PRELIMINARY PROGRAM

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The Executive Committee reserves the right to amend the program if necessary

Sunday, June 3

6:00 pm - 9:00 pm **Registration and Welcome Reception**

Monday, June 4

7:00 am **Breakfast**

7:45 am **Welcome**
Tina Lamers, *Uber ATG, USA*
Mina Rais-Zadeh, University of Michigan, USA

Plenary Presentation I

Session Chair: M. Rais-Zadeh, *University of Michigan, USA*

8:15 am **ENABLING THE NEXT GENERATION OF MEMS TECHNOLOGY**
William Chappell[1], R.H. Olsson III[1], and R.G. Polcawich[1,2]
[1]DARPA, USA and [2]US Army Research Laboratory, USA

Session 1 - Physics of Microfluidics

Session Chair: C. Buie, *Massachusetts Institute of Technology, USA*

9:05 am **PROBING THE FUNDAMENTAL EVAPORATION LIMIT WITH A NANOPOROUS MEMBRANE DEVICE**
Z. Lu[1], K.L. Wilke[1], I. Kinefuchi[2], and E.N. Wang[1]
[1]Massachusetts Institute of Technology, USA and [2]University of Tokyo, JAPAN

9:25 am **A MICROFLUIDIC DEVICE FOR MECHANICAL PROFILING OF HYDROGEL MICROPARTICLES**
Y. Niu and Y. Zhao
Ohio State University, USA

9:45 am **DROPLET MANIPULATION ON A SURFACE WITH ANISOTROPIC WETTABILITY USING IN-PLANE SYMMETRIC CYCLIC VIBRATION**
L. Qi, C. Ruck, and Y. Zhao
Ohio State University, USA

10:05 am **Break and Table Top Exhibits**

Session 2 - Optical Microsystems

Session Chair: J. Gorman, *National Institute of Standards & Technology (NIST), USA*

10:30 am **TUNABLE COLOR REFLECTOR WITH ZERO STATIC POWER**
M. Jafari[1], L.J. Guo[1], and M. Rais-Zadeh[1,2]
[1]*University of Michigan, USA and*
[2]*NASA Jet Propulsion Laboratory (JPL), USA*

10:50 am **A RECONFIGURABLE OPTOFLUIDIC DEVICE FOR ADAPTIVE IMAGING AND POSITION ESTIMATION WITH A WIDE FIELD OF VIEW**
H. Huang and Y. Zhao
Ohio State University, USA

11:10 am **BIOINSPIRED MULTIFUNCTIONAL NANOSTRUCTURES FOR MICRO-OPTICAL IMPLANTS**
V. Narasimhan[1], R.H. Siddique[1], J.O. Lee[1], S. Kumar[1], B. Ndjamen[1], J. Du[2], N. Hong[1], D. Sretavan[2], and H. Choo[1]
[1]*California Institute of Technology, USA and*
[2]*University of California, San Francisco, USA*

11:30 am **Preview of Poster Session 1 Presentations**
Session Chairs: E. Briot, *Qorvo, USA* and J. Chan, *ECS Federal, LLC, USA*

12:00 pm **Networking Lunch**

Poster Session 1

Session Chair: D. Weinstein, *Purdue University, USA*

1:30 pm **Contributed and Late News**
See page 11 for listing of poster presentations

4:00 pm **End of Day**

Tuesday, June 5

7:00 am **Breakfast**

7:10 am - 7:45 am **GUIDANCE TO ACHIEVING SUCCESS WITH NSF PROPOSALS: A PROGRAM DIRECTOR'S VIEW**
Shubhra Gangopadhyay
National Science Foundation (NSF), USA

8:10 am **Announcements**

Plenary Presentation II

Session Chair: A. Herr, *University of California, Berkeley, USA*

8:15 am **TOWARDS INDUSTRIALISATION OF MICROFLUIDIC SAMPLE-TO-ANSWER SOLUTIONS ENABLING POINT-OF-USE TESTING OF BIOSAMPLES: A DESIGN-FOR-MANUFACTURE LED PLATFORM APPROACH**
Jens Ducrée
Dublin City University, Ireland

Session 3 - Wearable Devices

Session Chair: Y.-K. Yoon, *University of Florida, USA*

9:05 am **PRECISION HIGH-BANDWIDTH OUT-OF-PLANE ACCELEROMETER AS CONTACT MICROPHONE FOR BODY-WORN AUSCULTATION DEVICES**
P. Gupta, Y. Jeong, J. Choi, M. Faingold, A. Daruwalla, and F. Ayazi
Georgia Institute of Technology, USA

9:25 am **MICROFABRICATED ELECTRODYNAMIC WIRELESS POWER RECEIVER FOR BIO-IMPLANTS AND WEARABLES**
N. Garraud, D. Alabi, J.D. Varela, D.P. Arnold, and A. Garraud
University of Florida, USA

9:45 am **A WIRELESSLY CONTROLLED FULLY IMPLANTABLE MICROSYSTEM FOR NANO-LITER RESOLUTION INNER EAR DRUG DELIVERY**
F. Forouzandeh[1], A. Alfadhel[1], X. Zhu[2], J.P. Walton[2], D.R. Cormier[1], R.D. Frisina[2], and D.A. Borkholder[1]
[1]Rochester Institute of Technology, USA and
[2]University of South Florida, USA

10:05 am **Break and Table Top Exhibits**

Session 4 - Microsystems for Biological Applications

Session Chair: M. Ziaei, *iSono Health, USA*

10:30 am **MULTISCALE LIQUID METAL THIN-FILM PATTERNING BASED ON SOFT LITHOGRAPHY FOR SKIN-MOUNTABLE, SOFT AND 3D-INTEGRATED BIOLOGICAL MICROSYSTEMS**
M. Kim, C. Kim, H. Alrowais, P. Getz, and O. Brand
Georgia Institute of Technology, USA

10:50 am **ROBUST AND SCALABLE TISSUE-ENGINEERINED ELECTRONIC NERVE INTERFACES (TEENI)**
C.A. Kuliasha, B.S. Spearman, E.W. Atkinson, P. Rustogi, A.S. Furniturewalla, E.A. Nunamaker, K.J. Otto, C.E. Schmidt, and J.W. Judy
University of Florida, USA

11:10 am **One Man's Purpose – A Radio Play**

12:15 pm - 1:45 pm **Networking Lunch**

7:00 pm - 10:00 pm **Tuesday Banquet**

Wednesday, June 6

7:15 am **Breakfast**

7:15 am **Women in MEMS**

8:10 am **Announcements**

Plenary Presentation III

Session Chair: F. Ayazi, *Georgia Institute of Technology, USA*

8:15 am **WIRELESS INTEGRATED MICRO SYSTEMS (WIMS): PAST, PRESENT, FUTURE**
Khalil Najafi
University of Michigan, USA

Session 5 - Levitated, Flying & Running Microrobots

Session Chair: S. Bergbreiter, *University of Maryland, USA*

9:05 am **A SIX-LEGGED MEMS SILICON ROBOT USING MULTICHIP ASSEMBLY**
D.S. Contreras and K.S.J. Pister
University of California, Berkeley, USA

9:25 am **A 3D-PRINTED 1 MG LEGGED MICROROBOT RUNNING AT 15 BODY LENGTHS PER SECOND**
R. St. Pierre[1], W. Gosrich[2], and S. Bergbreiter[1]
[1]University of Maryland, USA and
[2]State University of New York, Buffalo, USA

9:45 am **BATCH-FABRICATION OF DIAMAGNETICALLY LEVITATED MICROROBOTS**
C. Velez[1], R.E. Pelrine[2], A. Wong-Foy[2], and D.P. Arnold[1]
[1]University of Florida, USA and [2]SRI International, USA

10:05 am **TAKEOFF OF A FLYING MICROROBOT WITH COTS SENSOR PAYLOAD USING ELECTROHYDRODYNAMIC THRUST PRODUCED BY SUB-MILLIMETER CORONA DISCHARGE**
D.S. Drew and K.S.J. Pister
University of California, Berkeley, USA

10:25 am **Break and Table Top Exhibits**

Session 6 - Micro-Resonators & Resonator-Based Frequency Combs

Session Chair: A. Duwel, *Charles Stark Draper Laboratory, Inc., USA*

10:50 am **A FERROELECTRIC CAPACITOR (FECAP) BASED UNRELEASED RESONATOR**
Y. He[1], B. Bahr[2], and D. Weinstein[1]
[1]Purdue University, USA and [2]Texas Instruments, USA

11:10 am **PIEZOELECTRIC SINGLE CRYSTAL 6H SILICON CARBIDE MICROELECTROMECHANICAL RESONATORS**
R. Perahia, L.D. Sorenson, J.L. Bregman, L.X. Huang, M.S. White, K.S. Holabird, and D.T. Chang
HRL Laboratories, LLC, USA

11:30 am **FREQUENCY COMB GENERATION IN A NONLINEAR RESONATOR THROUGH MODE COUPLING USING A SINGLE TONE DRIVING SIGNAL**
D.A. Czaplewski[1], S.W. Shaw[2], O. Shoshani[3], M.I. Dykman[4], and D. Lopez[1]
[1]Argonne National Laboratory, USA, [2]Florida Institute of Technology, USA, [3]Ben-Gurion University of the Negev, ISRAEL, and [4]Michigan State University, USA

11:50 am **ULTRA-HIGH Q MONOCRYSTALLINE SILICON CARBIDEDISK RESONATORS ANCHORED UPON A PHONONIC CRYSTAL**
J. Yang, B. Hamelin, S.-D. Ko, and F. Ayazi
Georgia Institute of Technology, USA

12:10 pm - Poster Preview of Poster Session 2 Presentations
Session Chairs: A. Lal, *Cornell University, USA* and M.A. Maher, *SoftMEMS, USA*

12:40 pm - Networking Lunch

Poster Session 2

Session Chair: M. Motiee, *Analog Devices, USA*

2:10 pm - 4:40 pm **Contributed and Late News**
See page 17 for listing of poster presentations

Poster Session 3

Session Chair: Q. Zou, *Avago Technologies, USA*

6:30 pm - **Commercial and Open Posters**
See page 23 for listing of poster presentations

8:00 pm - **Awards Ceremony**

8:15 pm 10:00 pm **RUMP Session**

Thursday, June 7

7:30 am **Breakfast**

8:10 am **Announcements**

Plenary Presentation IV

Session Chair: T. Lamers, *Uber ATG, USA*

8:15 am **TOWARDS INTEGRATED OPTICAL GYROS USING BRILLOUIN LASERS**
Kerry Vahala, Y.H. Lai, M.G. Suh, J. Li, and K.Y. Yang
California Institute of Technology, USA

Session 7 - Late News Frequency-References, -Combs, and -Shifting Sensors

Session Chair: R. Perahia, *HRL Laboratories, USA*

9:05 am **A NEW LOW POWER MEMS DUAL MODE CLOCK WITH PPB STABILITY OVER TEMPERATURE**
L. Comenencia Ortiz[1], H.-K. Kwon[1], J. Rodriguez[1], D.B. Heinz[1], Y. Chen[2], G.D. Vukasin[1], D.D. Shin[1], and T.W. Kenny[1]
[1]Stanford University, USA and [2]Apple, Inc., USA

9:25 am **TOWARDS REAL-TIME MIDDLE ULTRAVIOLET (MUV) LIGHT DETECTION BY BETA GALLIUM OXIDE (β-Ga_2O_3) NEMS OSCILLATOR**
X.-Q. Zheng[1], J. Lee[1], S. Rafique[1,2], M. Rezaul Karim[2], L. Han[1,2], H. Zhao[2], C.A. Zorman[1], and P.X.-L. Feng[1]
[1]Case Western Reserve University, USA and
[2]Ohio State University, USA

9:45 am **SELF-SUSTAINED DUAL-MODE MECHANICAL FREQUENCY COMB SENSORS**
M. Park and A. Ansari
Georgia Institute of Technology, USA

10:05 am **Break and Table Top Exhibits**

Session 8 - Late News Advanced Processes for Bio Applications

Session Chair: A. Lal, *Cornell University, USA*

10:30 am **ENTERIC & 3D-PRINTED HYBRID PACKAGE FOR SAMPLING IN DIGESTIVE REGIONS**
G.E. Banis, L.A. Beardslee, J.M. Stine, and R. Ghodssi
University of Maryland, USA

10:50 am **ROBUST "RIBBED" NANOPOROUS MEMBRANES FOR IMPLANTABLE BIO-ARTIFICIAL KIDNEYS**
B.W. Chui, P. Taheri-Tehrani, N. Wright, J. Ly, and S. Roy
University of California, San Francisco, USA

11:10 am **AN ULTRASONICALLY POWERED IMPLANTABLE MICRO ELECTROLYTIC ABLATION (IMEA) FOR TUMOR NECROSIS**
A.K. Majumdar, S. Islam, and A. Kim
Temple University, USA

11:30 am - 1:00 pm **Networking Lunch**

1:00 pm **Workshop Adjourns**

Poster Session 1

Contributed and Late News

Monday, June 4 1:30 pm – 4:00 pm

Acoustic Transducers and Delay Lines

MP-01 A RADIO FREQUENCY NON-RECIPROCAL NETWORK BASED ON SWITCHED LOW-LOSS ACOUSTIC DELAY LINES
R. Lu, T. Manzaneque, Y. Yang, A. Gao, L. Gao, and S. Gong
University of Illinois, Urbana-Champaign, USA

MP-02 PMUT-BASED HIGH DATA RATE ULTRASONIC WIRELESS COMMUNICATION LINK FOR INTRA-BODY NETWORKS
B. Herrera, E. Demirors, G. Chen, R. Guida, F. Pop, N. Dave, C. Cassella, T. Melodia, and M. Rinaldi
Northeastern University, USA

Bio-Inspiration and Biomedical Devices and Systems

MP-03 ELECTRIC-FIELD INDUCED INCREASE IN PARACELLULAR VASCULAR PERMEABILITY
K.K. Rangharajan, P. Mohanasundaram, J. Morris, E. Akbari, G.B. Spychalski, J.W. Song, and S. Prakash
Ohio State University, USA

MP-04 MULTIMODAL INTELLIGENT TRANSWELL SYSTEM
P. Ramiah Rajasekaran, A. Chapin, D.N. Quan, S.H. Jang, L. Hu, J. Herberholz, W.E. Bentley, and R. Ghodssi
University of Maryland, USA

Characterization, Fabrication and Materials

MP-05 2D AND 3D DOPING OF SILICON MEMS STRUCTURES USING PHOSPHORUS-DOPED POLYSILICON AS A DOPANT SOURCE
P.J. Newby[1], K. Zandi[1], K. Côté[1], J.-P. Richard[1], K.-A. Belarbi[2]
[1]MiQro Innovation Collaborative Centre (C2MI), CANADA, and [2]Teledyne DALSA Semiconductor Inc., CANADA

MP-06 FABRICATION AND SUB-ASSEMBLY OF ELECTROSTATICALLY ACTUATED SILICON NITRIDE MICROSHUTTER ARRAYS
L.H. Oh[1], M.J. Li[2], K. Kim[3], D. Kelly[2], A. Kutyrev[4], S.H. Moseley[2], N.P. Costen[1], and G. Manos[2]
[1]SGT Inc., USA, [2]NASA, USA, [3]ASRC Federal Corp., USA, and [4]University of Maryland, USA

MP-07 **FABRICATION AND CHARACTERIZATION OF 3D PRINTED, 3D MICROELECTRODE ARRAYS WITH SPIN COATED INSULATION AND FUNCTIONAL ELECTROSPUN 3D SCAFFOLDS FOR "DISEASE IN A DISH" AND "ORGAN ON A CHIP" MODELS**
N. Azim[1], T. Ausaf[1], A. Kundu[1], L. Zhai[1], and S. Rajaraman[1,2]
[1]University of Central Florida, USA and
[2]Bridging the Innovation Development Gap (BRIDG), USA

MP-08 **FABRICATION OF SUB-MICRON METAL WIRES FOR HIGH-FREQUENCY LITZ WIRE**
K.J. Russell[1], A. Aydin[2], D.J.D. Carter[1], E. Kim[1], P.H. Lewis[1], L. Sun[2], X. Gong[2], C. Chang[2], R. Gordon[2], and A. Duwel[1]
[1]Charles Stark Draper Laboratory, Inc., USA and
[2]Harvard University, USA

MP-09 **FIRST FATIGUE MEASUREMENTS ON THICK EPI-POLYSILICON MEMS IN ULTRA-CLEAN ENVIRONMENT**
A.L. Alter[1], I.B. Flader[1], Y. Chen[2], L. Comenencia Ortiz[1], D.D. Shin[1], D.B. Heinz[1], and T.W. Kenny[1]
[1]Stanford University, USA and [2]Apple Inc., USA

MP-10 **INCREASING THE THICKNESS AND DEPOSITION RATE OF HIGH-PERFORMANCE ELECTROPLATED CoPt PERMANENT MAGNETS**
Y. Wang, J. Ewing, and D.P. Arnold
University of Florida, USA

MP-11 **MASKLESS 3D MICROFABRICATION OF DRUG-LADEN CAPSULATED MICROSTRUCTURES**
L. Qi, S. Yuan, R.X. Xu, and Y. Zhao
Ohio State University, USA

MP-12 **PRINTING BIOLOGICAL LIQUID ON HYDROPHOBIC 3D ELECTRODES**
S. Chu, M.J. Lerman, J.N. Culver, J.P. Fisher, and R. Ghodssi
University of Maryland, USA

Chemical, Biomedical, and Gas Sensors

MP-13 **A BIODEGRADABLE SENSOR HOUSED IN 3D PRINTED POROUS TUBE FOR IN-SITU SOIL NITRATE DETECTION**
H. Jiang, W. Yu, R. Rahimi, and B. Ziaie
Purdue University, USA

MP-14 **A SUB-PPB-LEVEL INTEGRATED ELECTROCHEMICAL HEAVY METAL ION MICROSENSOR**
H. Jiang[1], C. Yang[2], K. Yang[2], and L. Dong[2]
[1]Iowa State University, USA and [2]Analog Devices Inc., USA

MP-15 **FLEXIBLE IMPEDANCE SENSOR FOR WIRELESS MONITORING OF CATHETER BIOFILMS**
R.C. Huiszoon, J.M. Stine, L.A. Beardslee, P. Ramiah Rajasekaran, W.E. Bentley, and R. Ghodssi
University of Maryland, USA

Micro Robots

MP-16 **FIRST LEAPS OF AN ELECTROSTATIC INCHWORM MOTOR-DRIVEN JUMPING MICROROBOT**
J. Greenspun and K.S.J. Pister
University of California, Berkeley, USA

MP-17 **SOFT ROBOTICS: FLUID-DRIVEN SELF-FOLDING PAPERS**
H.-H. Chun, M. Mohammadifar, and S. Choi
State University of New York, Binghamton, USA

Microfluidics

MP-18 **THE μHAMMER: INVESTIGATING CELLULAR RESPONSE TO IMPACT WITH A HIGH THROUGHPUT MICROFLUIDIC MEMS DEVICE**
L.H.C. Patterson[1], J.L. Walker[1], E. Rodriguez-Mesa[2], K. Shields[2], J.S. Foster[2], M.T.Valentine[1], A.M. Doyle[1], and K.L. Foster[1,2]
[1]University of California, Santa Barbara, USA and
[2]Owl Biomedical, USA

MP-19 **TRANSIENT BIOBATTERIES: MICROFLUIDIC CONTROL FOR PROGRAMMABLE DISSOLUTION**
M. Mohammadifar and S. Choi
State University of New York, Binghamton, USA

MP-20 **VOLTAGE GATED NANOFLUIDIC CHIP FOR PROTEIN CAPTURE, AMPLIFICATION, AND RELEASE**
K.K. Rangharajan and S. Prakash
Ohio State University, USA

Modeling

MP-21 **A FLEXIBLE, MICROFABRICATED IMPEDIMETRIC FLUID TEMPERATURE SENSOR**
A. Baldwin, T. Hudson, E. Yoon, and E. Meng
University of Southern California, USA

MP-22 **EFFECT OF DIELECTRIC LOSS ON THE QUALITY FACTORS OF PIEZOELECTRICALLY DRIVEN LENGTH EXTENSIONAL MODE RESONATORS**

A. Qamar[1], S. Sherrit[2], X.-Q. Zhang[3], J. Lee[3], P.X.-L. Feng[3], and M. Rais-Zadeh[1,2]
[1]University of Michigan, USA, [2]California Institute of Technology, USA, and [3]Case Western Reserve University, USA

Physical and Optical Sensors and Actuators

MP-23 **BROADBAND LONG-WAVELENGTH INFRARED MICROMECHANICAL PHOTOSWITCH FOR ZERO-POWER HUMAN DETECTION**

S. Kang, S.D. Calisgan, Z. Qian, V. Rajaram, N.E. McGruer, and M. Rinaldi
Northeastern University, USA

MP-24 **FBAR-BASED SENSOR FOR WIRELESS RFID AUTHENTICATION OF INTEGRATED CIRCUITS**

A.A. Shkel, M. Barekatain, and E.S. Kim
University of Southern California, USA

MP-25 **THE EFFECT OF BIAS CONDITIONS ON AlGaN/GaN 2DEG HALL PLATES**

K.M. Dowling[1], H.S. Alpert[1], P. Zhang[2], A.N. Ramirez[1], A.S. Yalamarthy[1], H. Köck[3], U. Ausserlechner[3], and D.G. Senesky[1]
[1]Stanford University, USA, [2]Tsinghua University, CHINA, and [3]Infineon Technologies AG, AUSTRIA

MP-26 **TRENCH-ISOLATED BULK-TYPE PRESSURE SENSOR ON SILICON-ON-INSULATOR FOR HIGH-TEMPERATURE AND HIGH-PRESSURE DOWNHOLE APPLICATIONS**

E. Chan[1], D. Lin[1,2,3], L. Lu[1,4], K. Chau[1,2], and M. Wong[1]
[1]Hong Kong University of Science and Technology, HONG KONG, [2]Chinese Academy of Sciences, CHINA, [3]University of Chinese Academy of Sciences, CHINA, and [4]Hong Kong University of Science and Technology

Power Generation and Management

MP-27 **A YARN-BASED BACTERIA-POWERED BATTERY FOR SMART TEXTILES**

Y. Gao, L. Liu, and S. Choi
State University of New York, Binghamton, USA

Resonant Devices

MP-28 **A NANOMECHANICAL IDENTIFICATION TAG TECHNOLOGY FOR TRACEABILITY AND AUTHENTICATION APPLICATIONS**
M. Ramezani, A.R. Newsome, M. Ghatge, F. Zhang, S. Bhunia, and R. Tabrizian
University of Florida, USA

MP-29 **CIRCULARLY POLARIZED MECHANICAL RESONANCES**
P.-L. Yu and S.A. Bhave
Purdue University, USA

MP-30 **ENHANCING MICRO-OVEN POWER AND STIFFNESS IN ENCAPSULATED DEVICES FOR TIMING REFERENCE APPLICATIONS**
L. Comenencia Ortiz[1], D.D. Gerrard[1], I.B. Flader[1], G.D. Vukasin[1], D.B. Heinz[1], J. Rodriguez[1], S. Koppaka[1], D.D. Shin[1], H.-K. Kwon[1], S. Chandorkar[2], and T.W. Kenny[1]
[1]Stanford University, USA and [2]IISc Bangalore, INDIA

MP-31 **HIGH $K_t^2 \cdot Q$ LAMB-WAVE SCALN-ON-SILICON UHF AND SHF RESONATORS**
M. Ghatge[1], V. Felmetsger[2], and R. Tabrizian[1]
[1]University of Florida, USA and [2]OEM Group LLC., USA

Late News

MP-32 **3D PRINTED MICROFLUIDIC SELECTABLE RATIO MIXER PUMP IN 2 MM^3**
G.P. Nordin, H. Gong, and A.T. Woolley
Brigham Young University, USA

MP-33 **A FULLY-INTEGRATED WEARABLE MICROFLUIDIC ACTUATION AND SENSING PLATFORM FOR BIOMARKER ANALYSIS**
H. Lin[1], S. Lin[1], Y. Zhao[1], H. Hojaiji[1], S. Pilehvar[1], S. Thakur[2], M. Karapetian[1], K. King[1], R. Frias[1], and S. Emaminejad[1]
[1]University of California, Los Angeles, USA and [2]University of California, Berkeley, USA

MP-34 **A HIGHLY SENSITIVE IMPEDIMETRIC APTASENSOR FOR WEARABLE DETECTION OF HORMONES**
S. Pilehvar, S. Lin, H. Hojaiji, Y. Zhao, and S. Emaminejad
University of California, Los Angeles, USA

MP-35 **AN ULTRASONICALLY POWERED ACTIVE STENT FOR ENDOVASCULAR DISEASES**

S. Islam and A. Kim
Temple University, USA

MP-36 **ELECTROCHEMICALLY-FUNCTIONALIZED AND VERTICALLY CONDUCTIVE ADHESIVE TAPES FOR WEARABLE SWEAT BIOMARKER MONITORING**

Y. Zhao, H. Hojaiji, and S. Emaminejad
University of California, Los Angeles, USA

MP-37 **HOLLOW FLEXURAL RESONATORS WITH NANOSCALE THICKNESS**

W. Cha, S.M. Nicaise, D.E. Lilley, C. Lin, and I. Bargatin
University of Pennsylvania, USA

MP-38 **IMPLANTABLE, MICROFIBER NEUROELECTRODES FABRICATED OUT OF POLYCRYSTALLINE DIAMOND AND BORON-DOPED DIAMOND**

Y. Guo[1], C.A. Rusinek[2], R. Rechenberg[2], B. Fan[1], M.F. Becker[2], and W. Li[1]
[1]Michigan State University, USA, and [2]Fraunhofer USA, USA

MP-39 **TEMPERATURE-DEPENDENT TRANSIENT BEHAVIOR OF AlGaN/GaN HIGH ELECTRON MOBILITY PRESSURE SENSORS**

C.A. Chapin[1], K.M. Dowling[1], H.-P. Phan[1,2], R. Chen[1], and D.G. Senesky[1]
[1]Stanford University, USA and [2]Griffith University, AUSTRALIA

MP-40 **WHAT IS EFFECTIVE QUALITY FACTOR?**

J.M. Lehto Miller[1], A. Ansari[2], D.B. Heinz[1], Y. Chen[1], I.B. Flader[1], D.D. Shin[1], L.G. Villanueva[3], and T.W. Kenny[1]
[1]Stanford University, USA, [2]Georgia Institute of Technology, USA, and [3]École Polytechnique Fédérale de Lausanne, SWITZERLAND

Poster Session 2

Contributed and Late News

Wednesday, June 6 2:10 pm – 4:40 pm

Acoustic Transducers and Delay Lines

WP-01 **REALIZING RADIO FREQUENCY ACOUSTIC DELAYS AND TRANSVERSAL FILTERING WITH SUB-2 DB INSERTION LOSS AND 10% FRACTIONAL BANDWIDTH**
T. Manzaneque, R. Lu, Y. Yang, and S. Gong
University of Illinois, Urbana-Champaign, USA

WP-02 **SURFACE MICROMACHINED PIEZOELECTRIC MICROMACHINED ULTRASONIC TRANSDUCERS WITH HIGH FILL-FACTOR AND HIGH PERFORMANCE**
Q. Wang, G. Luo, Y. Kusano, and D.A. Horsley
University of California, Davis, USA

Bio-Inspiration and Biomedical Devices and Systems

WP-03 **A TWO-MINUTE ASSAY FOR ELECTRONIC QUANTIFICATION OF ANTIBODIES IN SALIVA ENABLED THROUGH MULTI-FREQUENCY IMPEDANCE CYTOMETRY AND MACHINE LEARNING ANALYSIS**
Z. Lin, J. Sui, P. Xie, K. Ahuja, and M. Javanmard
Rutgers University, USA

WP-04 **MULTI-MODAL MICROELECTRODE ARRAYS FOR THE INVESTIGATION OF PROTEIN ACTIN'S ELECTRO-MECHANOSENSING MECHANISMS TOWARD NEURODEGENERATIVE DISEASE MODELS ON A CHIP**
N. Azim, N. Castaneda, A. Diaz, H. Kang, and S. Rajaraman
University of Central Florida, USA

Characterization, Fabrication and Materials

WP-05 **A SIMPLE FABRICATION METHOD FOR DOUBLY REENTRANT OMNIPHOBIC SURFACES VIA STRESS INDUCED BENDING**
K.L. Wilke, M. Garcia, D.J. Preston, and E.N. Wang
Massachusetts Institute of Technology, USA

WP-06 **ACTIVE SELF-CLEANING SURFACES ON SOLAR MODULES**
D. Sun and K.F. Böhringer
University of Washington, USA

WP-07 **DIRECTED SELF ASSEMBLY OF COLLOIDAL PARTICLES FOR HIGH ASPECT RATIO BANDS**

V. Lochab[1], A. Yee[2], Y. Li[3], M. Yoda[2], A.T. Conlisk[1], and S. Prakash[1]
[1]Ohio State University, USA, [2]Georgia Institute of Technology, USA, and [3]Ibaraki University, JAPAN

WP-08 **MECHANICAL CHARACTERIZATION OF ADDITIVELY MANUFACTURED MICROSTRUCTURES USING A PROCESS INTEGRATED MEMS TENSILE TESTER**

I.S. Ladner[1,2], J.H. Cho[2], D.R. Cayll[2], V.H. Nguyen[1], M.A. Cullinan[2], and S.K. Saha[1]
[1]Lawrence Livermore National Laboratory, USA and [2]University of Texas, Austin, USA

WP-09 **MULTILAYER ALD CERAMIC FILMS FOR ENHANCEMENT OF PARYLENE BARRIER PROPERTIES IN COMPLIANT NEURAL PROBES WITH BONDED CHIPS**

M. Forssell, X.C. Ong, and G.K. Fedder
Carnegie Mellon University, USA

WP-10 **NANOPRINTING OF MINIATURE COMPOUND REFRACTIVE LENSES FOR DESKTOP HARD X-RAY IMAGING**

M. Mirzaeimoghri[1,2], A. Morales[1], C. McCue[2], D.L. DeVoe[2], and H. Wen[1]
[1]National Institute of Health, USA and [2]University of Maryland, USA

WP-11 **NANOSTENCIL FABRICATION WITH DOUBLE EXPOSURE OPTICAL LITHOGRAPHY FOR SCALABLE RESIST-FREE PATTERNING OF METAL ON POLYMERS**

J.S. Katz[1], W. Park[1], M.T. Barako[2], A. Sood[1], M. Asheghi[1], and K.E. Goodson[1]
[1]Stanford University, USA and [2]Northrup Grumman Corporation, USA

WP-12 **NOVEL ROOM TEMPERATURE MICROFLUIDIC DEVICE FABRICATION: A HIGH RESOLUTION, 3D PRINTING APPROACH USING ELECTROHYDRODYNAMIC JET PRINTING**

C. Pannier[1], Z. Wang[2], D. Hoelzle[3], and K. Barton[1]
[1]University of Michigan, USA, [2]University of Notre Dame, USA, and [3]Ohio State University, USA

WP-13 **PRECISE MICROSCALE PATTERNING OF BEAD LESS AND UNIFORM NANOFIBER VIA EXTREME NEAR-FIELD ELECTROSPINNING**

D. Shin, J. Kim, and J. Chang
University of Utah, USA

Chemical, Biomedical, and Gas Sensors

WP-14 **A MICRO COLLECTOR INJECTOR (μCOIN) FOR μGC SYSTEMS**
M. Akbar, N. Nuñovero, R. Hower, C. Zhan, J. Potkay, and E. Zellers
University of Michigan, USA

WP-15 **ENHANCING SELECTIVITY OF CANTILEVER-BASED RESONANT CHEMICAL SENSORS THROUGH TRANSIENT MEASUREMENTS AT ELEVATED TEMPERATURES**
P. Getz[1], C. Carron[1,2], and O. Brand[1]
[1]Georgia Institute of Technology, USA and [2]Harris Corporation, USA

WP-16 **MATTRESS-BASED SWEAT MONITORING FOR HUMAN HEALTH MONITORING AND SMART HOMES**
S. Pavlidis[1,2], M.-Y. Tsai[2], B. Brown[2], D. Jin[2], J.-D. Velilla[3], M. Defranks[3], and E. Vogel[2]
[1]North Carolina State University, USA, [2]Georgia Institute of Technology, USA, and [3]Serta Simmons Bedding, USA

WP-17 **RAPID DIFFERENTIATION OF HOST AND PARASITE EXOSOME VESICLES USING PHOTONIC CRYSTAL BIOSENSOR**
Y. Wang, W. Yuan, M. Kimber, M. Lu, and L. Dong
Iowa State University, USA

Micro Robots

WP-18 **MEMS AIRFOIL WITH INTEGRATED INCHWORM MOTOR AND FORCE SENSOR**
B. Kilberg, D. Contreras, J. Greenspun, H. Gomez, E. Liu, and K.S.J. Pister
University of California, Berkeley, USA

Microfluidics

WP-19 **CMOS COMPATIBLE GHZ ULTRASONIC FRESNEL MICROFLUIDIC ACTUATOR**
A. Ravi, J. Kuo, and A. Lal
Cornell University, USA

Modeling

WP-20 **A 5-BIT DIGITALLY OPERATED MEMS ACCELEROMETER**
A. Abbasalipour[1], V. Kumar[1], R. Jafari[2], and S. Pourkamali[1]
[1]University of Texas, Dallas, USA and [2]Texas A&M University, USA

WP-21 **ON DECOUPLED QUANTIFICATION OF ENERGY DISSIPATION MECHANISMS IN TOROIDAL RING GYROSCOPES**
Y. Wang[1], Y.-W. Lin[1], J. Rodriguez[2], G.D. Vukasin[2], D.D. Shin[2], H.-K. Kwon[2], D.B. Heinz[2],Y. Chen[2], D.D. Gerrard[2], T.W. Kenny[2], and A.M. Shkel[1]
[1]University of California, Irvine, USA and [2]Stanford University, USA

Physical and Optical Sensors and Actuators

WP-22 **CAPACITIVE TRANSDUCER ENHANCEMENT ON QUADRATURE COMPENSATION ELECTRODE OF YAW RATE GYROSCOPE**
P. Shao, E. Canales, and P. Zhu
NXP Semiconductors, USA

WP-23 **FACILE FABRICATION OF LOW-COST PASSIVE WIRELESS HUMIDITY SENSOR FOR SMART PACKAGING VIA ALL-LASER PROCESSING OF METALIZED PAPER**
R. Rahimi[1,2], J. Zhou[1,2], H. Jiang[1,2], T. Soleimani[3], and B. Ziaie[1,2]
[1]Purdue University, USA, [2]Birk Nanotechnology Center, USA, and [3]Michigan State University, USA

WP-24 **NANOSCALE TUNING FORK CAVITY OPTOMECHANICAL TRANSDUCERS WITH DESIGN ENABLED FREQUENCY TUNING AND TEMPERATURE COMPENSATION**
R. Zhang[1], R. Ilic[2], Y. Liu[1], and V. Aksyuk[2]
[1]Worcester Polytechnic Institute, USA, and [2]National Institute of Standards and Technology (NIST), USA

WP-25 **SMARTPHONE BASED FOCUS-FREE MACROSCOPY USING AN ADAPTIVE DROPLET LENS**
H. Huang and Y. Zhao
Ohio State University, USA

WP-26 **TWO-CHANNEL WAKEUP SYSTEM EMPLOYING ALUMINUM NITRIDE BASED MEMS RESONANT ACCELEROMETERS FOR NEAR-ZERO POWER APPLICATIONS**
R.W. Reger, S. Yen, B. Barney, M. Satches, A.I. Young, T. Pluym, M. Wiwi, M.A. Delaney, and B.A. Griffin
Sandia National Laboratories, USA

Power Generation and Management

WP-27 **MICRO BUCKLED BEAM BASED ULTRA-LOW FREQUENCY VIBRATION ENERGY HARVESTER**
R. Xu, H. Akay, and S.-G. Kim
Massachusetts Institute of Technology, USA

Resonant Devices

WP-28 **A SINGLE-CRYSTAL SILICON RESONATOR FOR AM DEMODULATION WITH ADDED SECOND-HARMONIC MODULATION**
M.E. Galanko, Y.-C. Lin, T. Mukherjee, and G.K. Fedder
Carnegie Mellon University, USA

WP-29 **CROSS-SECTIONAL QUASI-LAMÉ MODES IN THIN-FILM PIEZOELECTRIC-ON-SILICON RESONATORS**
S. Shahraini[1], H. Fatemi[2], and R. Abdolvand[1]
[1]University of Central Florida, USA and [2]Qorvo, USA

WP-30 **EIGENMODE OPTIMIZATION AND TOPOLOGICALLY PROTECTED STATES IN MAGNETO-MECHANICAL ULF TRANSMITTER ARRAYS**
I. Grinberg, J. Kim, and G. Bahl
University of Illinois, Urbana-Champaign, USA

WP-31 **PRECISE LOCAL TEMPERATURE MEASUREMENT OF FULLY ENCAPSULATED OVENIZED MEMS DEVICES**
H.-K. Kwon[1], D.B. Heinz[1], D.D. Shin[1], Y. Chen[2], L.C. Ortiz[1], G.D. Vukasin[1], and T.W. Kenny[1]
[1]Stanford University, USA and [2]Apple, Inc., USA

Late News

WP-32 **750 MHZ ZERO-POWER MEMS-BASED WAKE-UP RECEIVER WITH -60 DBM SENSITIVITY**
C. Cassella, M. Assylbekova, W.Z. Zhu, G. Chen, P. Kulik, G. Michetti, N. McGruer, and M. Rinaldi
Northeastern University, USA

WP-33 **A HIGH-MASS, EIGHT-FOLD SYMMETRIC SILICON CARBIDE MEMS GYROSCOPE**
E. Cook[1], M. Tomaino-Iannucci[1], J. Bernstein[1], M. Weinberg[1], J. Choy[1], K. Hobart[2], L. Luna[2], M. Tadjer[2], R. Myers-Ward[2], F. Kub[2], Y. Yang[3], E. Ng[3], I. Flader, Y. Chen[3], and T. Kenny[3]
[1]Draper, USA, [2]U.S. Naval Research Laboratory, USA, and [3]Stanford University, USA

WP-34 **A SILICON OPTOMECHANICAL ACCELEROMETER WITH HIGH BANDWIDTH AND SENSITIVITY**
Y. Bao[1,2], F. Zhou[1], T.W. LeBrun[1], and J.J. Gorman[1]
[1]National Institute of Standards and Technology (NIST), USA and [2]Theiss Research, USA

WP-35 **DEMONSTRATION OF A MICROFABRICATED SELF-OSCILLATING FLUIDIC HEAT ENGINE (SOFHE)**

T. Monin[1,2,3], A. Tessier-Poirier[1], A. Amnache[1], T. Skotnicki[3], S. Monfray[3], F. Formosa[2], and L.G. Fréchette[1]
[1]Universite de Sherbrooke, FRANCE, [2]Université Savoie-Mont-Blanc, FRANCE, and [3]STMicroelectronics, FRANCE

WP-36 **DIRECT MEASUREMENTS OF ANCHOR DAMPING IN PRESSURE-LIMITED RING RESONATORS**

G.D. Vukasin[1], J. Rodriguez[1], L. Comenencia Ortiz[1], G.M. Glaze[1], D.D. Gerrard[1], C.H. Ahn[1], Y. Yang[2], J. Lake[3], R.N. Candler[4], and T.W. Kenny[1]
[1]Stanford University, USA, [2]Integrated Device Technology Incorporated, USA, [3]uBeam, USA, and [4]University of California, Los Angeles, USA

WP-37 **IMAGING GIGAHERTZ DYNAMICS IN MICROMECHANICAL RESONATORS USING ULTRAFAST PULSED LASER INTERFEROMETRY**

L. Shao[1,2], V.J. Gokhale[1,2], J.C. Kuo[3], A. Lal[3], and J.J. Gorman[1]
[1]National Institute of Standards and Technology (NIST), USA, [2]University of Michigan, USA, and [3]Cornell University, USA

WP-38 **KNUDSEN-PUMP-BASED MICRO-HOVERCRAFTS**

J. Cortes, C. Stanczak, and I. Bargatin
University of Pennsylvania, USA

WP-39 **ORIGAMI-ENABLED MICROFLUIDICS**

X. Xie[1], C. Kelly[1], T. Liu[1], R.J. Lang[2], S. Gandolfo[1], Y. Boukataya[3], and C. Livermore[1]
[1]Northeastern University, USA, [2]Lang Origami, USA, and [3]University of Pennsylvania, USA

Poster Session 3

Commercial and Open Poster

Wednesday, June 6 6:30 pm – 8:00 pm

WCP **A RISING JOURNAL FROM NATURE PUBLISH GROUP: MICROSYSTEMS & NANOENGINEERING**

T. Cui1, T. Liu[2], and Y. Zhang[2]

[1]University of Minnesota, USA and

[2]Chinese Academy of Sciences, CHINA

WCP **COMPREHENSIVE MEMS DESIGN ANALYSIS WITH CoventorMP**

R. Jhaveri and S. Breit

Coventor, Inc., USA

WCP **CUSTOMIZED MEMS SOLUTIONS FOR PROOF-OF-PRINCIPLE THROUGH MEDIUM-VOLUME PRODUCTION**

J. Walker[1], H. Van den Vlekkert[2], R. Heideman[2], and A. Leinse[2]

[1]LioniX International, USA and

[2]LioniX International, THE NETHERLANDS

WCP **DWL 66+: MASKLESS LASER LITHOGRAPHY WITH THE ULTIMATE LITHOGRAPHY RESEARCH TOOL**

P. Heyl[1], N. Wijnaendts van Resandt[2], G. Moore[1]

[1]Heidelberg Instruments GmbH, GERMANY and

[2]Heidelberg Instruments, Inc., USA

WCP **FULL OPTICAL CHARACTERIZATION OF MEMS: REAL TIME DYNAMICS AND 3D TOPOGRAPHY**

E. Lawrence[1], D. Oliver[1], M. Heilig[2], and H. Steger[2]

[1]Polytec Inc., USA and [2]Polytec GmbH, GERMANY

WCP **HIGH RELIABLE PZT SPUTTERING TECHNOLOGIES FOR HIGH PERFORMANCE PIEZOMEMS DEVICES**

H. Kobayashi, T. Tsuyuki, I. Kimura, and K. Suu

ULVAC, Inc., JAPAN

WCP **HIGH THROUGHPUT LARGE FEATURE LITHOGRAPHY WITHOUT THE NEED FOR PHOTOMASKS**

J. Sasserath and J. Drakeford

Advanced Micro Patterning, USA

WCP **MOLECULAR VAPOR DEPOSITION (MVD): A VERSATILE, MULTIFUNCTIONAL TECHNOLOGY FOR IMPROVING PERFORMANCE AND RELIABILITY OF MEMS BASED PRODUCTS**

D. Springer, M. Grimes, and K. Atchison

SPTS Technologies, USA

WCP **REVISITING THE SEMINAL BOSCH DEEP REACTIVE ION ETCH PATENT**
S. Dixon-Warren
TechInsights Inc., CANADA

WCP **THE DHM (DIGITAL HOLOGRAPHY MICROSCOPE) AS ADVANCED 4D MEMS ANALYZER AND PROFILOMETER**
Y. Emery, J. Parent, and F. Liu
Lyncee Tec SA, SWITZERLAND and Lyncee Tec SA, USA