR FOR GREEN LEAF VOLATILE DETECTION ..... 250**  
Shakir-ul Haque Khan<sup>1</sup>, Sayali Tope<sup>1</sup>, Rana Dalpati<sup>1</sup>, Kyeong Heon Kim<sup>1</sup>, Seungbeom Noh<sup>1</sup>,  
Ashrafuzzaman Bulbul<sup>1</sup>, Ravi V. Mural<sup>2</sup>, Aishwaryadev Banerjee<sup>1</sup>, James C. Schnable<sup>2</sup>, Mingyue Ji<sup>1</sup>,  
Carlos Mastrangelo<sup>1</sup>, Ling Zang<sup>1</sup>, and Hanseup Kim<sup>1</sup>  
<sup>1</sup>University of Utah, USA and <sup>2</sup>University of Nebraska, Lincoln, USA

00:55 - 01:00

- B3-3C2 GRAPHENE OXIDE-CHITOSAN COMPOSITE-BASED FLEXIBLE  
ELECTROCHEMICAL SENSORS FOR LEAD ION DETECTION ..... 254**  
Pawan Pathak and Hyoungh J. Cho  
University of Central Florida, USA

01:00 - 01:05

- B3-3C3 REAL-TIME IN VIVO IMAGING OF INTRA-STEM ION DISTRIBUTION  
USING INSERTABLE CMOS SENSOR FOR PLANTS ..... 259**  
Kenta Sembo, Taichi Yoshida, Seitaro Toda, Tomoko Horio, Yasuyuki Kimura, Yong-Joon Choi,  
Kazuhiro Takahashi, Kotaro Takayama, Kazuaki Sawada, and Toshihiko Noda  
Toyohashi University of Technology, JAPAN

01:05 - 01:10

- B3-3C4 ZERO-POWER FLAME DETECTOR WITH WIDE FIELD-OF-VIEW BASED ON  
PLASMONICALLY-ENHANCED MICROMECHANICAL PHOTOSWITCH ..... 263**  
Sila Deniz Caliskan, Vageeswar Rajaram, Sungho Kang, Antea Risso, Zhenyun Qian, and Matteo Rinaldi  
Northeastern University, USA

01:10 - 01:15

- B3-3C5 SMOLDERING FIRE DETECTION USING LOW-POWER CAPACITIVE  
MEMS HYDROGEN SENSOR FOR FUTURE FIRE ALARM ..... 267**  
Yumi Hayashi, Yosuke Akimoto, Naoki Hiramatsu, Kei Masunishi, Tomohiro Saito, Hiroaki Yamazaki,  
Naofumi Nakamura, and Akihiro Kojima  
Toshiba Corporation, JAPAN

## Session 3D - Brains, Drugs Test and Screening

00:50 - 00:55

- B3-3D1 NEEDLE-TYPE 5- $\mu$ M PIXEL PITCH Ph-IMAGE SENSOR AND IMAGING  
OF PROTON EMISSIONS IN THE CEREBRAL CORTEX ..... 271**  
Kotaro Sakamoto<sup>1</sup>, Mai Madokoro<sup>1</sup>, Hiroshi Horiuchi<sup>2</sup>, Junko Ishida<sup>2</sup>, Tomoko Horio<sup>1</sup>,  
Yasuyuki Kimura<sup>1</sup>, Takeshi Hizawa<sup>1</sup>, Yong-Joon Choi<sup>1</sup>, Kazuhiro Takahashi<sup>1</sup>,  
Toshihiko Noda<sup>1</sup>, Junichi Nabekura<sup>2</sup>, and Kazuaki Sawada<sup>1</sup>  
<sup>1</sup>Toyohashi University of Technology, JAPAN and <sup>2</sup>National Institute for Physiological Sciences, JAPAN

00:55 - 01:00

- B3-3D2 A MULTI-CHEMICAL IMAGE SENSOR FOR SIMULTANEOUS VISUALIZATION  
OF LACTATE AND Ph DISTRIBUTION AND ITS APPLICATION FOR  
EXTRACELLULAR MEASUREMENT OF A HIPPOCAMPAL SLICE ..... 275**  
Hayato Muraguchi<sup>1</sup>, Hideo Doi<sup>1</sup>, Tomoko Horio<sup>1</sup>, Bijay Parajuli<sup>2</sup>, Eiji Shigetomi<sup>2</sup>,  
Youichi Shinozaki<sup>2</sup>, Yong-Joon Choi<sup>1</sup>, Kazuhiro Takahashi<sup>1</sup>, Toshiaki Hattori<sup>1</sup>,  
Toshihiko Noda<sup>1</sup>, Schuichi Koizumi<sup>2</sup>, and Kazuaki Sawada<sup>1</sup>  
<sup>1</sup>Toyohashi University of Technology, JAPAN and <sup>2</sup>University of Yamanashi, JAPAN

**01:00 - 01:05**

- B3-3D3 FABRICATION OF ULTRA-THIN MICRO-POROUS PDMS MEMBRANE FOR CELL CO-CULTURE IN BLOOD BRAIN BARRIER MODEL ON CHIP ..... 279**  
Fengyi Zheng<sup>1,2</sup>, Qiushi Li<sup>1</sup>, Panhui Yang<sup>1,2</sup>, Shihui Qiu<sup>1,2</sup>, Hongju Mao<sup>1,2</sup>, and Jianlong Zhao<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,

**01:05 - 01:10**

- B3-3D4 ENDOTHELIAL CHEMICAL REACTION AND DRUG TEST REPRODUCED ON MOLDED FLEXIBLE COLLAGEN HYDROGEL TUBE ..... 283**  
Shun Itai and Hiroaki Onoe  
Keio University, JAPAN

**01:10 - 01:15**

- B3-3D5 A TUBING-FREE SAMPLE-TO-DROPLET INTERFACE ENABLES FACILE SAMPLE LOADING OF DROPLET MICROFLUIDICS DEVICES TOWARD HIGH-THROUGHPUT SCREENING ..... 287**  
Fangchi Shao, Kuangwen Hsieh, Pengfei Zhang, Aniruddha M. Kaushik, and Tza-Huei Wang  
Johns Hopkins University, USA

**01:15 - 01:20**

- B3-3D6 A SILK-BASED OPTO-ELECTRONIC INTEGRATED NEURAL PROBE FOR ANIMAL MOTION CONTROL ..... 291**  
Chi Gu<sup>1,2</sup>, Huiran Yang<sup>1</sup>, Bohan Zhang<sup>3</sup>, Haoyuan Li<sup>4</sup>, Xueying Wang<sup>1,2</sup>, Zhitao Zhou<sup>1</sup>, Zhifeng Shi<sup>4</sup>, Ying Mao<sup>4</sup>, Xiaoling Wei<sup>1,2</sup>, and Tiger H. Tao<sup>1,2,3,5</sup>  
<sup>1</sup>Chinese Academy of Sciences, Shanghai, CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA, <sup>3</sup>Shanghai Tech University, CHINA, <sup>4</sup>Huashan Hospital of Fudan University, CHINA, and <sup>5</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA

**Poster Session II and Exhibit Inspection**

01:20 – 03:20 Presentations are listed by topic category with their assigned number starting on page 27.

03:20 Conclusion of Block 3

# Block 4 - Wednesday, 23 June

All times are Universal Time Coordinated (UTC)

## TRANSDUCERS Early Career Award Presentation

13:00 - 13:15

## Transducers 2023 Conference Announcement

13:15 - 13:27

### Transducers 2023 Conference Chairs

Satoshi Konishi, *Ritsumeikan University, JAPAN*

Shuji Tanaka, *Tohoku University, JAPAN*

## Hilton Head 2022 Workshop Announcement

13:27 - 13:30

### Hilton Head 2022 Workshop Chair

Reza Ghodssi, *University of Maryland, USA*

## Invited Speaker XIII

13:35 - 13:45

- B4-IS13** **QUANTUM CONTROL OF SPIN AND ORBITAL STATES WITH A DIAMOND MEMS RESONATOR** ..... 295  
**Gregory D. Fuchs**  
*Cornell University, USA*

## Invited Speaker XIV

13:35 - 13:45

- B4-IS14** **ORGAN CHIP MODELS OF HUMAN PHYSIOLOGY**  
**Anna Herland**  
*KTH Royal Institute of Technology, SWEDEN*

## Invited Speaker XV

13:35 - 13:45

- B4-IS15** **INTERROGATION AND CHARGING OF EMBEDDED SENSORS BY AUTONOMOUS VEHICLES** ..... 296  
Juan M. Arteaga, James O'Keeffe, David E. Boyle, Paul D. Mitcheson, and **Eric M. Yeatman**  
*Imperial College London, UK*

## Invited Speaker XVI

13:35 - 13:45

- B4-IS16** **DRAWING FEATURE MAPS OF MOLECULAR COMPUTATION** ..... 300  
**Teruo Fujii**  
*University of Tokyo, JAPAN*



## Session 4A - Resonators and RF MEMS

13:50 - 13:55

- B4-4A1 DESIGN OF ELECTROMAGNETIC RING RESONATOR WITH ZERO ANCHORLOSS ..... 301**  
Muhammad Jehanzeb Khan, Takashiro Tsukamoto, and Shuji Tanaka  
*Tohoku University, JAPAN*

13:55 - 14:00

- B4-4A2 A SILICON MEMS DISK RESONATOR OSCILLATOR DEMONSTRATING  
36 PPT FREQUENCY STABILITY ..... 305**  
Madan Parajuli, Guillermo Sobreviela, Hemin Zhang, and Ashwin A. Seshia  
*University of Cambridge, UK*

14:00 - 14:05

- B4-4A3 SINGLE-CHIP DUAL-BAND FILTERS BASED ON SPURIOUS-FREE DUAL-RESONANCE  
SC<sub>0.15</sub>AL<sub>0.85</sub>N LATERALLY COUPLED ALTERNATING THICKNESS (LCAT)  
MODE RESONATORS ..... 309**  
Chen Liu, Yao Zhu, Nan Wang, and Bangtao Chen  
*Agency for Science, Technology and Research (A\*STAR), SINGAPORE*

14:05 - 14:10

- B4-4A4 IN-PLANE BULK ACOUSTIC RESONATORS USING 50NM-THICK  
NANO-LAMINATED FERROELECTRIC HF<sub>0.5</sub>ZR<sub>0.5</sub>O<sub>2</sub> ..... 313**  
Troy Tharpe, Faysal Hakim, and Roozbeh Tabrizian  
*University of Florida, USA*

14:10 - 14:15

- B4-4A5 INTRINSICALLY SWITCHABLE FERROELECTRIC SCANDIUM  
ALUMINUM NITRIDE BULK ACOUSTIC WAVE RESONATORS ..... 317**  
Dicheng Mo, Sushant Rassay, and Roozbeh Tabrizian  
*University of Florida, USA*

14:15 - 14:20

- B4-4A6 SELF-HEATING AND QUALITY FACTOR: THERMAL CHALLENGES IN  
ALUMINUM SCANDIUM NITRIDE BULK ACOUSTIC WAVE RESONATORS ..... 321**  
Yue Zheng, Chao Yuan, Mingo Park, Samuel Graham, and Azadeh Ansari  
*Georgia Institute of Technology, USA*

## Session 4B - MEMS for Human Sensing and Machine Interfacing

13:50 - 13:55

- B4-4B1 ELECTRONIC SKIN FOR DETECTIONS OF HUMAN-ROBOT  
COLLISION FORCE AND CONTACT POSITION ..... 325**  
Qian Mao, Guozhen Li, and Rong Zhu  
*Tsinghua University, CHINA*

13:55 - 14:00

- B4-4B2 A TRIBOELECTRIC TACTILE PERCEPTION RING FOR  
CONTINUUM ROBOT COLLISION-AWARE ..... 329**  
Yuyang Sun<sup>1</sup>, Hanyang Li<sup>1</sup>, Cheng Hou<sup>1</sup>, Wenjie Shen<sup>1</sup>, Huicong Liu<sup>1</sup>,  
Tao Chen<sup>1</sup>, Hongliang Ren<sup>2</sup>, Xiuli Zuo<sup>3</sup>, and Yanqing Li<sup>4</sup>  
<sup>1</sup>Soochow University, CHINA, <sup>2</sup>National University of Singapore, CHINA,  
<sup>3</sup>Qilu Hospital of Shandong University, CHINA, and <sup>4</sup>Shandong University, CHINA

**14:00 - 14:05**

- B4-4B3 HAPTIC-FEEDBACK RING ENABLED HUMAN-MACHINE INTERFACE (HMI) AIMING AT IMMERSIVE VIRTUAL REALITY EXPERIENCE ..... 333**  
Zhongda Sun, Minglu Zhu, Zhaocong Chen, Xuechuan Shan, and Chengkuo Lee  
*National University of Singapore, SINGAPORE*

**14:05 - 14:10**

- B4-4B4 A GLOVE-BASED HUMAN-MACHINE INTERFACE ASSISTED BY ULTRA-STRETCHABLE STRAIN SENSORS AND THREE-AXIS FORCE SENSORS ..... 337**  
Xingyou Meng, Hanyang Li, Kui Zhang, Yuyang Sun, and Huicong Liu  
*Soochow University, CHINA*

**14:10 - 14:15**

- B4-4B5 AN MXENE-EDOT NANOCOMPOSITE BASED STRAIN SENSOR PATCH FOR WIRELESS HUMAN MOTION MONITORING ..... 341**  
Shipeng Zhang, Ashok Chhetry, Sudeep Sharma, Chani Park, and Jae Yeong Park  
*Kwangwoon University, KOREA*

**14:15 - 14:20**

- B4-4B6 MEMS-ENABLED WIRELESS URETERAL STENT WITH INTEGRATED ANTENNA FOR LOCAL PRESSURE MONITORING ..... 345**  
Mohammad Reza Yousefi Darestani, Nabil Shalabi, Dirk Lange, Ben H. Chew, and Kenichi Takahata  
*University of British Columbia, Vancouver, CANADA*

**Session 4C - Microrobots and Microswimmers**

**13:50 - 13:55**

- B4-4C1 FIRST JUMPS OF A SILICON MICROROBOT WITH AN ENERGY STORING SUBSTRATE SPRING ..... 349**  
Craig B. Schindler, Hani C. Gomez, and Kristofer S.J. Pister  
*University of California, Berkeley, USA*

**13:55 - 14:00**

- B4-4C2 AN UNTETHERED CRAWLING AND JUMPING MICRO-ROBOT ..... 353**  
Dongkai Wang<sup>1,2</sup>, Fanping Sui<sup>2</sup>, Wenying Qiu<sup>1,2</sup>, Yandeng Peng<sup>2</sup>, Min Zhang<sup>1</sup>, Xiaohao Wang<sup>1</sup>,  
and Liwei Lin<sup>1,2</sup>  
<sup>1</sup>*Tsinghua University, CHINA* and <sup>2</sup>*University of California, Berkeley, USA*

**14:00 - 14:05**

- B4-4C3 MICRO SWIMMING ROBOTS POWERED BY A SINGLE-AXIS ALTERNATING MAGNETIC FIELD WITH CONTROLLABLE MANIPULATION ..... 357**  
Fanping Sui<sup>1</sup>, Yuanyuan Huang<sup>2</sup>, Ruiqi Guo<sup>1</sup>, and Liwei Lin<sup>1</sup>  
<sup>1</sup>*University of California, Berkeley, USA* and <sup>2</sup>*Southwest University, CHINA*

**14:05 - 14:10**

- B4-4C4 UNTETHERED SOFT CRAWLING ROBOTS DRIVEN BY MAGNETIC ANISOTROPY ..... 361**  
Fanping Sui<sup>1</sup>, Dongkai Wang<sup>1,2</sup>, Ruiqi Guo<sup>1</sup>, Renxiao Xu<sup>1</sup>, and Liwei Lin<sup>1,2</sup>  
<sup>1</sup>*University of California, Berkeley, USA* and <sup>2</sup>*Tsinghua University, CHINA*

**14:10 - 14:15**

- B4-4C5 RECONFIGURABLE ACOUSTOFLUIDIC MANIPULATION OF PARTICLES IN RING-LIKE RICH PATTERNS ENABLED ON A BULK MICROMACHINED SILICON CHIP ..... 365**  
Jingui Qian<sup>1</sup>, Renhua Yang<sup>1</sup>, Habiba Begum<sup>1</sup>, and Joshua E.-Y. Lee<sup>1,2</sup>  
<sup>1</sup>*City University of Hong Kong, HONG KONG* and  
<sup>2</sup>*Agency for Science, Technology and Research (A\*STAR), SINGAPORE*

14:15 - 14:20

- B4-4C6 FABRICATION OF BIOINSPIRED ARTIFICIAL BACTERIAL FLAGELLA VIA TWO PHOTON LITHOGRAPHY AND WET METALLIZATION ..... 369**  
Roberto Bernasconi<sup>1</sup>, Gea Prioglio<sup>1</sup>, Carlos C.J. Alcantara<sup>2</sup>, Salvador Panè<sup>2</sup>, and Luca Magagnin<sup>1</sup>  
<sup>1</sup>Politecnico di Milano, ITALY and <sup>2</sup>ETH Zurich, SWITZERLAND

## Session 4D - MEMS with Beyond AI and Novel Computing Methods

13:50 - 13:55

- B4-4D1 AN EXPERIMENTAL STUDY OF THE PHOTORESPONSE OF 1T-1R OSCILLATORS BASED ON VANADIUM DIOXIDE: TOWARDS SPIKING SENSING SYSTEMS ..... 373**  
Teodor Rosca, Fatemeh Qaderi, Marco Riccardi, Olivier J.F. Martin, and Adrian M. Ionescu  
École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND

13:55 - 14:00

- B4-4D2 TOPOMEMS CIRCUIT: STEP-VARIABLE-RESETTABLE MEMS CAPACITOR FOR TOPOLOGICAL ELECTRICAL CIRCUIT ..... 377**  
Yoshio Mita<sup>1</sup>, Eric Lebrasseur<sup>1</sup>, Motohiko Ezawa<sup>1</sup>, Keigo Tsuji<sup>1</sup>, Minoru Kawamura<sup>2</sup>, and Akio Higo<sup>1</sup>  
<sup>1</sup>University of Tokyo, JAPAN and <sup>2</sup>RIKEN, JAPAN

14:00 - 14:05

- B4-4D3 DOUBLE-COFFEE RING NANOPLASMONIC EFFECTS WITH CONVOLUTIONAL NEURAL LEARNING FOR SARS-COV-2 DETECTION ..... 381**  
Kamyar Behrouzi and Liwei Lin  
University of California, Berkeley, USA

14:05 - 14:10

- B4-4D4 AI ON A CHIP FOR IDENTIFYING MICROALGAL CELLS WITH HIGH HEAVY METAL REMOVAL EFFICIENCY ..... 385**  
Muzhen Xu<sup>1</sup>, Jeffrey Harmon<sup>1</sup>, Tomohisa Hasunuma<sup>2</sup>, Akihiro Isozaki<sup>1,3</sup>, and Keisuke Goda<sup>1,4,5</sup>  
<sup>1</sup>University of Tokyo, JAPAN, <sup>2</sup>Kobe University, JAPAN, <sup>3</sup>Kanagawa Institute of Industrial Science and Technology, JAPAN, <sup>4</sup>Wuhan University, CHINA, and <sup>5</sup>University of California, Los Angeles, USA

14:10 - 14:15

- B4-4D5 MACHINE LEARNING AUGMENTED VOC IDENTIFICATION BY MID-INFRARED NANOANTENNAS WITH MICROFLUIDICS CHAMBERS ..... 389**  
Zhihao Ren, Zixuan Zhang, Jingxuan Wei, Haibo Wang, BOWEI Dong, and Chengkuo Lee  
National University of Singapore, SINGAPORE

## Poster Session III and Exhibit Inspection

14:20 – 16:20 Presentations are listed by topic category with their assigned number starting on page 27.

16:20 Conclusion of Block 4

## Block 5 - Thursday, 24 June

All times are Universal Time Coordinated (UTC)

### Plenary Speaker II & III Panel Presentation Opportunities for Transducers in Global Good

Moderator:

Hiroyuki Fujita, *Canon Medical Systems Corporation, JAPAN*

**07:00 - 07:30**

- B5-PS2** **DIGITAL TECHNOLOGY MEETS ETHICS: HOW TO THINK ABOUT THE GLOBAL GOOD WHEN YOU ARE CHANGING THE WORLD** ..... 393

**Andrea Renda**

*Centre for European Policy Studies (CEPS), BELGIUM*

- B5-PS3** **DIGITAL SOCIAL INNOVATION: TAIWAN CAN HELP** ..... 394

**Audrey Tang**

*Digital Minister, TAIWAN*

### Invited Speaker XVII

**07:35 - 07:45**

- B5-IS17** **MEMS TOOLS FOR ACCELERATING MATERIALS SCIENCE** ..... 395

**Alfred Ludwig**

*Ruhr Universität, Bochum (RUB), GERMANY*

### Invited Speaker XVIII

**07:35 - 07:45**

- B5-IS18** **SILICON NANOMECHANICAL RESONATORS AND LARGE SCALE OPTOMECHANICS FOR SENSING** ..... 396

**Sébastien Hentz**

*CEA, FRANCE*

### Invited Speaker XIX

**07:35 - 07:45**

- B5-IS19** **SMART 3D VOLUMETRIC PRINTING** ..... 397

Paul Delrot<sup>2</sup>, Damien Loterie<sup>2</sup> and **Christophe Moser**<sup>1</sup>

<sup>1</sup>*École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND* and <sup>2</sup>*Readily3D, SWITZERLAND*

### Invited Speaker XX

**07:35 - 07:45**

- B5-IS20** **EMERGING FUNCTIONS OF ELECTRICALLY-INDUCED BUBBLES AND ITS BIOMEDICAL APPLICATIONS** ..... 400

**Yoko Yamanishi**

*Kyushu University, JAPAN*

## Session 5A - Gyroscope, Magneto/Electrical Field, and Gravimeter

07:50 - 07:55

- B5-5A1** **A 0.1 DEG/H MODULE-LEVEL SILICON MEMS RATE INTEGRATING GYROSCOPE USING VIRTUALLY ROTATED DONUT-MASS STRUCTURE AND DEMONSTRATION OF THE EARTH'S ROTATION DETECTION** ..... 402  
Fumito Miyazaki<sup>1</sup>, Ryunosuke Gando<sup>1</sup>, Daiki Ono<sup>1,2</sup>, Shiori Kaji<sup>1</sup>, Hiroshi Ota<sup>2</sup>, Hiroki Hiraga<sup>1</sup>, Kei Masunishi<sup>1</sup>, Etsuji Ogawa<sup>1</sup>, Tetsuro Itakura<sup>1</sup>, and Yasushi Tomizawa<sup>1,2</sup>  
<sup>1</sup>Toshiba Corporation, JAPAN and <sup>2</sup>Device & System Platform Development Center Co. Ltd., JAPAN

07:55 - 08:00

- B5-5A2** **THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE PWM FREQUENCY EFFECT ON THE SENSITIVITY OF THERMAL EXPANSION-BASED ANGULAR MOTION SENSOR** ..... 406  
Huahuang Luo, Jose Cabot, Xiaoyi Wang, Mingzheng Duan, and Yi-Kuen Lee  
Hong Kong University of Science and Technology, HONG KONG

08:00 - 08:05

- B5-5A3** **A RESONANT LORENTZ-FORCE MAGNETOMETER BASED ON CAVITY SLOTTED DOUBLE-ENDED TUNING FORK TO ENHANCE Q-FACTOR AND SENSITIVITY** ..... 410  
Xiaoxiao Song<sup>1</sup>, Chen Wang<sup>2</sup>, Chengxin Li<sup>1</sup>, Fangzheng Li<sup>1</sup>, Jingqian Xi<sup>1</sup>, Yuan Wang<sup>1</sup>, Huafeng Liu<sup>1</sup>, Chun Zhao<sup>1</sup>, Liang-Cheng Tu<sup>1,3</sup>, and Michael Kraft<sup>2</sup>  
<sup>1</sup>Huazhong University of Science and Technology, CHINA, <sup>2</sup>University of Leuven, BELGIUM, and <sup>3</sup>Sun Yat-sen University, CHINA

08:05 - 08:10

- B5-5A4** **DESIGN AND CHARACTERIZATION OF AN ALN PIEZOELECTRIC MEMS MAGNETOMETER** ..... 414  
Ken-Wei Tang, Po-Chih Cheng, Shyam Trivedi, and Sheng-Shian Li  
National Tsing Hua University, TAIWAN

08:10 - 08:15

- B5-5A5** **INTEGRATION OF MAGNETOSTRICTIVE MICROSENSOR WITH HALL ELEMENT FOR MICROSTRUCTURE RESONANCE DETECTION** ..... 418  
Taiga Ezura, Naoki Inomata, and Takahito Ono  
Tohoku University, JAPAN

08:15 - 08:20

- B5-5A6** **A NOVEL HIGH SENSITIVE MODE-LOCALIZATION MEMS ELECTRIC FIELD SENSOR BASED ON CLOSED-LOOP FEEDBACK** ..... 423  
Zilong Wang<sup>1,2</sup>, Zhengwei Wu<sup>1</sup>, Xiangming Liu<sup>1,2</sup>, Yahao Gao<sup>1,2</sup>, Simin Peng<sup>1,2</sup>, Ren Ren<sup>1</sup>, Fengjie Zheng<sup>1</sup>, Yao Lv<sup>1</sup>, and Chunrong Peng<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,

## Session 5B - Optical MEMS

07:50 - 07:55

- B5-5B1** **A ONE-INCH APERTURE PIEZOELECTRIC TUNABLE LENS WITH SMALL FOOTPRINT** ..... 427  
Hitesh G.B. Gowda, Tobias Gräf, and Ulrike Wallrabe  
University of Freiburg, GERMANY

07:55 - 08:00

- B5-5B2** **BI-AXIAL MAGNETICALLY ACTUATED TUNABLE PRISM** ..... 431  
Pascal M. Weber, Matthias C. Wapler, Florian Lemke, and Ulrike Wallrabe  
University of Freiburg, GERMANY

**08:00 - 08:05**

- B5-5B3 CLOSED-LOOP CONTROL OF QUASI-STATIC SCANNING PZT MICROMIRRORS WITH EMBEDDED PIEZORESISTIVE SENSING AND SPURIOUS MODE REJECTION ..... 435**  
Paolo Frigerio<sup>1</sup>, Luca Molinari<sup>2</sup>, Andrea Barbieri<sup>2</sup>, Roberto Carminati<sup>2</sup>, Nicolò Boni<sup>2</sup>,  
and Giacomo Langfelder<sup>1</sup>  
<sup>1</sup>Politecnico di Milano, ITALY and <sup>2</sup>STMicroelectronics, ITALY

**08:05 - 08:10**

- B5-5B4 ACOUSTICALLY LEVITATED SPINNING OPTICAL SCANNER ..... 439**  
Takashi Sasaki and Kazuhiro Hane  
Tohoku University, JAPAN

**08:10 - 08:15**

- B5-5B5 MODELLING AND EXPERIMENTAL VALIDATION OF PIEZOELECTRICALLY DRIVEN MICRO-LENS ACTUATOR ..... 443**  
Syed Mamun R Rasid<sup>1</sup>, Aron Michael<sup>2</sup>, Hemanshu Roy Pota<sup>1</sup>, Ssu-Han Chen<sup>2</sup>, and Chee Yee Kwok<sup>2</sup>  
<sup>1</sup>University of New South Wales, Canberra, AUSTRALIA and  
<sup>2</sup>University of New South Wales, Sydney, AUSTRALIA

**08:15 - 08:20**

- B5-5B6 CONTINUOUSLY TUNABLE SILICON PHOTONIC MEMS 2x2 POWER COUPLER ..... 447**  
Alain Y. Takabayashi<sup>1</sup>, Hamed Sattari<sup>1</sup>, Pierre Edinger<sup>2</sup>, Peter Verheyen<sup>3</sup>,  
Kristinn B. Gylfason<sup>2</sup>, Wim Bogaerts<sup>3,4</sup>, and Niels Quack<sup>1</sup>  
<sup>1</sup>École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND, <sup>2</sup>KTH Royal Institute of Technology,  
SWEDEN, <sup>3</sup>Interuniversity Microelectronics Centre (IMEC), BELGIUM, and  
<sup>4</sup>Ghent University-IMEC, BELGIUM

**Session 5C - PowerMEMS 2 - Thermo - Tribo - Electro - Magnetic**

**07:50 - 07:55**

- B5-5C1 A STRATEGY TO REDUCE AIR BREAKDOWN EFFECT AND BOOST OUTPUT ENERGY FOR CONTACT-SEPARATION MODE TRIBOELECTRIC NANOGENERATOR ..... 451**  
Zeyuan Cao, Yao Chu, Shiwen Wang, Zibo Wu, Rong Ding, and Xiongying Ye  
Tsinghua University, CHINA

**07:55 - 08:00**

- B5-5C2 MAGNETICALLY EXCITED PIEZOELECTRIC ENERGY HARVESTER FOR MICROPOWER SUPPLY AND WAKEUP APPLICATIONS ..... 455**  
Björn Gojdka<sup>1</sup>, Torben Dankwort<sup>1</sup>, Marc A. Nowak<sup>1</sup>, Mani T. Bodduluri<sup>1</sup>,  
Minhaz Ahmed<sup>1,2</sup>, Sven Grünzig<sup>1</sup>, and Fabian Lofink<sup>1</sup>  
<sup>1</sup>Fraunhofer Institute for Silicon Technology ISIT, GERMANY and <sup>2</sup>Furtwangen University, GERMANY

**08:00 - 08:05**

- B5-5C3 AN ENERGY HARVESTING SCHEME WITH TEMPERATURE THRESHOLD TRIGGERED GENERATION FOR HEAT EVENT AUTONOMOUS MONITORING ..... 459**  
Ruofeng Han, Nianying Wang, Qisheng He, Jiachou Wang, and Xinxin Li  
Chinese Academy of Sciences (CAS), CHINA

**08:05 - 08:10**

- B5-5C4 COUPLING EFFECTS IN PARALLEL THERMOMAGNETIC GENERATORS BASED ON RESONANT SELF-ACTUATION ..... 463**  
Joel Joseph<sup>1</sup>, Mira Wehr<sup>1</sup>, Hiroyuki Miki<sup>2</sup>, Makoto Ohtsuka<sup>2</sup>, and Manfred Kohl<sup>1</sup>  
<sup>1</sup>Karlsruhe Institute of Technology (KIT), GERMANY and <sup>2</sup>Tohoku University, JAPAN

08:10 - 08:15

- B5-5C5 FLEXIBLE THERMOELECTRIC GENERATOR USING KIRIGAMI-FOLDING STRUCTURE ..... 467**  
Shingo Terashima and Eiji Iwase  
Waseda University, JAPAN

08:15 - 08:20

- B5-5C6 FABRICATION OF  $\mu$ TEGs BASED ON NANO-SCALE THERMOELECTRIC MATERIAL DISPERSIONS ..... 471**  
Swathi Krishna Subhash, Timo Gerach, Negin Sherkat, Harald Hillebrecht, Peter Woias, and Uwe Pelz  
University of Freiburg, GERMANY

## Session 5D - MEMS for Clinical Applications

07:50 - 07:55

- B5-5D1 A NEGATIVE DEPLETION-ENHANCED FILTRATION SYSTEM FOR HIGH-PURITY CIRCULATING TUMOR CELL ENRICHMENT FROM WHOLE BLOOD ..... 475**  
Qingmei Xu<sup>1,2</sup>, Tingyu Li<sup>1</sup>, Tingting Hun<sup>1</sup>, Jianyu Du<sup>1,3</sup>, Zheng Liu<sup>1</sup>, Kunzhe Song<sup>1</sup>, Xiao Ma<sup>4</sup>, and Wei Wang<sup>1</sup>  
<sup>1</sup>Peking University, CHINA, <sup>2</sup>Taiyuan Institute of Technology, CHINA, <sup>3</sup>China University of Geosciences, CHINA, and <sup>4</sup>Hangzhou Branemagic Medical Technology Co. Ltd., CHINA

07:55 - 08:00

- B5-5D2 A MICROFLUIDIC DEVICE PLATFORM RECONSTRUCTING LUNG PATTERN FOR CANCER IMMUNOTHERAPY APPLICATIONS ..... 479**  
Yu-Chen Chen<sup>1</sup>, Han-Jung Liao<sup>1</sup>, Jean-An Chieh<sup>1</sup>, Pin-Tzu Lai<sup>1</sup>, Yi-Ying Liang<sup>1</sup>, Kang-Yun Lee<sup>2</sup>, Wei-lun Sun<sup>2</sup>, Shu-Chuan Ho<sup>2</sup>, Yu-Shiuan Wang<sup>2</sup>, Wan-Chen Huang<sup>3</sup>, Wei-Chiao Chang<sup>2</sup>, Sung-Yang Wei<sup>1</sup>, and Cheng-Hsien Liu<sup>1</sup>  
<sup>1</sup>National Tsing Hua University, TAIWAN, <sup>2</sup>Taipei Medical University, TAIWAN, and <sup>3</sup>Academia Sinica, TAIWAN

08:00 - 08:05

- B5-5D3 GRAVITY AND FILM STRESS ANALYSIS FOR MEMS DEFORMABLE MIRROR WITH ELECTROSTATIC PISTON ARRAY ..... 483**  
Toshiyuki Tsuchiya<sup>1</sup>, Toshiki Ema<sup>1</sup>, Yoshikazu Hirai<sup>1</sup>, Christopher Welham<sup>2</sup>, and Hideyuki Maekoba<sup>2</sup>  
<sup>1</sup>Kyoto University, JAPAN and <sup>2</sup>Coventor, Inc., FRANCE

08:05 - 08:10

- B5-5D4 QUANTITATIVE FORCE MEASUREMENT OF THE EYE SURGICAL SIMULATOR FOR ILM PEELING BY USING QCR FORCE SENSOR ..... 487**  
Yuta Taniguchi<sup>1</sup>, Hiroataka Sugiura<sup>1</sup>, Toshiro Yamanaka<sup>1</sup>, Shiro Watanabe<sup>2</sup>, Seiji Omata<sup>3</sup>, Kanako Harada<sup>1</sup>, Mamoru Mitsuishi<sup>1</sup>, Takashi Ueta<sup>1</sup>, Tomoyasu Shiraya<sup>1</sup>, Koichiro Sugimoto<sup>1</sup>, Kiyohito Totsuka<sup>1</sup>, Fumiyuki Araki<sup>1</sup>, Muneyuki Takao<sup>1</sup>, Makoto Aihara<sup>1</sup>, and Fumihito Arai<sup>1</sup>  
<sup>1</sup>University of Tokyo, JAPAN, <sup>2</sup>Nagoya University, JAPAN, and <sup>3</sup>Kumamoto University, JAPAN

08:10 - 08:15

- B5-5D5 BIOFUNCTIONAL AND SELF-CONTRACTABLE SILK-BASED SENSING THREADS ..... 491**  
Yating Xie<sup>1,2</sup>, Keyin Liu<sup>2</sup>, and Tiger H. Tao<sup>1,2,3,4</sup>  
<sup>1</sup>ShanghaiTech University, CHINA, <sup>2</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>3</sup>University of Chinese Academy of Sciences (UCAS), CHINA, and <sup>4</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA

## Poster Session IV and Exhibit Inspection

08:20 – 10:20 Presentations are listed by topic category with their assigned number starting on page 27.

10:20 Conclusion of Block 5

# Block 6 - Friday, 25 June

All times are Universal Time Coordinated (UTC)

## Student Event

00:00 - 00:30

## Invited Speaker XXI

00:35 - 00:45

**B6-IS21 SILK-DRIVE: PROTEIN-BASED HARD DRIVE USING NEAR-FIELD NANO-OPTICS ..... 495**

Zhitao Zhou<sup>1</sup>, Jianjuan Jiang<sup>1</sup>, and **Tiger H. Tao**<sup>1,2,3,4</sup>

<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,

<sup>3</sup>ShanghaiTech University, CHINA, and

<sup>4</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA

## Invited Speaker XXII

00:35 - 00:45

**B6-IS22 NANOSTRUCTURED BIOSENSORS AND INTEGRATED SYSTEMS FOR HEALTH MONITORING ..... 498**

**Yuanjing Lin**

*Southern University of Science and Technology, CHINA*

## Invited Speaker XXIII

00:35 - 00:45

**B6-IS23 NATURE-INSPIRED SURFACES FOR WATER-ENERGY NEXUS ..... 501**

Wanghui Xu and **Zuankai Wang**

*City University of Hong Kong, CHINA*

## Invited Speaker XXIV

00:35 - 00:45

**B6-IS24 RESEARCH AND DEVELOPMENT ON MEMS BASED ELECTRIC FIELD SENSOR ..... 505**

**Shanhong Xia**<sup>1,2,3</sup>, Hucheng Lei<sup>1,4</sup>, Jun Liu<sup>1,4</sup>, Simin Peng<sup>1,4</sup>,

Chunrong Peng<sup>1,2</sup>, Pengfei Yang<sup>5</sup>, Xiaolong Wen<sup>6</sup> and Zhaozhi Chu<sup>1</sup>

<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>Beijing TFlying Transducer Technology Co., Ltd. CHINA,

<sup>3</sup>Beijing Institute of Collaborative Innovation, CHINA, <sup>4</sup>University of Chinese Academy of Sciences (UCAS)

CHINA, <sup>5</sup>Beijing Information Science and Technology University, CHINA,

<sup>6</sup>University of Science and Technology Beijing, CHINA

## Session 6A - Novel Lithography Techniques

00:50 - 00:55

**B6-6A1 SOFT LITHOGRAPHY-BASED FABRICATION METHOD FOR FLEXIBLE SUPEROMNIPHOBIC SURFACE ..... 509**

Thanh-Vinh Nguyen, Yuki Okamoto, Hironao Okada, Atsushi Takei, Yusuke Takei, and Masaaki Ichiki

*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN*



**00:55 - 01:00**

- B6-6A2 A "SOFT CASTING" PDMS PROCESS USING MULTI-FUNCTIONAL COVER FOR FABRICATION OF PRECISE MICROFLUIDIC CHIPS ..... 513**  
Shiyuan Gao<sup>1,2</sup>, Lei Wu<sup>1</sup>, Tiegang Xu<sup>1</sup>, Xiaoyue Zhu<sup>3</sup>, Xuefeng Wang<sup>1</sup>,  
Jianzhong Chen<sup>1</sup>, Wei Zhou<sup>1</sup>, and Xinxin Li<sup>1</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>ShanghaiTech University, CHINA, and  
<sup>3</sup>Fujian Agriculture and Forestry University, CHINA

**01:00 - 01:05**

- B6-6A3 TILTABLE UV-LED LITHOGRAPHY FOR 3D MICROFABRICATION ..... 517**  
Sabera Fahmida Shiba, Ke Wang, and Jungkwun "JK" Kim  
Kansas State University, USA

**01:05 - 01:10**

- B6-6A4 FINE PATTERNING ON 3D SAMPLE WITH CURVATURE AND DEPTH USING RESIST SHEET WITH LATENT IMAGE ..... 521**  
Takayuki Kuroyanagi<sup>1</sup>, Shigenori Saito<sup>2</sup>, and Minoru Sasaki<sup>1</sup>  
<sup>1</sup>Toyota Technological Institute, JAPAN and <sup>2</sup>Aicello Corporation, JAPAN

**01:10 - 01:15**

- B6-6A5 DIRECT INK WRITING OF PURE PDMS FOR SOFT 3D MICROSTRUCTURES AND TACTILE SENSORS ..... 525**  
Huyue Chen, Wen-Ming Zhang, Xiuyuan Li, Qifan Ding, and Lei Shao  
Shanghai Jiao Tong University, CHINA

**01:15 - 01:20**

- B6-6A6 ELECTRICAL PATTERNING SYSTEM UTILIZING ON-DEMAND MICRO-PLASMA-BUBBLES ..... 529**  
Yu Yamashita, Natsumi Basaki, Shinya Sakuma, and Yoko Yamanishi  
Kyushu University, JAPAN

**Session 6B - Novel Nano Materials and Devices**

**00:50 - 00:55**

- B6-6B1 SIMULTANEOUS ELECTROCHEMICAL DETECTION OF DOPAMINE AND URIC ACID WITH GRAPHENE QUANTUM DOTS DECORATED COBALT PHTHALOCYANINE NANOCOMPOSITE ..... 533**  
Bo Wu, Minzhang Li, Zongxiang Xu, Rajendran Ramachandran, and Fei Wang  
Southern University of Science and Technology, CHINA

**00:55 - 01:00**

- B6-6B2 FORMALDEHYDE SENSOR WITH PENTAGRAM-SHAPED CORE-SHELL NANOSTRUCTURE AS CATALYST ..... 537**  
Xuefeng Wang<sup>1</sup>, Yaron Cheng<sup>2</sup>, Li Su<sup>2</sup>, Pengcheng Xu<sup>1</sup>, and Xinxin Li<sup>1</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA, and <sup>3</sup>Shanghai Normal University, CHINA

**01:00 - 01:05**

- B6-6B3 NANOMECHANICAL AND OPTOMECHANICAL COUPLING IN SILICON CARBIDE / HEXAGONAL BORON NITRIDE HYBRID RESONATOR ..... 541**  
Yuncong Liu<sup>1</sup>, Yanan Wang<sup>1</sup>, Xu-Qian Zheng<sup>1</sup>, Qiang Lin<sup>2</sup>, and Philip X.-L. Feng<sup>1</sup>  
<sup>1</sup>University of Florida, USA and <sup>2</sup>University of Rochester, USA

**01:05 - 01:10**

- B6-6B4 ACOUSTOELECTRIC SURFACE ACOUSTIC WAVE SWITCH IN AN EPITAXIAL INGAAS ON LITHIUM NIOBATE HETEROSTRUCTURE ..... 545**  
Matthew J. Storey<sup>1</sup>, Lisa Hackett<sup>2</sup>, Sara DiGregorio<sup>2</sup>, Michael Miller<sup>2</sup>, Greg Peake<sup>2</sup>,  
Matt Eichenfield<sup>2</sup>, and Dana Weinstein<sup>1</sup>  
<sup>1</sup>Purdue University, USA and <sup>2</sup>Sandia National Laboratories, USA

**01:10 - 01:15**

- B6-6B5 EXTENSION OF FRACTURE LIFETIME OF SILICON SCANNING MICROMIRROR BY COATING WITH ATOMIC LAYER DEPOSITED ALUMINA THIN FILM ..... 549**  
Yuuki Fujita, Takashi Sasaki, Koichi Fukuda, Nguyen Thanh Tung,  
Fumio Ogawa, Toshiyuki Hashida, and Kazuhiro Hane  
Tohoku University, JAPAN

**01:15 - 01:20**

- B6-6B6 TRANSFER-PRINTED NEMS TUNABLE FABRY PÉROT FILTER FOR MID-INFRARED COMPUTATIONAL SPECTROSCOPY ..... 553**  
Yuhua Chang, Siyu Xu, Bowei Dong, Jingxuan Wei, Xianhao Le,  
Yiming Ma, Guangya Zhou, and Chengkuo Lee  
National University of Singapore, SINGAPORE

**Session 6C - PowerMEMS 3 - Zero-Power MEMS**

**00:50 - 00:55**

- B6-6C1 ZERO-POWER OPTO-ELECTRO-MECHANICAL ACTUATORS ..... 557**  
Mikhail A. Kanygin and Behraad Bahreyni  
Simon Fraser University, CANADA

**00:55 - 01:00**

- B6-6C2 A MILLIMETER SCALE PIEZOELECTRIC RECEIVER WITH SUB-MILLIWATT OUTPUT FOR ULTRASONIC WIRELESS POWER TRANSFER IN WATER ..... 561**  
Md. Shihab Uddin<sup>1</sup> and Joshua E.-Y. Lee<sup>1,2</sup>  
<sup>1</sup>City University of Hong Kong, HONG KONG and <sup>2</sup>Agency for Science, Technology and Research (A\*STAR)

**01:00 - 01:05**

- B6-6C3 ZERO POWER CROP WATER-STRESS DETECTOR BASED ON A MICROMECHANICAL PHOTOSWITCH MONITORING LEAF TRANSMITTANCE CHANGE ..... 565**  
Antea Riso, Vageeswar Rajaram, Sungho Kang, Sila Deniz Calisgan, Zhenyun Qian, and Matteo Rinaldi  
Northeastern University, USA

**01:05 - 01:10**

- B6-6C4 A POLY-DADMAC FUNCTIONALIZED NANOFIBROUS MAT-BASED SELF-POWERED HUMAN MOTION SENSOR FOR IOT APPLICATIONS ..... 569**  
S M Sohel Rana, Md Salauddin, M. Toyabur Rahman, Sanghyuk Yoon, Hyunok Cho,  
and Jae Y. Park  
Kwangwoon University, KOREA

**01:10 - 01:15**

- B6-6C5 SUB- $\mu$ W WIRELESS INFRARED SENSOR WITH ABOVE-THRESHOLD MEASUREMENT FUNCTION BASED ON A BISTABLE MICROMECHANICAL SWITCH ..... 573**  
Vageeswar Rajaram, Sila Deniz Calisgan, Sungho Kang, Antea Riso, Zhenyun Qian, and Matteo Rinaldi  
Northeastern University, USA

**01:15 - 01:20**

- B6-6C6 ACOUSTO-ELECTRIC WIRELESS PRESSURE SENSING SYSTEM ..... 577**  
Jeonga Han, Eungyoul Oh, Chaerin Jun, Jiseon Lee, and Seunghyun Song  
Sookmyung Women's University, KOREA

## Session 6D - IR Sensors and Modulators

00:50 - 00:55

- B6-6D1 SINGLE (111)-WAFER FABRICATION OF 100- $\mu$ M SCALE THERMOPILE/ABSORBER DOUBLE-DECK STRUCTURE FOR HIGH-DETECTIVITY IR-DETECTION ..... 581**  
Dan Xue<sup>1,2</sup>, Wenhan Zhou<sup>1,2</sup>, Haozhi Zhang<sup>1,2</sup>, Zao Ni<sup>1</sup>, Wei Li<sup>1</sup>, Jiachou Wang<sup>1,2</sup>, and Xinxin Li<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA

00:55 - 01:00

- B6-6D2 HETEROGENEOUS LiNbO<sub>3</sub>/SI DIRECT BONDING FOR WAVELENGTH-DEPENDENT MID-INFRARED IMAGING ..... 585**  
Jikai Xu<sup>1,2</sup>, Zhihao Ren<sup>1</sup>, Xinmiao Liu<sup>1</sup>, Cheng Xu<sup>1</sup>, Chenxi Wang<sup>2</sup>, Yanhong Tian<sup>2</sup>, and Chengkuo Lee<sup>1</sup>  
<sup>1</sup>National University of Singapore, SINGAPORE and <sup>2</sup>Harbin Institute of Technology, CHINA

01:00 - 01:05

- B6-6D3 ULTRA-SMALL PIXEL IR SENSING ARRAY FABRICATED WITH A POST-CMOS COMPATIBLE PROCESS ..... 589**  
Wenhan Zhou<sup>1,2</sup>, Haozhi Zhang<sup>1,2</sup>, Dan Xue<sup>1,2</sup>, Wei Li<sup>1</sup>, Zao Ni<sup>1</sup>, and Xinxin Li<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA

01:05 - 01:10

- B6-6D4 ELECTRICAL MODULATION TRANSMITTED IR LIGHT THROUGH VO<sub>2</sub> THIN FILM ON GAN MEMBRANES ..... 593**  
Ferhat Bayram<sup>1</sup>, Durga Gajula<sup>2</sup>, Balaadithya Uppalapati<sup>1</sup>, Digangana Khan<sup>1</sup>, and Goutam Koley<sup>1</sup>  
<sup>1</sup>Clemson University, USA and <sup>2</sup>Georgia Institute of Technology, USA

01:10 - 01:15

- B6-6D5 ZERO-BIAS LONG-WAVE INFRARED WAVEGUIDE PHOTODETECTOR VIA GRAPHENE/SILICON/HALIDE HETEROGENEOUS INTEGRATION ..... 597**  
Yiming Ma, Yuhua Chang, Bowei Dong, Jingxuan Wei, and Chengkuo Lee  
National University of Singapore, SINGAPORE

01:15 - 01:20

- B6-6D6 A PHOTOTHERMAL TRANSDUCER BASED ON 3D THERMAL MANAGEMENT ..... 601**  
Jinying Zhang, Defang Li, Zhuo Li, Xin Wang, and Suhui Yang  
Beijing Institute of Technology, CHINA

## Invited Speaker XXV

01:30 - 01:40

- B6-IS25 DEVELOPMENT OF ADVANCED DYNAMIC ANGIO MODEL (ADAM) SIMULATOR: ENABLING A REALISTIC SIMULATION OF ENDOVASCULAR INTERVENTION ..... 605**  
**Joonwon Kim**  
Pohang University of Science and Technology (POSTECH), KOREA

## Invited Speaker XXVI

01:30 - 01:40

- B6-IS26 SENSING WITH SERIAL OR PARALLEL MICROMECHANICAL RESONATORS ..... 606**  
**Honglong Chang**  
Northwestern Polytechnical University, CHINA

## Invited Speaker XXVII

01:30 - 01:40

**B6-IS27** **MICROMECHANICAL VIBRO-IMPACT RESONATOR-ENABLED SENSING APPLICATIONS** ..... 609

**Wei-Chang Li**

*National Taiwan University, TAIWAN*

## Invited Speaker XXVIII

01:30 - 01:40

**B6-IS28** **SOFT MICROFLUIDIC WEARABLE SENSORS FOR BIOMEDICAL APPLICATIONS** ..... 614

**Chwee Teck "CT" Lim**

*National University of Singapore, SINGAPORE*

## Just-In Press Presentations

01:50 - 02:40

02:40 **Conclusion of Block 6**

## Block 7 - Friday, 25 June

All times are Universal Time Coordinated (UTC)

## Award Ceremony and Closing Remarks

13:00 - 14:00

**TRANSDUCERS 2021 CONFERENCE CHAIRS**

Jürgen Brugger, *École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND*

Amy Duwel, *Draper Laboratory, USA*

Yoshio Mita, *University of Tokyo, JAPAN*

14:00 **Conclusion of 2021 Transducers Conference**

# Poster Presentations

All times are Universal Time Coordinated (UTC)

- B2** – Tuesday, 22 June            08:15 - 10:15  
**B3** – Wednesday, 23 June        01:20 - 03:20  
**B4** – Wednesday, 23 June        14:20 - 16:20  
**B5** – Thursday, 24, June         08:20 - 10:20

## Classification Chart

(last character of poster number)

<b>a</b>	<b>Actuators and Microsystems</b>
<b>b</b>	<b>Bio-Sensors and Microsystems Including In-Vitro Medical Applications</b>
<b>c</b>	<b>Chemical Sensors and Microsystems</b>
<b>d</b>	<b>Composite Materials, Polymers, and Fabrication Processes</b>
<b>e</b>	<b>Energy, Power and Thermal Management</b>
<b>f</b>	<b>Microfluidics Platform Technologies</b>
<b>g</b>	<b>Nanoscale Materials and Fabrication</b>
<b>h</b>	<b>Optical and Atomic Transducers</b>
<b>i</b>	<b>Packaging &amp; Solid-State Materials and Fabrication Processes</b>
<b>j</b>	<b>Physical Sensors and Microsystems</b>
<b>k</b>	<b>RF MEMS, Resonators and Oscillators</b>
<b>l</b>	<b>Wearable and In-Vivo Medical Devices and Microsystems</b>

## a - Actuators and Microsystems

- B2-201a** **ACOUSTIC STRUCTURAL COUPLING IN A SILICON BASED VIBRATING MESH NEBULIZER** ..... 615  
 Ruth Houlihan<sup>1</sup>, Michael Timothy<sup>2</sup>, Conor Duffy<sup>2</sup>, Ronan MacLoughlin<sup>2</sup>, and Oskar Olszewski<sup>1</sup>  
<sup>1</sup>Tyndall National Institute, IRELAND and <sup>2</sup>Aerogen Ltd., IRELAND
- B2-202a** **ELECTROSTATIC COMB DRIVE ACTUATOR ARRAY WITH INTEGRATED CANTILEVER FOR SCANNING PROBE APPLICATIONS** ..... 619  
 Kristen L. Genter<sup>1,2</sup>, Pavel Kabos<sup>2</sup>, and Victor M. Bright<sup>1</sup>  
<sup>1</sup>University of Colorado, Boulder, USA and <sup>2</sup>National Institute of Standards and Technology (NIST), USA
- B2-203a** **METALIZED SOFT POLYMERS FOR ELECTROMECHANICAL TRANSDUCERS ON GLASS SUBSTRATES** ..... 623  
 Boshen Liang<sup>1,2</sup>, Grim Keulemans<sup>1</sup>, Dominika Wysocka<sup>1</sup>, Lei Zhang<sup>1</sup>,  
 Veronique Rochus<sup>1</sup>, Tim Stakenborg<sup>1</sup>, Paul Heremans<sup>1,2</sup>, and David Cheyns<sup>1</sup>  
<sup>1</sup>Imec, BELGIUM and <sup>2</sup>University of Leuven (KU Leuven), BELGIUM

<b>B2-204a</b>	<b>MONITORING MICROMECHANICAL BUCKLING AT HIGH-SPEED FOR SENSING AND TRANSDUCER APPLICATIONS .....</b>	<b>627</b>
	Berke Demiralp, Hadi S. Pisheh, Berk Kucukoglu, Utku Hatipoglu, and M. Selim Hanay <i>Bilkent University, TURKEY</i>	
<b>B2-205a</b>	<b>TORSIONAL MEMS SCANNER BASED ON LiNbO<sub>3</sub> THIN FILM .....</b>	<b>631</b>
	Yushuai Liu <sup>1,2,3</sup> , Zhiyuan Gao <sup>1</sup> , Kangfu Liu <sup>1,2,3</sup> , and Tao Wu <sup>1</sup> <sup>1</sup> ShanghaiTech University, CHINA, <sup>2</sup> Chinese Academy of Sciences (CAS), CHINA, and <sup>3</sup> University of Chinese Academy of Sciences, CHINA	
<b>B3-301a</b>	<b>ROBUST ELECTROSTATIC INCHWORM MOTORS FOR MACROSCOPIC MANIPULATION AND MOVEMENT .....</b>	<b>635</b>
	Daniel Teal, Hani C. Gomez, Craig B. Schindler, and Kristofer S.J. Pister <i>University of California, Berkeley, USA</i>	
<b>B4-401a</b>	<b>LARGE-AREA THIN FILM HEATER FOR THERMAL TREATMENTS IN LAB-ON-CHIP .....</b>	<b>639</b>
	Nicola Lovecchio <sup>1</sup> , Giampiero de Cesare <sup>1</sup> , Augusto Nascetti <sup>1</sup> , Francesca Costantini <sup>1,2</sup> , and Domenico Caputo <sup>1</sup> <sup>1</sup> University of Rome, ITALY and <sup>2</sup> Research Centre for Plant Protection and Certification, ITALY	
<b>B4-402a</b>	<b>PROSPECT OF NEW AFM PROBE DESIGN ENABLED BY STRESS GRADIENT .....</b>	<b>643</b>
	Omar Alshehri <sup>1</sup> , Majed Al-Ghamdi <sup>2</sup> , Mohamed Arabi <sup>3</sup> , Mahmoud Khater <sup>4</sup> , Maher Bakri-Kassem <sup>3</sup> , and David Yevick <sup>3</sup> <sup>1</sup> King Saud University, SAUDI ARABIA, <sup>2</sup> King Abdulaziz City for Science and Technology, SAUDI ARABIA, <sup>3</sup> University of Waterloo, CANADA, and <sup>4</sup> King Fahad University for Petroleum and Minerals, SAUDI ARABIA	
<b>B4-403a</b>	<b>SINGLE-LAYER THIN-FILM LITHIUM NIOBATE OUT-OF-PLANE ACTUATORS .....</b>	<b>647</b>
	Justin Phelps, Kevin Chan, and Reza Abdolvand <i>University of Central Florida, USA</i>	
<b>B5-501a</b>	<b>ANALYSIS ON INTERNAL BIOMOLCULAR STRUCTURE OF ATP-DRIVE ACTOMYOSIN-COLLAGEN HYBRID ACTUATOR .....</b>	<b>651</b>
	Kenjiro Kohno <sup>1</sup> , Yuichi Hiratsuka <sup>2</sup> , and Hiroaki Onoe <sup>1</sup> <sup>1</sup> Keio University, JAPAN and <sup>2</sup> Japan Advanced Institute of Science and Technology (JST), JAPAN	
<b>B5-502a</b>	<b>BIO-INSPIRED MICROSCALE THREE DIMENSIONAL DIRECTIONAL SENSING MICROPHONE ARRAY .....</b>	<b>655</b>
	Ashiqur Rahaman and Byungki Kim <i>Korea University of Technology and Education, KOREA</i>	
<b>B5-503a</b>	<b>DEVELOPMENT OF LINEAR PMUT ARRAY WITH LOW MECHANICAL CROSSTALK TOWARD ULTRASONOGRAPHY APPLICATIONS .....</b>	<b>659</b>
	Pham Ngoc Thao <i>Vietnam National University, VIETNAM</i>	
<b>B5-504a</b>	<b>FABRICATION AND EVALUATION OF A NOVEL ACTUATOR FOR REACTION FORCE VARIABLE PASSIVE-TYPE TACTILE DISPLAYS .....</b>	<b>663</b>
	Masanori Murase, Keita Nambara, Takahiro Yamazaki, Chiemi Oka, Seiichi Hata, and Junpei Sakurai <i>Nagoya University, JAPAN</i>	
<b>B5-505a</b>	<b>FABRICATION OF MULTI-AXIS MOVING COIL TYPE ELECTROMAGNETIC MICRO-ACTUATOR USING PARYLENE BEAMS FOR PURE IN-PLANE MOTION .....</b>	<b>667</b>
	Huayu Wang, Shunsuke Yamada, and Shuji Tanaka <i>Tohoku University, JAPAN</i>	
<b>B5-506a</b>	<b>FLEXIBLE FILM LOUDSPEAKER BASED ON PIEZOELECTRIC PZT/SI ULTRA-THIN MEMS CHIPS .....</b>	<b>671</b>
	Takahiro Yamashita, Toshihiro Takeshita, Atsushi Oouchi, and Takeshi Kobayashi <i>National Institute of Advanced Industrial Science and Technology (AIST), JAPAN</i>	

- B5-507a HIGH DURABILITY LATCH-LOCK BI-STABLE SWITCH ON Y-SHAPED CANTILEVER ..... 675**  
 Zili Tang<sup>1</sup>, Qi Tao<sup>2</sup>, Zehua Lan<sup>3</sup>, Zong Liu<sup>1</sup>, Toshiyuki Tsuchiya<sup>4</sup>, Xiaohong Wang<sup>3</sup>, and Man Wong<sup>1</sup>  
<sup>1</sup>Hong Kong University of Science and Technology, HONG KONG, <sup>2</sup>Chinese Academy of Engineering Physics, CHINA, <sup>3</sup>Tsinghua University, CHINA, and <sup>4</sup>Kyoto University, JAPAN

## b - Bio-Sensors and Microsystems Including In-Vitro Medical Applications

- B2-206b A HIGH-DENSITY DRIVABLE MICROELECTRODES ARRAY FOR MULTI-BRAIN RECORDING ..... 679**  
 Longchun Wang<sup>1</sup>, Zhejun Guo<sup>1</sup>, Bowen Ji<sup>2</sup>, Ye Xi<sup>1</sup>, Bin Yang<sup>1</sup>, and Jingquan Liu<sup>1</sup>  
<sup>1</sup>Shanghai Jiao Tong University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA
- B2-207b A MICROFLUIDIC FLOW CYTOMETER COMPOSED OF DOUBLE T-TYPE CONSTRICTION CHANNEL WITH PREDEFINED FLUORESCENCE DETECTION WINDOW, ENABLING HIGH-THROUGHPUT CHARACTERIZATION OF INTRINSIC SINGLE-CELL STRUCTURAL AND ELECTRICAL PARAMETERS ..... 683**  
 Hongyan Liang<sup>1,2</sup>, Yi Zhang<sup>1,2</sup>, Minruihong Wang<sup>1,2</sup>, Yueying Li<sup>1</sup>, Deyong Chen<sup>1,2</sup>, Junbo Wang<sup>1,2</sup>, and Jian Chen<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA
- B2-208b MACHINE VISION BASED METHOD FOR MEASUREMENT SINGLE-CELL BIOPHYSICAL PROPERTIES USING DIELECTROPHORESIS MOBILITY ..... 687**  
 Shengjie Chen, Zhizhong Zhang, and Rong Zhu  
 Tsinghua University, CHINA
- B2-209b MEMS FLOW SENSOR CAPABLE OF MEASURING MULTI-VITAL SIGNS OF RESPIRATION, HEART RATE, AND BODY TEMPERATURE ..... 691**  
 Yoshihiro Hasegawa<sup>1</sup>, Seunghyeon Lee<sup>1</sup>, Miyoko Matsushima<sup>2</sup>, Shin Hasegawa<sup>3</sup>, Tsutomu Kawabe<sup>2</sup>, and Mitsuhiro Shikida<sup>1</sup>  
<sup>1</sup>Hiroshima City University, JAPAN, <sup>2</sup>Nagoya University, JAPAN, and <sup>3</sup>COSMOSWEB Co. Ltd., JAPAN
- B2-210b MULTIFUNCTIONAL 3D VIADUCT MICROELECTRODES FOR CONTINUOUS-FLOW DIELECTROPHORETIC RAILING AND ELECTROPORATION OF CELLS UNDER MODULATED ACTIVATION ..... 695**  
 Zili Tang, Stanley D. Kushigbor, Junwu Bai, Yang Bu, Sheng Ni, and Levent Yobas  
 Hong Kong University of Science and Technology, HONG KONG
- B2-211b MULTIMODAL NEUROTRANSMITTER IMAGE SENSOR WITH LATERAL ION DIFFUSION SUPPRESSOR ..... 699**  
 Chinatsu Kawakami, Shirlyn Eng Shu Ying, Tomoko Horio, Hideo Doi, Yong-Joon Choi, Kazuhiro Takahashi, Toshihiko Noda, and Kazuaki Sawada  
 Toyohashi University of Technology, JAPAN
- B2-212b OXYGEN AND LACTATE MONITORING IN 3D BREAST CANCER ORGANOID CULTURE WITH SENSOR-INTEGRATED MICROFLUIDIC PLATFORM ..... 703**  
 Johannes Dornhof<sup>1</sup>, Jochen Kieninger<sup>1</sup>, Harshini Muralidharan<sup>2</sup>, Jochen Maurer<sup>2</sup>, Gerald A. Urban<sup>1</sup>, and Andreas Weltin<sup>1</sup>  
<sup>1</sup>University of Freiburg, GERMANY and <sup>2</sup>University Hospital RWTH Aachen, GERMANY
- B2-213b RECONSTITUTING ORGAN-LEVEL PERIODONTAL SOFT TISSUE ON A CHIP ..... 707**  
 Laidi Jin<sup>1</sup>, Tian Tian<sup>2</sup>, Danyang Liu<sup>1</sup>, Hongjv Mao<sup>2</sup>, and Huiying Liu<sup>1</sup>  
<sup>1</sup>Dalian Medical University, CHINA and <sup>2</sup>Chinese Academy of Sciences (CAS), CHINA
- B2-214b REDOX-TYPE LABEL-FREE ATP IMAGE SENSOR FOR HIGHLY SENSITIVE IN VITRO IMAGING OF EXTRACELLULAR ATP ..... 711**  
 Hideo Doi, Tomoko Horio, Young-Joon Choi, Kazuhiro Takahashi, Toshihiko Noda, and Kazuaki Sawada  
 Toyohashi University of Technology, JAPAN

<b>B3-302b</b>	<b>A 3D BIO-PRINTED SPHEROIDS BASED PERFUSION IN VITRO LIVER ON CHIP FOR DRUG SCREENING</b> .....	<b>715</b>
	Tian Tian <sup>1</sup> , Chen Chen <sup>2</sup> , and Hongju Mao <sup>1</sup> <i><sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and <sup>2</sup>Dalian Medical University, CHINA</i>	
<b>B3-303b</b>	<b>A COST-EFFECTIVE PAPER-BASED SERS DEVICE FOR THE DETECTION OF CORTISOL IN SALIVA</b> .....	<b>719</b>
	Dilip Kumar Agarwal, Junfei Xia, Ayedin Sadeqi, Rachel Oweyung, Hojatollah R. Nejad, and Sameer Sonkusale <i>Tufts University, USA</i>	
<b>B3-304b</b>	<b>A MICROWELL-BASED IMPEDANCE SENSOR IN MICRONEEDLE SHAPE FOR MULTIPLEXING CYTOKINE DETECTION</b> .....	<b>723</b>
	Naixin Song <sup>1</sup> , Pengfei Xie <sup>2</sup> , Mehdi Javanmard <sup>2</sup> , and Mark Allen <sup>1</sup> <i><sup>1</sup>University of Pennsylvania, USA and <sup>2</sup>Rutgers University, USA</i>	
<b>B3-305b</b>	<b>FPGA-ASSISTED NONPARALLEL IMPEDANCE CYTOMETRY AS LOCATION SENSOR OF SINGLE PARTICLE</b> .....	<b>727</b>
	Tao Tang <sup>1</sup> , Xun Liu <sup>1</sup> , Yigang Shen <sup>2</sup> , Yapeng Yuan <sup>2</sup> , Yo Tanaka <sup>2</sup> , Yoichiroh Hosokawa <sup>1</sup> , and Yaxiaer Yalikun <sup>1,2</sup> <i><sup>1</sup>Nara Institute of Science and Technology, JAPAN and <sup>2</sup>RIKEN, JAPAN</i>	
<b>B3-306b</b>	<b>HIGHLY SENSITIVE SENSOR BASED ON GRAPHENE AND GOLD NANOPARTICLES FOR DOPAMINE SELECTIVE DETECTION</b> .....	<b>731</b>
	Wenzheng He <sup>1</sup> , Xiongying Ye <sup>1</sup> , and Tianhong Cui <sup>2</sup> <i><sup>1</sup>Tsinghua University, CHINA and <sup>2</sup>University of Minnesota, USA</i>	
<b>B3-307b</b>	<b>IN-PLANE MODE ENCASED CANTILEVERS FOR CANCER CELL DETECTION IN LIQUID</b> .....	<b>735</b>
	Hao Jia, Ying Chen, Xuefeng Wang, Tiegang Xu, and Xinxin Li <i><sup>1</sup>Chinese Academy of Sciences (CAS), CHINA</i>	
<b>B3-308b</b>	<b>USING ADVANCED 2D MATERIALS TO CLOSELY MIMIC VESTIBULAR HAIR CELL SENSORS</b> .....	<b>739</b>
	Sajad A. Moshizi <sup>1</sup> , Shohreh Azadi <sup>1</sup> , Andrew Belford <sup>1</sup> , Shuying Wu <sup>1</sup> , Zhao J. Han <sup>2</sup> , and Mohsen Asadnia <sup>1</sup> <i><sup>1</sup>Macquarie University, AUSTRALIA and <sup>2</sup>CSIRO Manufacturing, AUSTRALIA</i>	
<b>B4-404b</b>	<b>A HIGHLY SENSITIVE POINT-OF-CARE COVID-19 SEROLOGICAL TEST USING IMMUNO-PCR IN 35 MINS</b> .....	<b>743</b>
	Pengfei Zhang, Liben Chen, Jiumei Hu, Alexander Y. Trick, Fan-En Chen, Kuangwen Hsieh, Yang Zhao, and Tza-Huei Wang <i>Johns Hopkins University, USA</i>	
<b>B4-405b</b>	<b>DUAL MODE NEURAL PROBE WITH ENHANCED MICROSTRUCTURE FOR NEURAL STIMULATION AND RECORDING</b> .....	<b>747</b>
	Longchun Wang, Fang Wang, Zhejun Guo, Ye Xi, Bin Yang, and Jingquan Liu <i>Shanghai Jiao Tong University, CHINA</i>	
<b>B4-406b</b>	<b>ENRICHMENT AND ANALYSIS OF BREAST CANCER CELL-DERIVED EXTRACELLULAR VESICLES BY LASER-ASSISTED PROTEIN ADSORPTION IN THERMOPLASTIC MICROCHANNELS</b> .....	<b>751</b>
	André Kling, Jonas Nikoloff, Mario A. Saucedo-Espinosa, and Petra S. Dittrich <i>ETH Zurich, SWITZERLAND</i>	
<b>B4-407b</b>	<b>SMART TOOTH SYSTEM FOR IN-SITU WIRELESS PH MONITORING</b> .....	<b>755</b>
	Sayemul Islam <sup>1</sup> , Geelsu Hwang <sup>2</sup> , Seung Hyun Song <sup>3</sup> , and Albert Kim <sup>1</sup> <i><sup>1</sup>Temple University, USA, <sup>2</sup>University of Pennsylvania, USA, and <sup>3</sup>Sookmyung Women's University, KOREA</i>	



- B5-508b A NOVEL MICRO SPR SENSOR WITH MULTIPLE SENSING AREAS FOR JOINT DETECTION OF EARLY LIVER CANCER MARKERS ..... 759**  
 Jiaming Ma, Xingguo Zhang, Xiao Su, Hailong Chen, Haixia Yu, Ridong Wang, and Dachao Li  
*Tianjin University, CHINA*
- B5-509b EFFICIENT GAS-TO-LIQUID PARTITION USING GAS-FLOW CHANNELS FOR CELL-BASED GASEOUS ODORANT DETECTION ..... 763**  
 Takuma Nakane<sup>1</sup>, Toshihisa Osaki<sup>2</sup>, Hisatoshi Mimura<sup>2</sup>, Norihisa Miki<sup>1</sup>, and Shoji Takeuchi<sup>2,3</sup>  
<sup>1</sup>*Keio University, JAPAN*, <sup>2</sup>*Kanagawa Institute of Industrial Science and Technology (KISTEC), JAPAN*, and  
<sup>3</sup>*University of Tokyo, JAPAN*
- B5-510b FABRICATION AND CHARACTERIZATION OF 3D MICROELECTRODE ARRAYS (3D MEAS) WITH TRI-MODAL (ELECTRICAL, OPTICAL, AND MICROFLUIDIC) INTERROGATION OF ELECTROGENIC CELL CONSTRUCTS ..... 767**  
 Julia Freitas Orrico<sup>1</sup>, Avra Kundu<sup>1</sup>, Charles M. Didier<sup>1</sup>, Alexander Bosak<sup>2</sup>, Michael J. Moore<sup>2</sup>, and Swaminathan Rajaraman<sup>1</sup>  
<sup>1</sup>*University of Central Florida, USA* and <sup>2</sup>*Tulane University, USA*
- B5-511b LABEL-FREE MEASUREMENT OF T-CELL ACTIVATION BY MICROFLUIDIC ACOUSTOPHORESIS ..... 771**  
 Jayanth M. Dabbi, Yunhua Shi, Alket Mërtiri, Rebecca J. Christianson, and Jason Fiering  
*Draper, USA*
- B5-512b MONOLITHIC FABRICATION OF A LIPID BILAYER DEVICE USING STEREO LITHOGRAPHY ..... 775**  
 Kazuto Ogishi<sup>1</sup>, Toshihisa Osaki<sup>2</sup>, Yuya Morimoto<sup>1</sup>, and Shoji Takeuchi<sup>1,2</sup>  
<sup>1</sup>*University of Tokyo, JAPAN* and <sup>2</sup>*Kanagawa Institute of Industrial Science and Technology, JAPAN*
- B5-513b REAL TIME CYTOKINE QUANTIFICATION IN WOUND FLUID SAMPLES USING NANOWELL IMPEDANCE SENSING ..... 779**  
 Pengfei Xie<sup>1</sup>, Muhammad Tayyab<sup>1</sup>, Ali Ashraf<sup>1</sup>, Suneel Kumar<sup>1</sup>, Aaron Mazzeo<sup>1</sup>, Kaushik Sengupta<sup>2</sup>, François Berthiaume<sup>1</sup>, and Mehdi Javanmard<sup>1</sup>  
<sup>1</sup>*Rutgers Univeristy, USA* and <sup>2</sup>*Princeton University, USA*

## c - Chemical Sensors and Microsystems

- B2-215c A CMOS-MEMS FLUORESCENCE QUENCHING GAS SENSOR ENCAPSULATED WITH SILICON-BASED LED REFLECTOR ..... 783**  
 Ya-Chu Lee<sup>1</sup>, Shih-Wei Lin<sup>1</sup>, Cheng-Shiun Liou<sup>2</sup>, Chingfu Tsou<sup>2</sup>, and Weileun Fang<sup>1</sup>  
<sup>1</sup>*National Tsing Hua University, TAIWAN* and <sup>2</sup>*Feng Chia University, TAIWAN*
- B2-216c DEFORMABLE HUMIDITY SENSOR AND ITS PERFORMANCE BASED ON DOUBLE-NETWORK AND IONIC CONDUCTIVE HYDROGEL MEMBRANE ..... 787**  
 Zhenyi Li<sup>1</sup>, Zixuan Wu<sup>1</sup>, Haojun Ding<sup>1</sup>, Yaoming Wei<sup>1</sup>, Xing Yang<sup>1</sup>, Kai Tao<sup>2</sup>, and Jin Wu<sup>1</sup>  
<sup>1</sup>*Sun Yat-sen University, CHINA* and <sup>2</sup>*Northwestern Polytechnical University, CHINA*
- B2-217c ELECTROCHEMICAL SENSOR SYSTEM FOR GLYPHOSATE DETECTION ..... 791**  
 Besnik Uka, Jochen Kieninger, Gerald A. Urban, and Andreas Weltin  
*University of Freiburg, GERMANY*
- B2-218c HIGH DATA DIMENSIONALITY OF VIRTUAL SENSOR ARRAY BASED ON QCM AND MXENE FOR SELECTIVE VOC DETECTION ..... 795**  
 Dongsheng Li, Jintao Pang, Mengjiao Qu, Qian Zhang, and Jin Xie  
*Zhejiang University, CHINA*

<b>B2-219c</b>	<b>HIGHLY DEFORMABLE AND STABLE GAS SENSOR BASED ON ANTI-DRYING IONIC ORGANOHYDROGEL FOR O<sub>2</sub> GAS DETECTION</b> .....	<b>799</b>
	Yuanqing Lin <sup>1</sup> , Zixuan Wu <sup>1</sup> , Yaoming Wei <sup>1</sup> , Yuning Liang <sup>1</sup> , Kankan Zhai <sup>1</sup> , Kai Tao <sup>2</sup> , Chunwei Li <sup>1</sup> , Xi Xie <sup>1</sup> , and Jin Wu <sup>1</sup> <sup>1</sup> Sun Yat-sen University, CHINA and <sup>2</sup> Northwestern Polytechnical University, CHINA	
<b>B2-220c</b>	<b>INKJET TiO<sub>2</sub>-BASED SENSORS FOR ENVIRONMENTAL MONITORING</b> .....	<b>803</b>
	Bianca di Diodoro, Carmen Bax, Giacomo Langfelder, Roberto Bernasconi, Luca Magagnin, Stefano Prudenza, and Laura Capelli <i>Politecnico di Milano, ITALY</i>	
<b>B2-221c</b>	<b>POROUS TITANIA NANOSHEETS AS MICRO-GRAVIMETRIC SENSING MATERIAL FOR TRACE NO<sub>2</sub> DETECTION</b> .....	<b>807</b>
	Jialin Yang <sup>1,3</sup> , Ming Li <sup>1,2</sup> , Haitao Yu <sup>1</sup> , Pengcheng Xu <sup>1,2</sup> , and Xinxin Li <sup>1,2</sup> <sup>1</sup> Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup> University of Chinese Academy of Sciences (UCAS), CHINA, and <sup>3</sup> University of Shanghai for Science and Technology, CHINA	
<b>B2-222c</b>	<b>ZINC OXIDE GAS SENSOR ENHANCED WITH NANO BETA ZEOLITE CATALYST FOR HIGH-SENSITIVE FREON DETECTION</b> .....	<b>811</b>
	Xueqing Wang <sup>1,2</sup> , Pengcheng Xu <sup>1</sup> , Ying Chen <sup>1</sup> , and Xinxin Li <sup>1</sup> <sup>1</sup> Chinese Academy of Sciences (CAS), CHINA and <sup>2</sup> University of Chinese Academy of Sciences (UCAS), CHINA	
<b>B3-309c</b>	<b>A FLEXIBLE RUTHENIUM OXIDE ELECTRODEPOSITED SPCE SENSOR FOR STABLE DETECTION OF WIDE-RANGE Ph ENHANCED BY ANNEALING</b> .....	<b>815</b>
	Yujie He <sup>1</sup> , Yinong Chen <sup>1</sup> , Jing Zhang <sup>2</sup> , Yinfei Zheng <sup>1,2</sup> , and Xishan Guo <sup>1,2</sup> <sup>1</sup> Zhejiang University, CHINA and <sup>2</sup> Zhejiang Lab, CHINA	
<b>B3-310c</b>	<b>A SINGLE MICROCANTILEVER-TYPE GAS SENSOR WITH ENHANCED SENSITIVITY TO ETHANOL BY SPUTTERING ZNO WITH AU EMBEDDED IN O<sub>2</sub> ATMOSPHERE</b> .....	<b>819</b>
	Ruichen Liu, Dongcheng Xie, George Adedokun, Feng Xue, Lei Xu, and Feng Wu <i>University of Science and Technology of China, CHINA</i>	
<b>B3-311c</b>	<b>A WARPED-CANTILEVER MEMS MOS GAS SENSOR ARRAY</b> .....	<b>823</b>
	Feng Xue, Dongcheng Xie, Ruichen Liu, George Adedokun, Lei Xu, and Feng Wu <i>University of Science and Technology of China, CHINA</i>	
<b>B3-312c</b>	<b>CO<sub>2</sub> GAS SENSING BY CMOS-MEMS SCALN-BASED PYROELECTRIC DETECTOR BASED ON MID-IR ABSORPTION</b> .....	<b>827</b>
	Doris K.T. Ng, Chong-Pei Ho, Linfang Xu, Weiguo Chen, Yuan Hsing Fu, Tantan Zhang, Li-Yan Siow, Norhanani Jaafar, Eldwin J. Ng, Yuan Gao, Hong Cai, Qingxin Zhang, and Lennon Y.T. Lee <i>Agency for Science, Technology and Research (A*STAR), SINGAPORE</i>	
<b>B3-313c</b>	<b>ENHANCED FORMALDEHYDE SENSING PERFORMANCE BASED ON SNO<sub>2</sub> NANOSHEETS/TITANIUM CARBIDE (MXENE) COMPOSITES</b> .....	<b>831</b>
	Gaoqiang Niu, Rajendran Ramachandran, Changhui Zhao, and Fei Wang <i>Southern University of Science and Technology, CHINA</i>	
<b>B3-314c</b>	<b>STIMULI-RESPONSIVE STRUCTURAL-COLOR HYDROGEL CHEMICAL SENSOR MICROARRAY WITH SEPARATED FUNCTIONAL STRUCTURES</b> .....	<b>835</b>
	Ryohei Ueno, Shota Yamawaki, and Hiroaki Onoe <i>Keio University, JAPAN</i>	
<b>B4-408c</b>	<b>CHARACTERIZATION OF SMART HYDROGEL-BASED ULTRASOUND RESONATORS FOR IMPLANTABLE SENSING APPLICATIONS</b> .....	<b>839</b>
	Navid Farhoudi, Prattay D. Kairy, Jules J. Magda, Florian Solzbacher, and Christopher F. Reiche <i>University of Utah, USA</i>	

<b>B4-409c</b>	<b>HYDROGEL-BASED SENSITIVE AND HUMIDITY-RESISTANT OXYGEN GAS SENSORS ENABLED BY POROUS ECOFLEX MEMBRANES .....</b>	<b>843</b>
	Jindong Ye <sup>1</sup> , Zixuan Wu <sup>1</sup> , Yuning Liang <sup>1</sup> , Bizhang Zhong <sup>1</sup> , Zijing Zhou <sup>1</sup> , Zhenyi Li <sup>1</sup> , Yaoming Wei <sup>1</sup> , Kai Tao <sup>2</sup> , and Jin Wu <sup>1</sup> <i><sup>1</sup>Sun Yat-san University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA</i>	
<b>B4-410c</b>	<b>INFLUENCE OF THE CARBON NANOTUBE DENSITY ON BUILDING SENSITIVE AND NOISE-FREE VOLATILE ORGANIC COMPOUND SENSORS .....</b>	<b>847</b>
	Daniel Sim <sup>1,2</sup> , Tiffany Huang <sup>1</sup> , Rajesh R. Naik <sup>1</sup> , and Steve S. Kim <sup>1</sup> <i><sup>1</sup>Air Force Research Laboratory (AFRL), USA and <sup>2</sup>UES Inc., USA</i>	
<b>B5-514c</b>	<b>CHEMOCAPACITIVE DETECTION OF ETHYLENE USING POTASSIUM PERMANGANATE/POLYIMIDE COMPOSITE THIN-FILMS .....</b>	<b>851</b>
	Aishwaryadev Banerjee, Chayanjit Ghosh, Shakir-ul Haque Khan, Adwait Deshpande, Erfan Pourshaban, Mohit U. Karkhanis, Seungbeom Noh, Hanseup Kim, and Carlos H. Mastrangelo <i>University of Utah, USA</i>	
<b>B5-515c</b>	<b>FERROGEL-BASED WIRELESS ACOUSTO-BIOCHEMICAL SENSING .....</b>	<b>855</b>
	Jiseon Lee <sup>1</sup> , Chaerin Jun <sup>1</sup> , Eungyoul Oh <sup>1</sup> , Jeonga Han <sup>1</sup> , Albert Kim <sup>2</sup> , and Seunghyun Song <sup>1</sup> <i><sup>1</sup>Sookmyung Women's University, KOREA and <sup>2</sup>Temple University, USA</i>	
<b>B5-516c</b>	<b>MID-IR METAMATERIAL ABSORBER WITH POLYVINYLAMINE AS A SENSITIVE LAYER FOR ON-CHIP SENSING OF CARBON DIOXIDE .....</b>	<b>859</b>
	Hong Zhou <sup>1</sup> , Dongxiao Li <sup>1</sup> , Xindan Hui <sup>1</sup> , Xianming He <sup>1</sup> , He Huang <sup>1,2</sup> , and Xiaojing Mu <sup>1</sup> <i><sup>1</sup>Chongqing University, CHINA and <sup>2</sup>Chinese Academy of Sciences (CAS), CHINA</i>	
<b>B5-517c</b>	<b>SPLIT-RING-SHAPED BIODEGRADABLE pH SENSOR FOR WIRELESS AND BATTERY-FREE MONITORING OF AGRICULTURAL FIELDS .....</b>	<b>863</b>
	Katsutoshi Hori <sup>1</sup> , Ayaka Inami <sup>1</sup> , Tetsuo Kan <sup>2</sup> , and Hiroaki Onoe <sup>1</sup> <i><sup>1</sup>Keio University, JAPAN and <sup>2</sup>University of Electro-Communications, JAPAN</i>	
<b>B5-518c</b>	<b>SURFACE-ENHANCED RAMAN SCATTERING OF AU COATED HEMISPHERIC DIAMOND NANO-THORN .....</b>	<b>867</b>
	Chen Lin, Guanzhou Lin, Jinwen Zhang, and Wengang Wu <i>Peking University, CHINA</i>	

## d - Composite Materials, Polymers, and Fabrication Processes

<b>B2-223d</b>	<b>A GLASS-LIKE CARBON MEMS STRAIN SENSOR .....</b>	<b>871</b>
	Jongmoon Jang <sup>1,2</sup> , Giulia Panusa <sup>1</sup> , Giovanni Boero <sup>1</sup> , and Juergen Brugger <sup>1</sup> <i><sup>1</sup>École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND and <sup>2</sup>Korea Institute of Materials Science (KIMS), KOREA</i>	
<b>B2-224d</b>	<b>OPTIMIZATION OF ZnO/Su-8 BASED PHOTOPATTERNABLE, PIEZOELECTRIC NANO-COMPOSITES FOR MECHANICAL ENERGY HARVESTING APPLICATIONS .....</b>	<b>875</b>
	Nadeem Tariq Beigh and Dhiman Mallick <i>Indian Institute of Technology Delhi, INDIA</i>	
<b>B3-315d</b>	<b>CARBON BLACK-GELATIN COMPOSITE THIN-FILM CHEMIRESTOR WITH LARGE RESPONSE TO CHEMICAL VAPORS .....</b>	<b>880</b>
	Chun Huang <sup>1</sup> , Zhuqing Wang <sup>1,2</sup> , Yi-Te Huang <sup>1</sup> , Noriko Tsuruoka <sup>1</sup> , and Takahito Ono <sup>1</sup> <i><sup>1</sup>Tohoku University, JAPAN and <sup>2</sup>Sichuan University, CHINA</i>	
<b>B3-316d</b>	<b>THE EFFECT OF ANNEALING THIN FILM PARYLENE C-PLATINUM INTERFACES CHARACTERIZED BY BROADBAND DIELECTRIC SPECTROSCOPY .....</b>	<b>884</b>
	Eugene J. Yoon <sup>1</sup> , Angela C. Stelson <sup>2</sup> , Nathan D. Orloff <sup>2</sup> , Christian J. Long <sup>2</sup> , James C. Booth <sup>2</sup> , and Ellis F. Meng <sup>1</sup> <i><sup>1</sup>University of Southern California, USA and <sup>2</sup>National Institute of Standards and Technology (NIST), USA</i>	

<b>B4-411d</b>	<b>3D PRINTED GRAPHENE-COATED FLEXIBLE LATTICE AS PIEZORESISTIVE PRESSURE SENSOR .....</b>	<b>888</b>
	Amar M. Kamat <sup>1</sup> and Ajay Giri Prakash Kottapalli <sup>1,2</sup> <sup>1</sup> University of Groningen, NETHERLANDS and <sup>2</sup> Massachusetts Institute of Technology, USA	
<b>B4-412d</b>	<b>ABSORBENT AND FLEXIBLE CONDUCTIVE NANOCOMPOSITES FOR BIOELECTRONIC APPLICATIONS .....</b>	<b>892</b>
	Dhruv R. Seshadri <sup>1,2</sup> , Nicholas D. Bianco <sup>1,2</sup> , Christian A. Zorman <sup>1,2</sup> , and Kath M. Bogie <sup>1,2</sup> <sup>1</sup> Case Western Reserve University, USA and <sup>2</sup> Louis Stokes Cleveland VA Medical Center, USA	
<b>B4-413d</b>	<b>FLEXIBLE PIEZOELECTRIC AND PIEZORESISTIVE MECHANISMS COUPLED SENSOR FOR HIGHLY DYNAMIC AND STATIC COLLABORATIVE DETECTION .....</b>	<b>896</b>
	Lijun Lu, Guosheng Hu, Yang Huang, Jingquan Liu, and Bin Yang Shanghai Jiao Tong University, CHINA	
<b>B4-414d</b>	<b>HYBRID FABRICATION METHOD FOR MICROFLUIDIC CHANNELS WITHIN A POLYMER NANOCOMPOSITE FOR NEURAL INTERFACING APPLICATIONS .....</b>	<b>900</b>
	Youjoung Kim <sup>1,2</sup> , Natalie Mueller <sup>1,2</sup> , William Schwartzman <sup>1,2</sup> , Varoon Aluri <sup>1,2</sup> , Amanda Herried <sup>1,2</sup> , Jeffrey R. Capadona <sup>1,2</sup> , and Allison Hess-Dunning <sup>1,2</sup> <sup>1</sup> Case Western Reserve University, USA and <sup>2</sup> Louis Stokes Cleveland Veterans Affairs Medical Center, USA	
<b>B4-415d</b>	<b>LASER-CARBONIZED MXENE-REINFORCED HIERARCHICAL NANOFIBERS FOR BREATHABLE AND REUSABLE ELECTROPHYSIOLOGICAL E-TATTOOS .....</b>	<b>904</b>
	Md Sharifuzzaman, Md Abu Zahed, Sudeep Sharma, Sanghyuk Yoon, Chani Park, and Jae Y. Park Kwangwoon University, KOREA	
<b>B4-416d</b>	<b>MULTIDIRECTIONAL LITHOGRAPHY OF CELL-LADEN HYDROGELS .....</b>	<b>908</b>
	Pegah Pezeshkpour, Wouter ven der Wijngaart, and Anna Herland KTH Royal Institute of Technology, SWEDEN	
<b>B4-417d</b>	<b>POINTWISE FABRICATION AND FLUIDIC SHAPING OF CARBON NANOTUBE FIELD EMITTERS .....</b>	<b>912</b>
	Crystal E. Owens <sup>1</sup> , Jon Ludwick <sup>2,3</sup> , Joy Y. Ma <sup>1</sup> , Robert J. Headrick <sup>4</sup> , Steven M. Williams <sup>3</sup> , Megan Creighton <sup>1,2</sup> , Tyson C. Back <sup>2</sup> , Benji Maruyama <sup>2</sup> , Matteo Pasquali <sup>4</sup> , Gareth H. McKinley <sup>1</sup> , and A. John Hart <sup>1</sup> <sup>1</sup> Massachusetts Institute of Technology, USA, <sup>2</sup> Air Force Research Laboratory, USA, <sup>3</sup> University of Cincinnati, USA, and <sup>4</sup> Rice University, USA	
<b>B5-519d</b>	<b>MANUFACTURING HIGH NUMERICAL APERTURE MICROLENS ARRAY BY MICROFLUIDICS AND OIL-INDUCED EXPANDABLE PDMS MEMBRANE .....</b>	<b>916</b>
	Pin-Chuan Chen, Liang-Ta Chen, and Cing-Sung Yeh National Taiwan University of Science and Technology, TAIWAN	

## e - Energy, Power and Thermal Management

<b>B2-225e</b>	<b>ALL-POLYMER SOFT-X-RAY-CHARGED PIEZOELECTRET FOR PUSH-BUTTON ENERGY HARVESTER .....</b>	<b>920</b>
	Jia Lu and Yuji Suzuki University of Tokyo, JAPAN	
<b>B2-226e</b>	<b>HEAT STORAGE THERMOELECTRIC GENERATOR FOR WIRELESS IOT SENSING SYSTEMS .....</b>	<b>924</b>
	Truong Thi Kim Tuoi, Nguyen Van Toan, and Takahito Ono Tohoku University, JAPAN	

<b>B2-228e</b>	<b>PYROELECTRICALLY RECHARGEABLE ELECTRET FOR CONTINUOUS VIBRATION ENERGY HARVESTER .....</b>	<b>928</b>
	Pedro Gonzalez Losada, Filipe Alves, Marco Martins, Stephen Mundy, Rosana Dias, and KB Vinayakumar <i>International Iberian Nanotechnology Laboratory, PORTUGAL</i>	
<b>B3-317e</b>	<b>AN INVISIBLE BIONIC DRAGONFLY BASED ON FULLY-TRANSPARENT CONDUCTIVE HYDROGEL AND DIELECTRIC ELASTOMER .....</b>	<b>932</b>
	Ronggang He, Kai Tao, Zhensheng Chen, Bowen Ji, Qiang Shen, Dayong Qiao, Weizheng Yuan, and Honglong Chang <i>Northwestern Polytechnical University, CHINA</i>	
<b>B3-318e</b>	<b>INTERSECTING BOOK INSPIRED HIGH-POWER-DENSITY ELECTRET/TRIBOELECTRIC MULTILAYERED POWER GENERATOR WITH FLEXIBLE INTERDIGITAL ELECTRODES .....</b>	<b>936</b>
	Hao Huang <sup>1</sup> , Zhe Zhao <sup>1</sup> , Kai Tao <sup>1</sup> , Jin Wu <sup>2</sup> , Bowen Ji <sup>1</sup> , Weizheng Yuan <sup>1</sup> , and Honglong Chang <sup>1</sup> <sup>1</sup> Northwestern Polytechnical University, CHINA and <sup>2</sup> Sun Yat-sen University, CHINA	
<b>B3-319e</b>	<b>MICRO-PATTERNED ELECTRET POWER GENERATOR FOR SIMULTANEOUS OSCILLATION AND ROTATORY DETECTION IN RAILWAYS .....</b>	<b>940</b>
	Jiaqian Ding <sup>1</sup> , Zhe Zhao <sup>1</sup> , Yaozheng Wang <sup>1</sup> , Kai Tao <sup>1</sup> , Jin Wu <sup>2</sup> , Weizheng Yuan <sup>1</sup> , and Honglong Chang <sup>1</sup> <sup>1</sup> Northwestern Polytechnical University, CHINA and <sup>2</sup> Sun Yat-sen University, CHINA	
<b>B3-320e</b>	<b>MULTI-ARCHED ASYNCHRONOUS TRIBOELECTRIC SENSOR BASED ON ULTRA-STRETCHABLE HYDROGEL FOR A NOVEL DISPLACEMENT MEASURING MECHANISM .....</b>	<b>944</b>
	Zhensheng Chen <sup>1</sup> , Jiahao Yu <sup>1</sup> , Haozhe Zeng <sup>1</sup> , Kai Tao <sup>1</sup> , Zixuan Wu <sup>2</sup> , Jin Wu <sup>2</sup> , Weizheng Yuan <sup>1</sup> , and Honglong Chang <sup>1</sup> <sup>1</sup> Northwestern Polytechnical University, CHINA and <sup>2</sup> Sun Yat-sen University, CHINA	
<b>B3-321e</b>	<b>THERMOELECTRIC GENERATOR WITH SERIES/PARALLEL SWITCHING FUNCTION FOR IMPROVEMENT OF EXTRACTED POWER .....</b>	<b>948</b>
	Ryuji Sorimachi and Eiji Iwase <i>Waseda University, JAPAN</i>	
<b>B4-418e</b>	<b>A ROTARY ENERGY HARVESTER WITH LIQUID METAL COILS EMBEDDED IN PDMS MEMBRANE .....</b>	<b>952</b>
	Zih-Jyun Wei, Yi-Cheng Zhang, and Shih-Jui Chen <i>National Central University, TAIWAN</i>	
<b>B4-419e</b>	<b>AN ULTRA-LOW FREQUENCY MAGNET-TETHERED VIBRATION ENERGY HARVESTER FOR SELF-POWERED SENSING .....</b>	<b>956</b>
	Sayed Nahiyen Masabi, Hailing Fu, and Stephanos Theodossiades <i>Loughborough University, UK</i>	
<b>B4-420e</b>	<b>MAGNETICALLY-COUPLED MICROMACHINED ELECTROSTATIC ENERGY HARVESTER DRIVEN BY EYELID BLINK MOTION .....</b>	<b>960</b>
	Erfan Pourshaban, Mohit U. Karkhanis, Adwait Deshpande, Aishwaryadev Banerjee, Chayanjit Ghosh, Hanseup Kim, and Carlos H. Mastrangelo <i>University of Utah, USA</i>	
<b>B4-421e</b>	<b>NONLINEAR WIND ENERGY HARVESTING BASED ON MECHANICAL SYNCHRONOUS SWITCH HARVESTING ON INDUCTOR .....</b>	<b>964</b>
	Mayue Shi, Andrew S. Holmes, and Eric M. Yeatman <i>Imperial College London, UK</i>	
<b>B4-422e</b>	<b>PCB INTEGRATED LiNbO<sub>3</sub> PYROELECTRIC HIGH VOLTAGE SUPPLY WITH ELECTROSTATIC SWITCH REGULATOR .....</b>	<b>968</b>
	Di Ni, Ved Gund, and Amit Lal <i>Cornell University, USA</i>	

- B5-520e A UNIFIED DESIGN OF BROADBAND TWO-DEGREE-OF-FREEDOM VIBRATION ENERGY HARVESTING SYSTEM FOR HIGH-QUALITY FACTOR GENERATORS ..... 972**  
 Tomoya Miyoshi<sup>1</sup>, Hiroyuki Mitsuya<sup>2</sup>, Hiroshi Toshiyoshi<sup>1</sup>, and Yuji Suzuki<sup>1</sup>  
<sup>1</sup>University of Tokyo, JAPAN and <sup>2</sup>Saginomiya Seisakusho, JAPAN

## f - Microfluidics Platform Technologies

- B2-229f CENTRIFUGAL STEP EMULSIFICATION MICROFLUIDICS SUPPORTING DROPLET DIGITAL LOOP-MEDIATED ISOTHERMAL AMPLIFICATION (LAMP) OF SARS-COV-2 N GENE ..... 976**  
 Zhi Shi, Nan Dong, Xiaochen Lai, Haixia Yu, and Dachao Li  
 Tianjin University, CHINA
- B2-230f INTEGRATED ON-CHIP CELLULAR EXOSOME ISOLATION AND RNA ANALYSIS MICROSYSTEM ..... 980**  
 Yunxing Lu<sup>1,2</sup>, Xiaoyu Jian<sup>1</sup>, Zhaoduo Tong<sup>1,2</sup>, Zhenhua Wu<sup>1</sup>, Shihui Qiu<sup>1,2</sup>, Chuanjie Shen<sup>1,2</sup>, Hao Yin<sup>1,2</sup>, and Hongju Mao<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,
- B2-231f MULTI-STAGE MICROFLUIDIC CAPTURE ARRAYS FOR DETECTING VARIOUS ALZHEIMER'S DISEASE BIOMARKERS IN SALIVA ..... 984**  
 Pengcheng Zhao<sup>1,2</sup>, Jianan Hui<sup>1,3</sup>, Hongju Mao<sup>1,3</sup>, Guowu Ma<sup>2</sup>, and Huiying Liu<sup>2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>Dalian Medical University, Dalian, CHINA, and  
<sup>3</sup>University of Chinese Academy of Sciences (UCAS) CHINA
- B2-232f OPEN DROPLET MICROFLUIDICS FOR TESTING MULTI-DRUG RESISTANCE AND ANTIBIOTIC RESILIENCE IN BACTERIA ..... 988**  
 Santosh Pandey, Taejoon Kong, Nicholas Backes, and Gregory J. Phillips  
 Iowa State University, USA
- B3-322f A SERPENTINE MICROCHANNEL WITH ADDED CAVITIES PLATFORM FOR MAGNETIC SEPARATION OF LUNG ADENOCARCINOMA CELLS UTILIZING APTAMER-CONJUGATED MAGNETIC BEAD APPROACH ..... 992**  
 Hang Tran Thanh<sup>1</sup>, Loc Do Quang<sup>1</sup>, Bao-Anh Hoang<sup>1</sup>, Tung Thanh Bui<sup>1</sup>, Trinh Chu Duc<sup>1</sup>, and Chun-Ping Jen<sup>2</sup>  
<sup>1</sup>Vietnam National University, VIETNAM and <sup>2</sup>National Chung Cheng University, TAIWAN
- B3-323f MICROFLUIDIC CELL SEPARATION AND GENETIC ANALYSIS OF KURUMA SHRIMP ..... 996**  
 Tomoki Murakami<sup>1</sup>, Hiroaki Suzuki<sup>1</sup>, and Keiichiro Koiwai<sup>2</sup>  
<sup>1</sup>Chuo University, JAPAN and <sup>2</sup>Tokyo University of Agriculture and Technology, JAPAN
- B3-324f NEAR INFRARED LIGHT-TRIGGERED ON-DEMAND DRUG DELIVERY FROM NON-TOXIC HYDROGEL MICROBEADS WITH HEAT TRANSDUCER ..... 1000**  
 Shuhei Takatsuka<sup>1</sup>, Takeshi Kubota<sup>1</sup>, Yuta Kurashina<sup>1,2</sup>, and Hiroaki Onoe<sup>1</sup>  
<sup>1</sup>Keio University, JAPAN and <sup>2</sup>Tokyo Institute of Technology, JAPAN
- B4-423f A VACUUM-DRIVEN MICROFLUIDIC ARRAY FOR MULTI-STEP SAMPLE DIGITALIZATION ..... 1004**  
 Jiumei Hu, Liben Chen, Pengfei Zhang, Kuangwen Hsieh, Hui Li, and Tza-Huei Wang  
 Johns Hopkins University, USA
- B4-424f EFFICIENT DRIVING OF ACOUSTIC MICROFLUIDIC DEVICES USING A RESONANT PLATE ..... 1008**  
 Rebecca J. Christianson, Charles Lissandrello, Jason Durant, Ryan Dubay, and Jason Fiering  
 Draper, USA

- B4-425f FEMTOSECOND LASER MULTI-PULSE IRRADIATION FOR HIGH THROUGH-PUT MULT-SELECTABLE PARTICLE SORTING ..... 1012**  
 Ryota Kiya<sup>1</sup>, Yo Tanaka<sup>2</sup>, Yaxiaer Yalikun<sup>1,2</sup>, and Yoichiroh Hosokawa<sup>1</sup>  
<sup>1</sup>Nara Institute of Science and Technology, JAPAN and <sup>2</sup>RIKEN, JAPAN
- B4-426f PLASMONIC-ENHANCED FLOATING ELECTRODE OPTOELECTRONIC TWEEZERS (FEOET) FOR EFFECTIVE OPTICAL DROPLET MANIPULATION ..... 1016**  
 Si Kuan Thio<sup>1</sup>, Sungwoo Bae<sup>1</sup>, Yee Kan Koh<sup>1</sup>, and Sung-Yong Park<sup>2</sup>  
<sup>1</sup>National University of Singapore, SINGAPORE and <sup>2</sup>San Diego State University, USA
- B5-521f A LOW-FIELD PORTABLE NUCLEAR MAGNETIC RESONANCE (NMR) MICROFLUIDIC FLOWMETER ..... 1020**  
 Eren Aydin and Kofi A.A. Makinwa  
 Delft University of Technology (TU Delft), NETHERLANDS
- B5-522f AN INTEGRATED MICROFLUIDIC PLATFORM FOR DETECTING BRCA1/BRCA2 GENE MUTATION AND RISK ASSESSMENT OF OVARIAN CANCER ..... 1024**  
 Yu-Hung Cheng<sup>1</sup>, Chih-Hung Wang<sup>1</sup>, Keng-Fu Hsu<sup>2</sup>, and Gwo-Bin Lee<sup>1</sup>  
<sup>1</sup>National Tsing Hua University, TAIWAN and <sup>2</sup>National Cheng Kung University, TAIWAN
- B5-523f CLASSIFICATION OF WHITE BLOOD CELLS BASED ON CELL DIAMETER, SPECIFIC MEMBRANE CAPACITANCE AND CYTOPLASMIC CONDUCTIVITY LEVERAGING MICROFLUIDIC CONSTRICTION CHANNEL ..... 1028**  
 Huiwen Tan<sup>1,2</sup>, Minruihong Wang<sup>1,2</sup>, Yi Zhang<sup>1,2</sup>, Xukun Huang<sup>2</sup>, Deyong Chen<sup>1,2</sup>,  
 Min-Hsien Wu<sup>3</sup>, Junbo Wang<sup>1,2</sup>, and Jian Chen<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,  
 and <sup>3</sup>Chang Gung University, CHINA
- B5-524f LUNG CANCER ON CHIP FOR TESTING IMMUNOTHERAPY ..... 1032**  
 Han-Jung Liao<sup>1</sup>, Jean-An Chieh<sup>1</sup>, Yu-Chen Chen<sup>1</sup>, Kang-Yun Lee<sup>2</sup>, Yao-Fei Chan<sup>3</sup>, Shu-Chuan Ho<sup>2</sup>,  
 Wei-lun Sun<sup>2</sup>, Yu-Shiuan Wang<sup>2</sup>, Wan-Chen Huang<sup>4</sup>, Wei-Chiao Chang<sup>2</sup>, and Cheng-Hsien Liu<sup>1</sup>  
<sup>1</sup>National Tsing Hua University, TAIWAN, <sup>2</sup>Taipei Medical University, TAIWAN,  
<sup>3</sup>Linkuo Chang Gung Hospital, TAIWAN, and <sup>4</sup>Academia Sinica, TAIWAN
- B5-525f PARTICLE SIZE DETERMINATION IN IMPEDANCE FLOW CYTOMETRY USING MEASURED OPACITY ..... 1036**  
 Douwe S. de Bruijn, Koen F.A. Jorissen, Wouter Olthuis, and Albert van den Berg  
 University of Twente, NETHERLANDS

## g - Nanoscale Materials and Fabrication

- B2-233g BACTERIAL FORCE ON NANOPILLARS: INTERACTION AT SINGLE CELL ..... 1040**  
 Jagriti Singh, Vaibhav Sharma, Saurabh Chandorkar, and Prosenjit Sen  
 Indian Institute of Science, INDIA
- B3-325g HIERARCHICAL ZNO NANOSPIKES ON ROUGH NANOPILLARS FOR GAS SENSING WITH SELF-CLEANING PROPERTIES ..... 1044**  
 Yang Liu<sup>1,2</sup>, Jie Cheng<sup>1,2</sup>, Aiyao Tang<sup>1,2</sup>, Mingxiao Li<sup>1,2</sup>, Haiyang Mao<sup>1,2</sup>,  
 Na Zhou<sup>1,2</sup>, and Chengjun Huang<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA
- B3-326g HIGH THROUGHPUT 16 NM NANOGAP BY VARIABLE SHAPED BEAM METHOD USING F7000S-VD02 EB LITHOGRAPHY ..... 1048**  
 Akio Higo, Yukinori Ochiai, and Yoshio Mita  
 University of Tokyo, JAPAN

- B3-327g MACHINE LEARNING-BASED DAMAGE PREDICION METHOD FOR THE MICRO/NANO STRUCTURES FABRICATED BY HELIUM FOCUSED ION BEAM ..... 1052**  
 Qianhuang Chen, Tianyang Shao, Yan Xing, and Zaifa Zhou  
*Southeast University, CHINA*
- B4-427g A NEW APPROACH TO CALCULATE THE PIEZOELECTRIC COEFFICIENT OF PIEZO-SEMICONDUCTOR NANOWIRES INTEGRATED IN NANOCOMPOSITES: EXPERIMENT AND SIMULATION ..... 1056**  
 Andrés Jenaro Lopez Garcia<sup>1</sup>, Ran Tao<sup>2</sup>, Mireille Mouis<sup>1</sup>, and Gustavo Ardila<sup>1</sup>  
<sup>1</sup>*University Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, FRANCE* and <sup>2</sup>*Shenzhen University, CHINA*
- B4-428g IN-SITU SYNTHESIS OF MULTILAYER GRAPHENE ON TIN FILM VIA LOCALIZED HEATING OF AMORPHOUS CARBON USING AN ELECTROTHERMAL CANTILEVER NANOPROBE ..... 1060**  
 Ingrid Torres<sup>1</sup>, Sadegh Mehdi Aghaei<sup>2</sup>, Nezih Pala<sup>1</sup>, and Angelo Gaitas<sup>3</sup>  
<sup>1</sup>*Florida International University, USA*, <sup>2</sup>*Worcester Polytechnic Institute, USA*, and <sup>3</sup>*Icahn School of Medicine at Mount Sinai, USA*
- B4-429g TOWARDS REALIZING THE LOW-COERCIVE FIELD OPERATION OF SPUTTERED FERROELECTRIC  $Sc_xAl_{1-x}N$  ..... 1064**  
 Ved Gund, Benyamin Davaji, Hyunjea Lee, Joseph Casamento, Huili Grace Xing, Debdeep Jena, and Amit Lal  
*Cornell University, USA*
- B5-526g A METHOD FOR BIAXIAL FRACTURE STRESS TEST OF NANOSCALE FILM ..... 1068**  
 Fengyang Li, Leijian Cheng, and Dacheng Zhang  
*Peking University, CHINA*

## h - Optical and Atomic Transducers

- B2-234h PLASMONIC SILVER GRATING FOR MID-INFRARED SENSING ..... 1072**  
 Gerald Stocker<sup>1</sup>, Jasmin Spettel<sup>1,2</sup>, Thang Duy Dao<sup>2</sup>, Andreas Tortschanoff<sup>2</sup>, Reyhaneh Jannesari<sup>3</sup>, Gerald Pühringer<sup>3</sup>, Parviz Saeidi<sup>3</sup>, Florian Dubois<sup>2</sup>, Clement Fleury<sup>2</sup>, Cristina Consani<sup>2</sup>, Thomas Grille<sup>1</sup>, Elmar Aschauer<sup>1</sup>, and Bernhard Jakoby<sup>3</sup>  
<sup>1</sup>*Infineon Technologies Austria AG, AUSTRIA*, <sup>2</sup>*Silicon Austria Labs GmbH, AUSTRIA*, and <sup>3</sup>*Johannes Kepler University, AUSTRIA*
- B3-328h NARROW TRENCH PLASMONIC MID-INFRARED DETECTOR WITH DISTINCT RESPONSIVITY FOR RECONSTRUCTIVE SPECTROSCOPY ..... 1076**  
 Shun Yasunaga<sup>1,2</sup> and Tetsuo Kan<sup>2</sup>  
<sup>1</sup>*University of Tokyo, JAPAN* and <sup>2</sup>*University of Electro-Communications, JAPAN*
- B3-329h SINGLE-MICRON SCALE TWO-LAYER MICRO AU CHIRAL STRUCTURE WITH CIRCULARLY POLARIZED LIGHT ABSORPTION IN FIR REGION ..... 1080**  
 Gaku Furusawa<sup>1</sup>, Takashi Sekiya<sup>2</sup>, Hiroaki Nakamura<sup>2</sup>, and Tetsuo Kan<sup>1</sup>  
<sup>1</sup>*University of Electro-Communications, JAPAN* and <sup>2</sup>*Idemitsu Kosan Co., Ltd., JAPAN*
- B4-430h AN INTEGRATED BIFUNCTIONAL METASURFACE MULTIPLEXED POLARIZATION, WAVELENGTH, AND ANGLE ..... 1084**  
 Yun Huang<sup>1</sup>, Liye Li<sup>1</sup>, Yusa Chen<sup>1</sup>, Tian Kang<sup>1</sup>, Guanzhou Lin<sup>1</sup>, Shengxiao Jin<sup>1</sup>, Kenan Zhang<sup>2</sup>, Peimin Lu<sup>2</sup>, and Wengang Wu<sup>1</sup>  
<sup>1</sup>*Peking University, CHINA* and <sup>2</sup>*Fuzhou University, CHINA*
- B4-431h ASPHERICAL HIGH-SPEED VARIFOCAL PIEZOELECTRIC MEMS MIRROR ..... 1088**  
 Jaka Pribošek, Markus Bainschab, Adrien Piot, and Mohssen Moridi  
*Silicon Austria Labs, AUSTRIA*



<b>B4-432h</b>	<b>DEFECT DETECTIONS OF POLYMERS MATERIALS BASED ON BI-MATERIAL MICROCANTILEVER FPA AT 3.1THZ .....</b>	<b>1092</b>
	Jiahao Miao, Jia Xu, Yi Liu, Yuan Tian, and Xiaomei Yu <i>Peking University, CHINA</i>	
<b>B4-433h</b>	<b>DEMONSTRATION OF RESONANT ADAPTIVE MIRRORS .....</b>	<b>1096</b>
	Amr Kamel <sup>1</sup> , Samed Kocer <sup>1</sup> , Taylan Das <sup>2</sup> , Lyazzat Mukhangaliyeva <sup>1</sup> , Resul Saritas <sup>1</sup> , Parsin Hajireza <sup>1</sup> , Mustafa Yavuz <sup>1</sup> , and Eihab Abdel-Rahman <sup>1</sup> <sup>1</sup> <i>University of Waterloo, CANADA and</i> <sup>2</sup> <i>Kirikkale University, TURKEY</i>	
<b>B4-434h</b>	<b>MITIGATING HYSTERESIS EFFECTS IN OPEN-LOOP-DRIVEN PZT MEMS MICROMIRRORS WITH PIEZORESISTIVE SENSING .....</b>	<b>1100</b>
	Paolo Frigerio <sup>1</sup> , Matteo Gianollo <sup>1</sup> , Giovanni Pezzi <sup>1</sup> , Luca Molinari <sup>2</sup> , Andrea Barbieri <sup>2</sup> , Marco Zamprogno <sup>2</sup> , Roberto Carminati <sup>2</sup> , Nicolò Boni <sup>2</sup> , and Giacomo Langfelder <sup>1</sup> <sup>1</sup> <i>Politecnico di Milano, ITALY and</i> <sup>2</sup> <i>STMicroelectronics, ITALY</i>	
<b>B4-435h</b>	<b>PICOMETER LEVEL DIMENSIONAL SENSING USING MICROSPHERICAL GLASS SHELL WHISPERING GALLERY MODE RESONATORS .....</b>	<b>1104</b>
	Vedant Sumaria and Srinivas Tadigadapa <i>Northeastern University, USA</i>	
<b>B5-527h</b>	<b>ATOMIC VAPOR ACTUATORS .....</b>	<b>1108</b>
	Amber J. Sucich, Danny M. Kim, and Christopher S. Roper <i>HRL Laboratories, LLC, USA</i>	
<b>B5-528h</b>	<b>CONSISTENCY EVALUATION ON PREPARATION METHODS OF OPTICAL FIBER PHOTOACOUSTIC PROBE .....</b>	<b>1110</b>
	Shanshan Lu <sup>1</sup> , Cheng Li <sup>1,2</sup> , Shangchun Fan <sup>1</sup> , and Xuefeng Song <sup>3</sup> <sup>1</sup> <i>Beihang University, Beijing, CHINA, </i> <sup>2</sup> <i>Beihang University, Shenzhen, CHINA, and</i> <sup>3</sup> <i>Southern University of Science and Technology, CHINA</i>	
<b>B5-529h</b>	<b>MID-INFRARED WAVEGUIDE-INTEGRATED DIELECTRIC METALENS BY BIGRADIANT SLOTS ON SILICON .....</b>	<b>1114</b>
	Zhihao Ren, Jinyuan Liu, Qifeng Qiao, Xinmiao Liu, Bowei Dong, Yuhua Chang, Guangya Zhou, and Chengkuo Lee <i>National University of Singapore, SINGAPORE</i>	
<b>B5-530h</b>	<b>RECONSTRUCTIVE SPECTROMETER BASED ON PLASMONIC SCHOTTKY PHOTODETECTOR WITH MEMS ANGULAR MODULATOR .....</b>	<b>1118</b>
	Masaaki Oshita <sup>1</sup> , Yosuke Yamamoto <sup>1</sup> , Shiro Saito <sup>2</sup> , and Tetsuo Kan <sup>1</sup> <sup>1</sup> <i>University of Electro-Communications, JAPAN and</i> <sup>2</sup> <i>Aisin Cosmos R&amp;D Co., Ltd., JAPAN</i>	

## i - Packaging & Solid-State Materials and Fabrication Processes

<b>B2-235i</b>	<b>A COMBINED SPIN COATING AND LIFT-OFF PROCESS (CSLOP) TO REALIZE THICK SILVER MICROSTRUCTURES WITH A HIGH ASPECT RATIO FOR IOT APPLICATIONS .....</b>	<b>1122</b>
	Chi-Fu Huang <sup>1</sup> , Ray Tung Chiang <sup>2</sup> , and Yu-Ting Cheng <sup>1</sup> <sup>1</sup> <i>National Yang Ming Chiao Tung University, TAIWAN and</i> <sup>2</sup> <i>LIWEI Nano Tech Co., Ltd., TAIWAN</i>	
<b>B2-236i</b>	<b>CONTACTLESS ENDPOINT DETECTION OF GOLD ETCHING USING QUARTZ-BASED CAPACITIVE DETECTOR .....</b>	<b>1126</b>
	Takuro Okuwaki, Takaaki Haino, Masayuki Sohgawa, and Takashi Abe <i>Niigata University, JAPAN</i>	

<b>B3-330i</b>	<b>DEVELOPMENT OF A WIRELESS CO<sub>2</sub> SENSOR MODULE WITH A PACKAGE ON PACKAGE STRUCTURE .....</b>	<b>1130</b>
	Yuji Furuta, Tatsuaki Denda, Tomoharu Fujii, and Yoshihiro Ihara Shinko Electric Industries Co., Ltd., JAPAN	
<b>B3-331i</b>	<b>FABRICATION AND CHARACTERIZATION OF EVAPORATED ZINC ANODES FOR SMALL-SCALE ZINC-AIR BATTERIES .....</b>	<b>1134</b>
	Vishal Venkatesh, Qi Yang, Jingwen Zhang, James Pikul, and Mark G. Allen <i>University of Pennsylvania, USA</i>	
<b>B3-332i</b>	<b>FULLY CMOS-COMPATIBLE WAFER BONDING BASED ON PRESS MARKING USING THICK ELECTROPLATED ALUMINUM .....</b>	<b>1138</b>
	Muhammad Salman Al Farisi <sup>1,2</sup> , Takashiro Tsukamoto <sup>1</sup> , and Shuji Tanaka <sup>1</sup> <sup>1</sup> <i>Tohoku University, JAPAN and</i> <sup>2</sup> <i>Hiroshima City University, JAPAN</i>	
<b>B3-333i</b>	<b>NOVEL PRESSURE SENSOR CAPSULE PRODUCED IN SILICONE-OIL MODIFIED PDMS INTEGRATED WITH A MICROFLOW METER FOR URINARY TRACT OBSTRUCTION DETECTION IN CLINICAL UROLOGY .....</b>	<b>1142</b>
	Yong-Jun Lin <sup>1</sup> , Kai-Hao Liu <sup>1</sup> , Yung-Shun Juan <sup>2</sup> , and Che-Hsin Lin <sup>1</sup> <sup>1</sup> <i>National Sun Yat-sen University, TAIWAN and</i> <sup>2</sup> <i>Kaohsiung Medical University Chung-Ho Memorial Hospital, TAIWAN</i>	
<b>B3-334i</b>	<b>THE INFLUENCES OF NON-VOLATILE SURFACE COMPOUND LAYER ON THE PLASMA ETCHING OF BOROSILICATE GLASS .....</b>	<b>1146</b>
	Seungmok Lee, Masashi Hasegawa, and Kazuhiro Nishizono <i>Kyocera Corporation, JAPAN</i>	
<b>B4-436i</b>	<b>FABRICATION AND CHARACTERIZATION OF HOLLOW MICRONEEDLE ARRAY USING DIFFRACTION UV LITHOGRAPHY .....</b>	<b>1150</b>
	Jun Ying Tan <sup>1</sup> , Albert Kim <sup>2</sup> , and Jungkwun “JK” Kim <sup>1</sup> <sup>1</sup> <i>Kansas State University, USA and</i> <sup>2</sup> <i>Temple University, USA</i>	
<b>B4-437i</b>	<b>PLANAR CMOS-COMPATIBLE FUSION-BONDED SILICA VACUUM PACKAGES .....</b>	<b>1154</b>
	Lin Du, Xuan Wang, and Mark G. Allen <i>University of Pennsylvania, USA</i>	
<b>B5-531i</b>	<b>EVALUATION OF NEW SOLID RUBIDIUM SOURCE USING ATOMIC CLOCK STABILIZATION LOOP .....</b>	<b>1158</b>
	Motoaki Hara <sup>1</sup> , Yuichiro Yano <sup>1</sup> , Masaya Toda <sup>2</sup> , Takahito Ono <sup>2</sup> , and Tetsuya Ido <sup>1</sup> <sup>1</sup> <i>National Institute of Information and Communications Technology, JAPAN and</i> <sup>2</sup> <i>Tohoku University, JAPAN</i>	
<b>B5-532i</b>	<b>HIGH LIGHT POWER DENSITY DUV-LED PACKAGING USING HIGH DENSITY TSV IN SILICON CAVITY AND LASER-GLASS-FRIT-BONDED GLASS CAP .....</b>	<b>1162</b>
	Hirofumi Chiba <sup>1</sup> , Yukio Suzuki <sup>2</sup> , Yoshiaki Yasuda <sup>1</sup> , Tianjiao Gong <sup>2</sup> , and Shuji Tanaka <sup>2</sup> <sup>1</sup> <i>Stanley Electric Co., LTD., JAPAN and</i> <sup>2</sup> <i>Tohoku University, JAPAN</i>	
<b>B5-533i</b>	<b>NOVEL MICROCHANNEL PROFILE CONTROL OF MICROPOWDER BLASTING USING DYNAMIC VISCOELASTICITY OF MASK .....</b>	<b>1166</b>
	Mikinari Takada, Mao Hamamoto, and Hiromasa Yagyu Kanto Gakuin University, JAPAN	

## j - Physical Sensors and Microsystems

<b>B2-237j</b>	<b>AN ABSOLUTE CAPACITIVE PRESSURE SENSOR BASED ON A SIMT-FABRICATED VACUUM CAVITY .....</b>	<b>1170</b>
	Yushen Hu <sup>1,2</sup> , Fei Wang <sup>2</sup> , and Man Wong <sup>1</sup> <sup>1</sup> <i>Hong Kong University of Science and Technology, HONG KONG and</i> <sup>2</sup> <i>Southern University of Science and Technology, CHINA</i>	

- B2-238j AN EAR-INSPIRED SOUND PRESSURE AMPLIFICATION STRUCTURE FOR FABRY-PEROT ACOUSTIC SENSOR ..... 1174**  
Xi Xiao<sup>1</sup>, Cheng Li<sup>1</sup>, Shangchun Fan<sup>1</sup>, and Xuefeng Song<sup>2</sup>  
<sup>1</sup>Beihang University, Beijing, CHINA and <sup>2</sup>Southern University of Science and Technology, CHINA
- B2-239j AN UNDERWATER FLOW SENSOR INSPIRED BY AIR-RETAINING HAIRS OF NOTONECTA ..... 1178**  
Keli Wang, Yan Wang, Zhiqiang Ma, Deyuan Zhang, Huawei Chen, and Yonggang Jiang  
Beihang University, Beijing, CHINA
- B2-240j CORROSION MONITORING OF SACRIFICIAL ANODES BASED ON CONTOUR PLOT ANALYSIS OF ELECTRO-MECHANICAL IMPEDANCE SPECTRA ..... 1182**  
Jeslin Thalapil, Durgesh Tamhane, Sauvik Banerjee, and Siddharth Tallur  
Indian Institute of Technology Bombay, INDIA
- B2-241j FORCE SENSOR USING IONIC LIQUID CAPILLARY BRIDGE ..... 1186**  
Thanh-Vinh Nguyen, Shinya Kano, Atsushi Takei, and Masaaki Ichiki  
National Institute of Advanced Industrial Science and Technology (AIST), JAPAN
- B2-242j FULL SILICON CAPACITIVE FORCE SENSORS WITH LOW TEMPERATURE DRIFT AND HIGH TEMPERATURE RANGE ..... 1190**  
Muhannad Ghanam, Thomas Bilger, Frank Goldschmidtboeing, and Peter Woias  
Freiburg University, GERMANY
- B2-243j HIGH TEMPERATURE SURFACE ACOUSTIC WAVE SENSOR WITH STRAIN ISOLATION STRUCTURE ..... 1194**  
Guangyao Pei, Binghe Ma, Jian Luo, and Jinjun Deng  
Northwestern Polytechnical University, CHINA
- B2-244j IN-SITU MODE-MATCHING CONTROL FOR A SINGLE-CHIP HORIZONTAL DUAL-AXIS MEMS GYROSCOPE BASED ON MODULATING QUADRATURE COUPLING WITH SILICON GRATINGS ..... 1198**  
Jian Cui and Qiancheng Zhao  
Peking University, CHINA
- B2-245j INDUCTIVE TRANSDUCERS WITH 2D MICROCOILS IN REFLECTION DIFFERENTIAL TRANSMITTER-RECEIVER MODE FOR THE MICRO NON-DESTRUCTIVE TESTING OF GRINDING BURN ..... 1202**  
Isman Khazi<sup>1,2</sup>, Andras Kovacs<sup>1</sup>, and Ulrich Mescheder<sup>1,2</sup>  
<sup>1</sup>Furtwangen University, GERMANY and <sup>2</sup>University of Freiburg, GERMANY
- B2-246j MEMS GAS JET FLOW GYROMETER - A NUMERICAL APPROACH ..... 1206**  
Alexandre Kechaf<sup>1</sup>, Alain Giani<sup>1</sup>, Philippe Combette<sup>1</sup>, Marwan Tedjini<sup>1</sup>,  
Caroline Gauthier-Blum<sup>2</sup>, and Markus Schneider<sup>2</sup>  
<sup>1</sup>Université de Montpellier, FRANCE and <sup>2</sup>ISL - French-German Research Institute of Saint-Louis, FRANCE
- B2-247j P(VDF-TRFE)/BTO NANOFIBER BASED ARTIFICIAL LATERAL LINE SENSOR FOR FLOW DETECTION ..... 1211**  
Xiaohe Hu<sup>1</sup>, Zheng Gong<sup>1</sup>, Zhiqiang Ma<sup>1</sup>, Kaijie Wang<sup>1,2,3</sup>, Deyuan Zhang<sup>1</sup>, and Yonggang Jiang<sup>1</sup>  
<sup>1</sup>Beijang University, Beijing, CHINA, <sup>2</sup>Beijing Tongren Hospital, CHINA, and  
<sup>3</sup>Capital Medical University, CHINA
- B2-248j SENSITIVITY ENHANCEMENT IN VACUUM PACKAGED RESONANT MEMS STRAIN SENSORS WITH ON-CHIP STRAIN AMPLIFICATION MECHANISM ..... 1215**  
Luca Belsito, Luca Masini, and Alberto Roncaglia  
National Research Council, ITALY
- B2-249j SINGLE-CHIP INTEGRATION OF CMOS COMPATIBLE MEMS TEMPERATURE/HUMIDITY AND HIGHLY SENSITIVE FLOW SENSORS FOR HUMAN THERMAL COMFORT SENSING APPLICATION ..... 1219**  
Izhar<sup>1</sup>, Wei Xu<sup>2</sup>, Hadi Tavakkoli<sup>1</sup>, Jose Cabot<sup>1</sup>, Xu Zhao<sup>1</sup>, Mingzheng Duan<sup>1</sup>, and Yi-Kuen Lee<sup>1</sup>  
<sup>1</sup>Hong Kong University of Science and Technology, HONG KONG and <sup>2</sup>Shenzhen University, CHINA

- B2-250j THEORETICAL AND EXPERIMENTAL STUDIES OF ELECTROCHEMICAL IMPEDANCE BASED MICRO CALORIMETRIC FLOW SENSOR ..... 1223**  
 Xuankai Xu<sup>1</sup>, Zetao Fang<sup>1</sup>, Jiufu Zheng<sup>1</sup>, Bo Gao<sup>2</sup>, and Wei Xu<sup>1</sup>  
<sup>1</sup>Shenzhen University, CHINA and <sup>2</sup>Hong Kong University of Science and Technology, CHINA
- B2-251j ULTRASENSITIVE SURFACE ACOUSTIC WAVE GAS SENSOR FOR TRACE VOCs DETECTION BASED ON SENSING MECHANISM OF GAS-LIQUID PHASE TRANSITION ..... 1227**  
 Xishan Guo<sup>1,2</sup>, Jing Zhang<sup>2</sup>, Yinong Chen<sup>1</sup>, Yujie He<sup>1</sup>, Liren Wang<sup>1</sup>, and Yinfei Zheng<sup>1,2</sup>  
<sup>1</sup>Zhejiang University, CHINA and <sup>2</sup>Zhejiang Lab, CHINA
- B2-252j ANTI-FREEZING AND ANTI-DRYING ORGANOHYDROGEL COATED WITH GRAPHENE FOR HIGHLY SENSITIVE AND ULTRASTRETCHABLE STRAIN SENSING ..... 1231**  
 Xing Yang<sup>1</sup>, Zixuan Wu<sup>1</sup>, Yaoming Wei<sup>1</sup>, Haojun Ding<sup>1</sup>, Zhenyi Li<sup>1</sup>, Kai Tao<sup>2</sup>, and Jin Wu<sup>1</sup>  
<sup>1</sup>Sun Yat-sen University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA
- B3-335j 0.5MM×0.5MM HIGH-TEMPERATURE PRESSURE SENSORS FABRICATED WITH IC-FOUNDRY-COMPATIBLE PROCESS IN (100)/(111) HYBRID SOI WAFERS ..... 1235**  
 Peng Li<sup>1,2</sup>, Jiachou Wang<sup>1</sup>, and Xinxin Li<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and <sup>2</sup>Fudan University, CHINA
- B3-336j A COMPACT HIGH-SENSITIVITY TEMPERATURE SENSOR USING AN ENCAPSULATED CLAMPED-CLAMPED MEMS BEAM RESONATOR ..... 1239**  
 Xuecui Zou<sup>1</sup>, Sally Ahmed<sup>1</sup>, Nizar Jaber<sup>2</sup>, and Hossein Fariborzi<sup>1</sup>  
<sup>1</sup>King Abdullah University of Science and Technology (KAUST), SAUDI ARABIA and  
<sup>2</sup>King Fahd University of Petroleum and Minerals (KFUPM), SAUDI ARABIA
- B3-337j A MICROMACHINED RESONANT LOW-PRESSURE SENSOR USING AN ISLAND-DIAPHRAGM STRUCTURE ..... 1243**  
 Yu Zheng<sup>1,2</sup>, Sen Zhang<sup>1,2</sup>, Deyong Chen<sup>1</sup>, Junbo Wang<sup>1</sup>, and Jian Chen<sup>1</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA
- B3-338j A RESONANT DIFFERENTIAL PRESSURE MICROSENSOR WITH COMPENSATIONS OF TEMPERATURE AND STATIC PRESSURE ..... 1247**  
 Chao Cheng<sup>1,2</sup>, Yadong Li<sup>1,2</sup>, Yulan Lu<sup>1,2</sup>, Junbo Wang<sup>1,2</sup>, Deyong Chen<sup>1,2</sup>, and Jian Chen<sup>1,2</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA and  
<sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA
- B3-339j A SYSTEM BASED ON PIEZOELECTRIC MICROMACHINED ULTRASOUND TRANSDUCER FOR SOCIAL DISTANCING AND HUMAN-MACHINE INTERACTION ..... 1251**  
 Tao Ruan, Qi Wang, Qingda Xu, Bin Yang, and Jingquan Liu  
 Shanghai Jiao Tong University, CHINA
- B3-340j AN L-SHAPED 2-DIMENSIONAL PARTICLE VELOCITY SENSOR ..... 1255**  
 Zhezheng Zhu, Lingmeng Yang, Wenhan Chang, Chengchen Gao, Yilong Hao, and Zhenchuan Yang  
 Peking University, CHINA
- B3-341j FABRICATION OF ULTRA-THIN GLASS SHEET FOR ON-CHIP GLASS PRESSURE SENSOR ..... 1259**  
 Yapeng Yuan<sup>1,2</sup>, Yaxiaer Yaliku<sup>2,3</sup>, Yigang Shen<sup>1,2</sup>, and Yo Tanaka<sup>1,2</sup>  
<sup>1</sup>Osaka University, JAPAN, <sup>2</sup>RIKEN, JAPAN, and  
<sup>3</sup>Graduate School of Nara Institute of Science and Technology, JAPAN
- B3-342j FLEXIBLE SMART ACOUSTIC WAVE PATCHES FOR EFFECTIVE DETECTION AND ELIMINATION OF SURFACE CONDENSATION ..... 1263**  
 Qian Zhang<sup>1,2</sup>, Yong Wang<sup>1,2,3</sup>, Tao Wang<sup>1</sup>, Dongsheng Li<sup>1</sup>, Jin Xie<sup>1</sup>, Hamdi Torun<sup>2</sup>, and YongQing Fu<sup>2</sup>  
<sup>1</sup>Zhejiang University, CHINA, <sup>2</sup>University of Northumbria, UK, and <sup>3</sup>Westlake University, CHINA

<b>B3-343j</b>	<b>IN-SITU DEPOSITION OF PRESSURE AND TEMPERATURE SENSITIVE E-SKIN FOR ROBOTIC APPLICATIONS .....</b>	<b>1267</b>
	Jarred W. Fastier-Wooller <sup>1</sup> , Trung Hieu Vu <sup>1</sup> , Canh-Dung Tran <sup>2</sup> , Toan Dinh <sup>2</sup> , Van Thanh Dau <sup>1</sup> , and Dzung Viet Dao <sup>1</sup> <i><sup>1</sup>Griffith University, AUSTRALIA and <sup>2</sup>University of Southern Queensland, AUSTRALIA</i>	
<b>B3-344j</b>	<b>OPTIMIZING HARBOR SEAL WHISKER MORPHOLOGY FOR DEVELOPING 3D-PRINTED FLOW SENSOR .....</b>	<b>1271</b>
	Xingwen Zheng <sup>1</sup> , Amar M. Kamat <sup>1</sup> , Vinayak S. Harish <sup>1</sup> , Ming Cao <sup>1</sup> , and Ajay Kottapalli <sup>1,2</sup> <i><sup>1</sup>University of Groningen, NETHERLANDS and <sup>2</sup>Massachusetts Institute of Technology, USA</i>	
<b>B3-345j</b>	<b>POLYMER BASED ACOUSTIC WAVE SENSOR USING HOT EMBOSSING TECHNIQUE .....</b>	<b>1275</b>
	Jungyoon Kim, Tianyi Zhang, Quan Guan, John Sartori, Lauren Linderman, Vuk Mandic, and Tianhong Cui <i>University of Minnesota, USA</i>	
<b>B3-346j</b>	<b>SELF-HEATING CMOS FLOW SENSOR .....</b>	<b>1279</b>
	Reshmi Waikhom, Lung-Jieh Yang, Horng-Yuan Shih, and Cai-Ruo Kuo <i>Tamkang University, TAIWAN</i>	
<b>B4-438j</b>	<b>A CONFIGURABLE MEASUREMENT RANGE AND BANDWIDTH MEMS DISK RESONATOR GYROSCOPE .....</b>	<b>1283</b>
	Hao Wang, Jianbing Xie, and Honglong Chang <i>Northwestern Polytechnical University, CHINA</i>	
<b>B4-439j</b>	<b>A MASS SENSOR BASED ON AN ALUMINUM NITRIDE MEMS OSCILLATOR FOR GAS SENSING APPLICATIONS .....</b>	<b>1287</b>
	Chien-Hao Weng, Gayathri Pillai, and Sheng-Shian Li <i>National Tsing Hua University, TAIWAN</i>	
<b>B4-440j</b>	<b>ANALYSIS OF QUADRATURE AND FREQUENCY SPLIT IN A MEMS VIBRATING RING GYROSCOPE WITH STRUCTURAL IMPERFECTIONS .....</b>	<b>1291</b>
	Mehran Hosseini-Pishrobat, and Erdinc Tatar <i>Bilkent University, TURKEY</i>	
<b>B4-441j</b>	<b>BIOMIMETIC ARTIFICIAL HAIR SENSOR ARRAY: TOWARDS SELF-HEALING SENSORS .....</b>	<b>1295</b>
	Minerva G. Vargas Gleason and Walter Lang <i>University of Bremen, GERMANY</i>	
<b>B4-442j</b>	<b>DESIGN AND MODELLING OF A COMPLIANT CONSTANT-FORCE SURGICAL TOOL FOR OBJECTIVE ASSESSMENT OF OSSICULAR CHAIN MOBILITY .....</b>	<b>1299</b>
	Loïc Tissot-Daguette <sup>1</sup> , Charles Baur <sup>1</sup> , Axel Bertholds <sup>2</sup> , Pere Llosas <sup>2</sup> , and Simon Henein <sup>1</sup> <i><sup>1</sup>École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND and <sup>2</sup>Sensoptic SA, SWITZERLAND</i>	
<b>B4-443j</b>	<b>DESIGN, MODELING AND VALIDATION OF A FLEXIBLE STRAIN SENSOR BASED ON MOIRE PATTERNS AND IMAGE PROCESSING .....</b>	<b>1303</b>
	Xiaoke Ding and Long Que <i>Iowa State University, USA</i>	
<b>B4-444j</b>	<b>DEVELOPMENT OF A THERMO-COMPUTING PLATFORM .....</b>	<b>1307</b>
	Vahideh Shirmohammadli and Behraad Bahreyni <i>Simon Fraser University, CANADA</i>	
<b>B4-445j</b>	<b>ELECTRIC FIELD SENSOR WITH STABILIZED INTERFEROMETRIC READOUT .....</b>	<b>1311</b>
	Hajrudin Besic <sup>1</sup> , Andreas Kainz <sup>2</sup> , Matthias Kahr <sup>2</sup> , Wilfried Hortschitz <sup>2</sup> , and Franz Keplinger <sup>1</sup> <i><sup>1</sup>Vienna University of Technology (TU Wien), AUSTRIA and <sup>2</sup>Danube University Krems, AUSTRIA</i>	

- B5-534j A COMPACT LOW-POWER MEM RESONATOR-BASED ANALOG TO DIGITAL CONVERTER WITH FEEDTHROUGH SIGNAL CANCELLATION ..... 1315**  
 Sally Ahmed, Xuecui Zou, and Hossein Fariborzi  
*King Abdullah University of Science and Technology (KAUST), SAUDI ARABIA*
- B5-535j A KIRIGAMI MEMS VELOCITY ACOUSTIC TRANSDUCER ..... 1319**  
 Sangmin Oh<sup>1</sup>, Benyamin Davaji<sup>2</sup>, James Richie<sup>1</sup>, Amit Lal<sup>2</sup>, and Chung Hoon Lee<sup>1</sup>  
<sup>1</sup>Marquette University, USA and <sup>2</sup>Cornell University, USA
- B5-536j A NOVEL 0-5 KPA PIEZORESISTIVE PRESSURE SENSOR BASED ON PENINSULA STRUCTURE DIAPHRAGM ..... 1323**  
 Chengwu Gao, Fengyang Li, Fang Yang, and Dacheng Zhang  
*Peking University, CHINA*
- B5-537j A ROBUST AUTOPARAMETRICALLY EXCITED ANGULAR RATE SENSOR ..... 1327**  
 Bhargav Gadhvi, Farid Golnaraghi, and Behraad Bahreyni  
*Simon Fraser University, CANADA*
- B5-538j DEVELOPMENT OF WEIGHING SYSTEMS WITH IMPROVED DYNAMIC RANGE USING HIGH-RESOLUTION RESONANT MEMS STRAIN SENSORS ..... 1331**  
 Luca Belsito, Matteo Ferri, Luca Masini, and Alberto Roncaglia  
*National Research Council, ITALY*
- B5-539j ELECTROMECHANICAL MODELING AND EXPERIMENTAL VALIDATION OF A DUAL-TRANSDUCTION ELECTRODYNAMIC WIRELESS POWER RECEIVER ..... 1335**  
 Miah A. Halim, Spencer E. Smith, Adrian A. Rendon-Hernandez, and David P. Arnold  
 University of Florida, USA
- B5-540j FABRICATION PROCESS AND EVALUATION OF PRINTED STRAIN SENSORS FOR DETECTION OF MAXIMUM STRAIN DIRECTION ..... 1339**  
 Daniel Zymelka and Takeshi Kobayashi  
*National Institute of Advanced Industrial Science and Technology (AIST), JAPAN*
- B5-541j INVESTIGATIONS ON NONLINEARITIES OF ROOF TILE-SHAPE MODES FOR PRESSURE MEASUREMENT APPLICATIONS ..... 1343**  
 Tobias Zengerle<sup>1</sup>, Michael Stopp<sup>1</sup>, Abdallah Ababneh<sup>2</sup>, and Helmut Seidel<sup>1</sup>  
<sup>1</sup>Saarland University, GERMANY and <sup>2</sup>Yarmouk University, JORDAN
- B5-542j MULTI-FREQUENCY THIN FILM HBAR MICROSENSOR FOR ACOUSTIC IMPEDANCE SENSING OVER THE GHZ RANGE ..... 1347**  
 Jesus Yanez, Arantxa Uranga, and Nuria Barniol  
*Universitat Autònoma de Barcelona, SPAIN*
- B5-543j NUMERICAL STUDY AND EXPERIMENTAL INVESTIGATION OF AN ELECTROHYDRODYNAMIC DEVICE FOR INERTIAL SENSING ..... 1351**  
 Thu-Hang Nguyen<sup>1</sup>, Ngoc Van Tran<sup>2</sup>, Thien Xuan Dinh<sup>3</sup>, Canh-Dung Tran<sup>4</sup>, Van Thanh Dau<sup>5</sup>, Trinh Duc Chu<sup>1</sup>, Hai Nguyen Hoang<sup>1</sup>, and Tung Thanh Bui<sup>1</sup>  
<sup>1</sup>Vietnam National University, VIETNAM, <sup>2</sup>Academy of Military Science and Technology, VIETNAM, <sup>3</sup>Explosion Research Institute Inc., VIETNAM, <sup>4</sup>University of Southern Queensland, AUSTRALIA, and <sup>5</sup>Griffith University, AUSTRALIA
- B5-544j RADIO FREQUENCY TEMPERATURE TRANSDUCERS BASED ON INSULATOR-METAL PHASE TRANSITION IN VO<sub>2</sub> AND GE-DOPED VO<sub>2</sub> ALD THIN FILMS ..... 1355**  
 Andrei A. Muller<sup>1</sup>, Riyaz Khadar<sup>1</sup>, Kham M. Niang<sup>2</sup>, Guandong Bai<sup>2</sup>, Elison Matioli<sup>1</sup>, John Robertson<sup>2</sup>, and Adrian M. Ionescu<sup>1</sup>  
<sup>1</sup>École Polytechnique Fédérale de Lausanne (EPFL), SWITZERLAND and <sup>2</sup>Cambridge University, UK
- B5-545j RF RING OSCILLATOR GRAPHENE-BASED STRAIN SENSOR ..... 1359**  
 Mohamed W. Tawfik, Abdelhameed Sharaf, and Mohamed Serry  
*American University, Cairo, EGYPT*

- B5-546j ROBUST AND SENSITIVE THERMAL SENSOR USING THE 3-OMEGA-METHOD TO MEASURE THE CONCENTRATION OF BINARY MIXTURES ..... 1363**  
 Ralf E. Bernhardsgrütter<sup>1,2</sup>, Christoph J. Hepp<sup>1</sup>, Katrin Schmitt<sup>2</sup>, and Jürgen Wöllenstein<sup>2</sup>  
<sup>1</sup>Innovative Sensor Technology IST AG, SWITZERLAND and <sup>2</sup>University of Freiburg, GERMANY

## k - RF MEMS, Resonators and Oscillators

- B2-253k AN ULTRA-BROADBAND CONTACT-CAPACITIVE RF MEMS SWITCH FOR 15-110GHZ APPLICATIONS ..... 1367**  
 Yulong Zhang<sup>1</sup>, Huiliang Liu<sup>2</sup>, and Zewen Liu<sup>1</sup>  
<sup>1</sup>Tsinghua University, CHINA and <sup>2</sup>China Academy of Space Technology, CHINA
- B2-254k DESIGN AND FABRICATION OF LAMB WAVE RESONATOR BASED ON 15% SCANDIUM-DOPED ALUMINUM NITRIDE THIN FILM ..... 1371**  
 Shuai Shao<sup>1,2,3</sup>, Zhifang Luo<sup>1,2,3</sup>, and Tao Wu<sup>1</sup>  
<sup>1</sup>ShanghaiTech University, CHINA, <sup>2</sup>Chinese Academy of Sciences (CAS), CHINA, and <sup>3</sup>University of Chinese Academy of Sciences (UCAS), CHINA
- B3-347k BOOSTING Q OF <100> ALIGNED ALN-ON-SILICON LATERALLY VIBRATING RESONATORS BY WIDE ACOUSTIC BANDGAP PHONONIC CRYSTAL ANCHORS ..... 1375**  
 Renhua Yang<sup>1</sup>, Jingui Qian<sup>1</sup>, and Joshua E.-Y. Lee<sup>1,2</sup>  
<sup>1</sup>City University of Hong Kong, HONG KONG and <sup>2</sup>Agency for Science, Technology and Research (A\*STAR), SINGAPORE
- B3-348k IN-HOUSE FABRICATION OF SOLENOID INDUCTOR AND MULTILAYER METAL CORE USING 3D PRINTING, SELECTIVE ELECTROLESS PLATING, ELECTROPLATING, AND PRESSING ..... 1379**  
 Jun Ying Tan, Abdulfeta Ahmed, and Jungkwun "JK" Kim  
 Kansas State University, USA
- B3-349k Ku-BAND FREQUENCY SELECTIVE 3D VERTICAL PILLAR ARRAY ..... 1383**  
 Sabera Fahmida Shiba<sup>1</sup>, Jun Ying Tan<sup>1</sup>, Cheolbok Kim<sup>2</sup>, Sung Jin Kim<sup>3</sup>, and Jungkwun Kim<sup>1</sup>  
<sup>1</sup>Kansas State University, USA, <sup>2</sup>Corning Inc., USA, and <sup>3</sup>University of Miami, USA
- B4-446k TAPPING BANDWIDTH WIDENING OF CMOS-MEMS VIBRO-IMPACTING RESONATORS BASED ON DOUBLE-SIDED STOPPER STRUCTURES ..... 1387**  
 Chun-Pu Tsai, Hsuan-Wei Wang, and Wei-Chang Li  
 National Taiwan University, TAIWAN
- B4-447k TRACE GAS SPECTROSCOPY USING CAVITY OPTOMECHANICS ..... 1392**  
 Joris Baraillon, Pierre Labeye, and Laurent Duraffourg  
 Université Grenoble, FRANCE
- B5-547k CMOS COMPATIBLE ALUMINIUM NITRIDE SOLIDLY MOUNTED RESONATOR WITH AN INTEGRATED MICROHEATER FOR TEMPERATURE MODULATION ..... 1396**  
 Jan Peter Specht, Siavash Esfahani, Marina Cole, and Julian William Gardner  
 University of Warwick, UK
- B5-548k HIGH-Q GALLIUM NITRIDE THICKNESS-SHEAR BAW RESONATORS WITH REDUCED TEMPERATURE SENSITIVITY ..... 1400**  
 Mayur Ghatge<sup>1</sup>, Mina Rais-Zadeh<sup>2</sup>, and Roozbeh Tabrizian<sup>1</sup>  
<sup>1</sup>University of Florida, USA and <sup>2</sup>NASA Jet Propulsion Laboratory, USA

## I - Wearable and In-Vivo Medical Devices and Microsystems

- B2-2551 OMNIDIRECTIONAL POLYHEDRAL ULTRASOUND TRANSDUCER FOR POWERING IMPLANTABLE MICRODEVICES ..... 1404**  
Moonchul Park<sup>1</sup>, Sayemul Islam<sup>1</sup>, Seung Hyun Song<sup>2</sup>, and Albert Kim<sup>1</sup>  
<sup>1</sup>Temple University, USA and <sup>2</sup>Sook Myung Women's University, KOREA
- B2-2561 RELIABLE CONNECTION BETWEEN STRETCHABLE ELECTRODES ON PDMS AND FLEXIBLE FLAT CABLE BY INTRODUCING THERMAL RELEASE TAPE ..... 1408**  
Bowen Ji<sup>1</sup>, Yuhao Zhou<sup>1</sup>, Zhejun Guo<sup>2</sup>, Kai Zhang<sup>1</sup>, Minghao Wang<sup>3</sup>, Kai Tao<sup>1</sup>, Huicheng Feng<sup>1</sup>, Honglong Chang<sup>1</sup>, and Jingquan Liu<sup>2</sup>  
<sup>1</sup>Northwestern Polytechnical University, CHINA, <sup>2</sup>Shanghai Jiao Tong University, CHINA, and <sup>3</sup>Hangzhou Dianzi University, CHINA
- B3-3501 A SILICON RECORDING PROBE WITH INTEGRATED AG/AGCL REFERENCE ELECTRODE FOR IN-SITU PH SENSING ..... 1412**  
Longchun Wang<sup>1</sup>, Zhejun Guo<sup>1</sup>, Bowen Ji<sup>2</sup>, Ye Xi<sup>1</sup>, Bin Yang<sup>1</sup>, and Jingquan Liu<sup>1</sup>  
*Shanghai Jiao Tong University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA*
- B3-3511 A SILK-BASED MICRONEEDLE PATCH FOR CONTROLLED MULTI-DRUG DELIVERY IN GLIOMA TREATMENT ..... 1416**  
Zijing Wang<sup>1,2</sup>, Keyin Liu<sup>1</sup>, Nan Qin<sup>1</sup>, and Tiger H. Tao<sup>1,3,4,5</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>Shanghai Normal University, CHINA, <sup>3</sup>University of Chinese Academy of Sciences (UCAS), CHINA, <sup>4</sup>ShanghaiTech University, CHINA, and <sup>5</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA
- B3-3521 BIOMIMIC ANTIBACTERIAL SENSING SILK BIO-PATCH ..... 1420**  
Zhiheng Gao<sup>1,2</sup>, Tiger H. Tao<sup>1,2,3,4</sup>, and Keyin Liu<sup>1</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>ShanghaiTech University, CHINA, <sup>3</sup>University of Chinese Academy of Sciences (UCAS), CHINA, and <sup>4</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA
- B3-3531 DEVELOPMENT OF ATTACHABLE TRANSPARENT ULTRASONIC TRANSDUCER: A VERSATILE PHOTOACOUSTIC IMAGING DEVICE FOR BODY SENSOR NETWORK .... 1424**  
Ya-Han Liu, Chih-Ying Li, Li-Xiang Chen, Hsin-Yi Su, Yeong-Her Wang, and Chih-Hsien Huang  
*National Cheng-Kung University, TAIWAN*
- B3-3541 SELF-HEALABLE SOFT IONOTRONIC SKIN FOR GESTURE RECOGNITION ..... 1428**  
Yanghong Zhang<sup>1,2</sup>, Mengwei Liu<sup>1,2</sup>, Zhitao Zhou<sup>1</sup>, Yujia Zhang<sup>1,2</sup>, and Tiger H. Tao<sup>1,2,3,4</sup>  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA, <sup>3</sup>ShanghaiTech University, CHINA, and <sup>4</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA
- B4-4481 A BAND-AID TYPE SENSOR FOR WEARABLE PHYSIOLOGICAL MONITORING ..... 1432**  
Thanh-Vinh Nguyen, Hironao Okada, Yusuke Takei, Atsushi Takei, and Masaaki Ichiki  
National Institute of Advanced Industrial Science and Technology (AIST), JAPAN
- B4-4491 A COMPARATIVE EVALUATION OF A WEARABLE MEMS TACTILE SENSORS ARRAY AND A PHOTOPLETHYSMOGRAPHY SENSOR FOR ATRIAL FIBRILLATION DETECTION UNDER SITTING CONDITION ..... 1436**  
Weijie Luo, Vikas Sharma, and Darrin J. Young  
*University of Utah, USA*
- B4-4501 DEVELOPMENT OF A CLINICAL-GRADE OCT/OCT-ANGIOGRAPHY ENDOMICROSCOPE FOR IMAGING IN THE BLADDER ..... 1440**  
Gerardo González-Cerdas<sup>1</sup>, Yanis Taeye<sup>1</sup>, Felix Jund<sup>1</sup>, Christoph Bauer<sup>2</sup>, Dragan Sandic<sup>2</sup>, Hans Zappe<sup>1</sup>, and Çağlar Ataman<sup>1</sup>  
<sup>1</sup>University of Freiburg, GERMANY and <sup>2</sup>Blazejewski MEDI-TECH GmbH, GERMANY



- B4-4511 FLEXIBLE MICROELECTRODE ARRAYS WITH IN-PLANE SHIELDING FOR HIGH QUALITY ELECTROCORTICOGRAPHY RECORDING ..... 1444**  
*Feihong Xu<sup>1,2</sup>, Zhitao Zhou<sup>1</sup>, Haoyuan Li<sup>3</sup>, Xiaoling Wei<sup>1,2</sup>, and Tiger H. Tao<sup>1,2,4,5</sup>*  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>University of Chinese Academy of Sciences (UCAS), CHINA,  
<sup>3</sup>Fudan University, CHINA, <sup>4</sup>ShanghaiTech University, CHINA, and  
<sup>5</sup>Shanghai Research Center for Brain Science and Brain-Inspired Intelligence, CHINA
- B4-4521 PIEZOELECTRICALLY AND CAPACITIVELY INTEGRATED WEARABLE DEVICE WITH STRETCHABLE ABILITY FOR MONITORING RAPID CHANGE IN GAIT AND PRECISELY STEP COUNTING ..... 1448**  
*Guo-Hua Feng<sup>1</sup> and Cheng-Yen Chiang<sup>2</sup>*  
<sup>1</sup>National Tsing Hua University, TAIWAN and <sup>2</sup>National Chung Cheng University, TAIWAN
- B4-4531 POLYIMIDE (PI) FLEXIBLE HOLLOW MICRONEEDLE ARRAY PREPARED BASED ON OPTIMIZED DUAL-MOULDING PROCESSES ..... 1452**  
*Yingjie Ren, Junshi Li, Zhongyan Wang, Tingyu Li, Dong Huang, and Zhihong Li*  
*Peking University, CHINA*
- B4-4541 SALT-PERCOLATED, ANTI-DRYING, ANTI-FREEZING AND TRANSPARENT HYDROGELS FOR STRETCHABLE TEMPERATURE AND STRAIN SENSOR ..... 1456**  
*Zixuan Wu<sup>1</sup>, Haojun Ding<sup>1</sup>, Yaoming Wei<sup>1</sup>, Xing Yang<sup>1</sup>, Kai Tao<sup>2</sup>, Zhenyi Li<sup>1</sup>, Wenxi Huang<sup>1</sup>, and Jin Wu<sup>1</sup>*  
<sup>1</sup>Sun Yat-sen University, CHINA and <sup>2</sup>Northwestern Polytechnical University, CHINA
- B5-5491 3D PRINTED DIFFERENTIAL FORCE AND POSITION SENSOR BASED ON LOSSY TRANSMISSION LINES ..... 1460**  
*Martijn Schouten, Parth Patel, Remco Sanders, and Gijs Krijnen*  
*University of Twente, NETHERLANDS*
- B5-5501 A TUNABLE MORPHING POLYELECTROLYTE SYSTEM FOR SMART OCULAR APPLICATIONS ..... 1464**  
*Ansu Sun, Sreepathy Sridhar, Xue Chen, Yifan Li, and Ben B. Xu*  
*Northumbria University, UK*
- B5-5511 FINGER-WORN DENSE PRESSURE-SENSOR ARRAY FOR ARTERIAL PULSE ACQUISITION ..... 1468**  
*Jianzhong Chen<sup>1,2</sup>, Yi Sun<sup>1</sup>, Ke Sun<sup>1</sup>, Rong Zheng<sup>3</sup>, Heng Yang<sup>1</sup>, Yifei Zhong<sup>3</sup>, and Xinxin Li<sup>1,2</sup>*  
<sup>1</sup>Chinese Academy of Sciences (CAS), CHINA, <sup>2</sup>ShanghaiTech University, CHINA, and  
<sup>3</sup>Longhua Hospital, Shanghai University of Traditional Chinese Medicine, CHINA
- B5-5521 OPTIMIZATION OF MOTOR-BASED ROTATIONAL TRIBOELECTRIC NANOGENERATORS (ROTENGs) FOR NEURAL STIMULATION ..... 1472**  
*Minseok Kang, Heejae Shin, Youngjun Cho, Jaeu Park, Jinwoong Jeong, and Sanghoon Lee*  
*Daegu Gyeongbuk Institute of Science and Technology (DGIST), KOREA*
- B5-5531 OPTOGENETIC STIMULATOR WITH  $\mu$ LED-COUPLED OPTICAL FIBER ON FLEXIBLE SUBSTRATE VIA 3D PRINTED MOUNT ..... 1476**  
*Keonghwan Oh<sup>1,2</sup>, Yong-Ak Song<sup>1,2</sup>, and Sohmyung Ha<sup>1,2</sup>*  
<sup>1</sup>New York University, USA and <sup>2</sup>New York University, Abu Dhabi, UAE