

Sunday, June 6, 2010

6:00 p.m.- **Registration and Welcome Reception**
9:00 p.m.

Monday, June 7, 2010

7:00 a.m. **Breakfast**

7:45 a.m. **Welcome and Introduction**
Kimberly L. Turner, *University of California, Santa Barbara, USA*
David J. Monk, *Freescale Semiconductor, Inc., USA*

Invited Speaker I

Session Chair: D.J. Monk, *Freescale Semiconductor, USA*

8:15 a.m. **BOSCH DRIE SHAPING MEMS - HISTORY, APPLICATIONS
AND FUTURE DIRECTIONS** 1
Franz Laermer and A. Urban
Robert Bosch GmbH, GERMANY

Session 1 - Sensors and Actuators

Session Chair: M. Lutz, *SiTime, USA*

9:00 a.m. **COMPOSITE POLYSILICON-PLATINUM LATERAL
NANOELECTROMECHANICAL RELAYS** 7
R. Parsa¹, S. Chong¹, N. Patil¹, K. Akarvardar², J. Provine¹, D. Lee¹, D. Elata³,
S. Mitra¹, H.-S.P. Wong¹, and R.T. Howe¹
¹*Stanford University, USA*, ²*SEMATECH, USA*, and
³*Technion – Israel Institute of Technology, ISRAEL*

9:25 a.m. **3-D MICROMACHINED SPHERICAL SHELL RESONATORS WITH
INTEGRATED ELECTROMAGNETIC AND ELECTROSTATIC
TRANSDUCERS** 11
S.A. Zotov, I.P. Prikhodko, A.A. Trusov, and A.M. Shkel
University of California, Irvine, USA

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PRINTING OF METALLIC MICRO AND NANO STRUCTURES** 15
F. Xiao, T.H. Wu, and P.Y. Chiou
University of California, Los Angeles, USA

10:15 a.m. **Break and Tabletop Exhibits**

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

Session 2 - Microfluidics and Chemical Sensors

Session Chair: H. Jerman, *Coherent, Inc., USA*

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University of California, Berkeley, USA
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L.A. Beardslee¹, K.S. Demirci¹, Y. Luzinova¹, J.J. Su¹, B. Mizaikoff³,
S. Heinrich², F. Josse², and O. Brand¹
¹*Georgia Institute of Technology, USA*, ²*Marquette University, USA*, and
³*University of Ulm, GERMANY*
- 11:30 a.m. **SECOND EIGENMODE OPERATION OF SUSPENDED MICROCHANNEL RESONATORS FOR HIGH PRECISION FLOW-THROUGH MASS SENSING** 27
J. Lee and S.R. Manalis
Massachusetts Institute of Technology, USA
- 12:00 p.m. **Poster/Oral Session – Preview Presentation 1**
Session Chair: S. Bart, *Analog Devices, Inc., USA*
- 1:00 p.m. **Networking Lunch**
- 2:30 p.m. **Poster/Oral Session 1 – Contributed and Late News**
- 4:00 p.m. Session Chairs: D. Arnold, *University of Florida, USA*,
T. Lamers, *Avago Technologies, USA*, and A.M. Shkel, *DARPA, USA*
See page 22 for listing of Contributed Posters and Late News Posters for Session 1
- 4:00 p.m. **Poster/Oral Session 2 – Contributed and Late News**
- 5:30 p.m. Session Chairs: J. Bernstein, *Draper Laboratory, USA* and E. Chow, *Palo Alto Research Center, USA*
See page 26 for listing of Contributed Posters and Late News Posters for Session 2

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Tuesday, June 8, 2010

7:30 a.m. **Breakfast**

Invited Speaker II

Session Chair: M. Shannon, *University of Illinois, Urbana-Champaign, USA*

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S.P. Branagan, N. Contento, and Paul W. Bohn
University of Notre Dame, USA

Session 3 - Surface Fluidics

Session Chair: M. Shannon, *University of Illinois, Urbana-Champaign, USA*

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L.F. Hong and T.R. Pan
University of California, Davis, USA

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University of California, Los Angeles, USA

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K.-H. Chu, R. Xiao, M.E. Alf, K.K. Gleason, and E.N. Wang
Massachusetts Institute of Technology, USA

10:15 a.m. **Break and Tabletop Exhibits**

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Session 4 - Physical Sensors

Session Chair: A. Chavan, *Corventis, Inc., USA*

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	C.A. Gutierrez and E. Meng <i>University of Southern California, USA</i>	
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7:00 p.m. - 9:00 p.m.	Banquet	

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Wednesday, June 9, 2010

7:30 a.m. **Breakfast**

Invited Speaker III

Session Chair: S. Bhawe, *Cornell University, USA*

8:15 a.m. **DEVELOPMENT OF HIGH-PERFORMANCE, HIGH-VOLUME
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Joe Seeger, M. Lim, and S. Nasiri
InvenSense, Inc., USA

Session 5 - Resonators/Filters

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Sandia National Laboratories, USA

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S. Chandorkar, M.A. Hopcroft, B. Kim, and T.W. Kenny*
Stanford University, USA

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A. Rahafrooz and S. Pourkamali
University of Denver, USA

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University of Michigan, USA
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Arizona State University, USA
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M. McCarthy¹, R. Enright^{1,2}, K. Gerasopoulos³, J.N. Culver³, R. Ghodssi³, and E.N. Wang¹
¹*Massachusetts Institute of Technology, USA*, ²*University of Limerick, IRELAND*, and ³*University of Maryland, USA*
- 12:00 p.m. **Networking Lunch**
- 1:30 p.m.

Session 7 - Late News Oral

Session Chair: B. Frazier, *Georgia Institute of Technology, USA*

- 1:30 p.m. **BULK METALLIC GLASS NANOWIRES FOR USE IN DIRECT ALCOHOL FUEL CELL** 90
M. Carmo¹, S. Ding¹, G. Kumar¹, K. Sun², J. Schroers¹, and A.D. Taylor¹
¹*Yale University, USA* and ²*University of Michigan, USA*
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J. Yeom^{1,2} and M.A. Shannon¹
¹*University of Illinois, Urbana-Champaign, USA* and ²*Cbana Labs Inc., USA*
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P. Fletcher, B. Bhatia, Y. Wu, M. Shannon, and W. King
University of Illinois, Urbana-Champaign, USA
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C.C. Chen, Y.C. Chen, K.-Y. Lin, and Y. T. Cheng
National Chiao Tung University, TAIWAN

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Stanford University, USA

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R. Tabrizian, G. Casinovi, and F. Ayazi
Georgia Institute of Technology, USA

3:00 p.m. **Poster/Oral Session – Preview Presentation 2**
- 3:30 p.m. Session Chair: A. Herr, *University of California, Berkeley, USA*

5:00 p.m. **Poster/Oral Session 3 – Contributed Posters**
- 6:30 p.m. Session Chairs: H. Desai, *MEMSIC, USA* and M. Huff, *MEMS Exchange, USA*
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6:30 p.m. **Poster/Oral Session 4 – Commercial & Open Posters**
- 8:00 p.m. Session Chairs: B. Frazier, *Georgia Institute of Technology, USA* and M. Post, *National Research Council of Canada, CANADA*
See page 33 for listing of Commercial & Open Posters for Session 4

8:00 p.m. **Rump Session - The MicroFeud: Come See What the Survey Says**
- 9:30 p.m. Session Chairs: P. Hartwell, *Hewlett-Packard Laboratories, USA* and B. Hardy, *MEMSCAP Inc., USA*

Assemble your "MEMS Families" to guess what are the most popular responses of the MEMS community to the pre-survey. Fun, factoids, beer, and prizes.

NOTES:

Thursday, June 10, 2010

7:30 a.m. **Breakfast**

Invited Speaker IV

Session Chair: S. Casalnuovo, *Sandia National Laboratories, USA*

8:15 a.m. **MICROFLUIDIC DELIVERY OF NANOMEDICINE:
THE LITTLE DROP OF FLUID THAT COULD** 102
Abraham P. Lee, A.T.-H. Hsieh, A. Tovar, and K. Hettiarachchi
University of California, Irvine, USA

Session 8 - Bio Analysis

Session Chair: S. Casalnuovo, *Sandia National Laboratories, USA*

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C. Hou and A.E. Herr
University of California, Berkeley, USA

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J.W. Hines¹, L. Timucin¹, C. Beasley¹, R. Ricks¹, M. McIntyre¹, C. Friedericks¹,
M. Henschke¹, R. Leung¹, M. Diaz-Aguado¹, C. Kitts³, I. Mas³, R. Rasay³,
E. Agasid¹, E. Luzzi¹, K. Ronzano¹, D. Squires¹, and B. Yost¹
¹*NASA Ames Research Center, USA*, ²*University of Texas Medical Branch, USA*, and
³*Santa Clara University, USA*

9:50 a.m. **AUTOMATED PROTEIN IMMUNOBLOTTING BY
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GEL IN TWO-DIMENSIONAL MICRODEVICE** 114
M. He and A.E. Herr
University of California, Berkeley, USA

10:15 a.m. **Break and Tabletop Exhibits**

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Session 9 – Actuators

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- 10:40 a.m. **RADIAL THERMOELECTRIC GENERATOR MODULES FOR IN-LINE POWER GENERATION FROM HOT GAS STREAMS** 118
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University of Florida, USA
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L. Giacchino and Y.-C. Tai
California Institute of Technology, USA
- 11:30 a.m. **NANOENERGETIC SILICON AS A THRUST ACTUATOR FOR JUMPING MICROROBOTS** 126
L.J. Currano¹, W.A. Churaman¹, J. Rajkowski², C.J. Morris¹, and S. Bergbreiter²
¹*U.S. Army Research Laboratory, USA* and ²*University of Maryland, USA*
- 11:55 a.m. **PARAMETER SWEEP STRATEGIES FOR SENSING USING BIFURCATIONS IN MEMS** 130
C.B. Burgner¹, K.L. Turner¹, N.J. Miller², and S.W. Shaw²
¹*University of California, Santa Barbara, USA* and ²*Michigan State University, USA*
- 12:20 p.m. **Networking Lunch and Workshop Adjourns**
- 2:00 p.m.

NOTES:

Poster/Oral Session 1
Contributed and Late News

Monday, June 7
2:30 p.m. - 4:00 p.m.

Bio-Inspiration and Biomedical Devices

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R.D. Averitt¹, and X. Zhang¹
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Case Western Reserve University, USA

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¹*Georgia Institute of Technology, USA and* ²*Sandia National Laboratories, USA*
- P5 **POROUS SILICON RESONATOR FOR SENSITIVE VAPOR DETECTION** 150
Y. Hwang, F. Gao, and R.N. Candler
University of California, Los Angeles, USA

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- P6 **A MICROFLUIDIC PLATFORM FOR THE FLUIDIC ISOLATION AND OBSERVATION OF CELLS CHALLENGED WITH PATHOGENS** 154
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¹*Sandia National Laboratories, USA,* ²*University of Tennessee, USA, and* ³*GAITS, USA*
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University of California, Los Angeles, USA
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Arizona State University, USA

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	¹ Virginia Polytechnic Institute and State University, USA and	
	² Kuwait Institute for Scientific Research, KUWAIT	
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	E.P. Furlani ¹ , H.V. Panchawagh ¹ , and T.L. Sounart ²	
	¹ Eastman Kodak Company, USA and ² Sandia National Laboratories, USA	
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Poster Session 2
Contributed and Late News

Monday, June 7
4:00 p.m. - 5:30 p.m.

Bio-Inspiration and Biomedical Devices

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University of Toronto, CANADA
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Cornell University, USA
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X.Y. Zheng¹, H. Surks², and X. Zhang¹
¹*Boston University, USA* and ²*Tufts Medical Center, USA*

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University of Michigan, USA

Microfluidics

- P40 **A MICROMACHINED CLOG-FREE EJECTOR FOR LONG-TERM RELIABLE HYDROGEL PRINTING** 282
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Poster/Oral Session 4
Commercial & Open Posters
Wednesday, June 9
6:30 p.m. - 8:00 p.m.

Commercial Posters

- CP1 **A NOVEL APPROACH TO MEMS/IC CO-DESIGN AND CO-SIMULATION**
M. Kamon¹, S. Breit¹, G. Lorenz², S. Rouvillois², and J.-F. Chianetta²
¹Coventor, Inc., USA and ²Coventor, Inc., FRANCE
- CP2 **A NOVEL METHOD FOR FILLING AND PLANARIZATION OF HIGH ASPECT RATIO TRENCHES AND VIAS**
R. Trichur, M. Fowler, J. McCutcheon, and M. Daily
Brewer Science, Inc., USA
- CP3 **A UNIVERSAL, HIGH-VACUUM, WAFER-LEVEL, MEMS PACKAGING TECHNOLOGY/SERVICE**
D. Sparks, S. Massoud-Ansari, T. Hubbard, and B. Newman
Integrated Sensing Systems (ISSYS), Inc., USA
- CP4 **BROAD-BANDWIDTH, TIME-DOMAIN VIBRATION MEASUREMENTS ON AN ULTRASOUND TRANSDUCER WITH A NEW ULTRA-HIGH-FREQUENCY LASER DOPPLER VIBROMETER**
J. Foley¹, D.E. Oliver¹, S. Boedecker², G. Siegmund², and C. Rembe²
¹Polytec, Inc., USA and ²Polytec GmbH, GERMANY
- CP5 **CAVITY SOI: ADDED VALUE FOR MEMS MANUFACTURING**
P. Sandow¹, J. Mäkinen², J. Sormunen², M. Palokangas², and J. Karttunen²
¹Okmetic Inc., USA and ²Okmetic Oyj, FINLAND
- CP6 **CO-DESIGN AND SIMULATION TOOLS FOR MEMS BASED SYSTEMS**
M.A. Maher¹ and S. Cases²
¹SoftMEMS LLC, USA and ²SoftMEMS EURL, FRANCE
- CP7 **COMPARISON OF ETCH PROCESSES FOR PATTERNING HIGH ASPECT RATIO AND NANOSCALE FEATURES IN SILICON**
R. Gunn, D. Stephens, and C. Welch
Oxford Instruments Plasma Technology
- CP8 **JOURNAL OF MICROMECHANICS AND MICROENGINEERING: EXPRESS MEMS RESEARCH WITH JMM**
I. Forbes
IOP Publishing, USA
- CP9 **MORE GAIN, LESS PAIN - HOW A LAW FIRM'S TECHNICAL DEPTH IMPROVES THE PATENT PROCESS**
J. Walker and W. Breyer
DeMont & Breyer Patent Law, USA
- CP10 **SINGLE WAFER, "DRY" HF VAPOR OXIDE ETCH TOOL FOR UNIVERSITY AND SMALL R&D FACILITIES**
D. Vestyck, P. Hammond, and D. Vestyck
Primaxx Inc., USA
- CP11 **SPRINGER'S NEW WEB BASED RESEARCH TOOLS**
S. Elliot, O. Ernst, and B. Bishop
Springer, USA

Open Posters

- OP1 **A LOW-POWER BIOMIMETIC ANGULAR ROTATION SENSOR FOR A VESTIBULAR PROSTHESIS**
P. Bhatti¹, P. Challa^{1,2}, and M. McClain³
¹Georgia Institute of Technology, USA ²Emory University, USA, and ³Axion Biosciences
- OP2 **A MICROFLUIDIC SYSTEM FOR VOLUMETRIC MEASUREMENT OF CONDUCTIVE FLUIDS**
H. Yu¹, R.C. Roberts¹, D. Li², K. Xu², and N.C. Tien¹
¹Case Western Reserve University, USA and ²Tianjin University, CHINA
- OP3 **A MICROMACHINED WORKBENCH FOR MEASURING THERMOPOWER OF NANOMATERIALS**
P. Joshi¹, M.P. Chang¹, V. Toutam¹, N.B. Duarte², and S.A. Tadigadapa¹
¹Pennsylvania State University, USA and ²Solar Power Industries, USA
- OP4 **ADVANCED SPUTTER TECHNOLOGY FOR PIEZOELECTRIC ALN FILMS**
V.V. Felmetsger and P.N. Laptev
OEM Group Inc., USA
- OP5 **ALD-METAL UNCOOLED BOLOMETERS**
S. Yoneoka¹, M. Liger², G. Yama², F. Feldmann², R. Schuster², J. Provine¹, R.T. Howe¹, and T.W. Kenny¹
¹Stanford University, USA and
²Robert Bosch LLC Research and Technology Center, USA
- OP6 **ASYMMETRICALLY-GAPPED CANTILEVER -- REVISITED**
Y. Li, Q. Zheng, H. Tu, Y. Hu, and Y. Xu
Wayne State University, USA
- OP7 **CLASS ON A CHIP**
T. Dallas¹, G. Sivakumar¹, G. Ramirez¹, S. Lacouture¹, A. Vijayasai¹, O. Sahil¹, S. Rawool¹, S. Johns², J.A. Nava³, M. Cole¹, L. Sokol⁴, and C. Melhauser⁴
¹Texas Tech University, USA, ²Baylor University, USA, ³Angelo State University, USA, and ⁴University of Colorado, USA
- OP8 **FORMALDEHYDE SENSORS BASED ON SnO₂/NiO NANOCOMPOSITE FILMS PREPARED BY PULSED LASER DEPOSITION**
M.L. Post, J.L. Dunford, J.J. Tunney, X. Du, D. Stewart, J. Weber, and M. Post
National Research Council of Canada, CANADA
- OP9 **FRACTURE STRENGTH OF DEEP REACTIVE ION-ETCHED SILICON WITH A RANGE OF SIDEWALL ROUGHNESSES**
B.M. Huigens¹, G. Beique², F. Modica², and A.M. Fitzgerald¹
¹AM Fitzgerald & Associates, LLC, USA and ²Tegal Corporation, USA
- OP10 **HIGH-ASPECT-RATIO CNT MICRONOZZLES FOR ELECTROSPRAY IONIZATION**
A.M. Konneker¹, N.B. Morrill¹, S.A. Getty², Y. Zheng², R.C. Davis¹, R.R. Vanflett¹, and D.D. Allred¹
¹Brigham Young University, USA and ²Goddard Space Flight Center, USA
- OP11 **LATERAL MERGING CONTINUOUS INKJET**
Y. Xie and C. Ellinger
Eastman Kodak Co., USA

- OP12 **MAGNETIC BEADS MANIPULATION ON A CMOS CHIP**
T. Ishikawa, F. Kaneko, J. Lee, and K. Johguchi
Hiroshima University, JAPAN
- OP14 **MICRO-ELECTROMECHANICAL INDUCTORS FOR POWER CONVERTERS**
Y. Zhang and D.P. Arnold
University of Florida, USA
- OP13 **MICROBALL BEARINGS FOR MICROSYSTEMS INTEGRATION**
M.I. Beyaz, B. Hanrahan, and R. Ghodssi
University of Maryland, USA
- OP15 **MICROFLUIDIC POWER SOURCE BASED ON SUPERLYOPHOBIC POROUS Si MEMBRANES**
V.V. Lifton and S. Simon
mPhase Technologies, Inc., USA
- OP16 **NANOSTRUCTURED PIEZOELECTRIC ACOUSTIC SENSORS**
S.B. Horowitz¹, D. Mathias¹, J.P. Cortes¹, J. Fox¹, M. Sanghadasa², and P. Ashley²
¹*Ducommun, Inc., USA* and ²*US Army - AMRDEC, USA*
- OP17 **PARAMETER SWEEP STRATEGIES FOR SENSING USING BIFURCATIONS IN MEMS**
C.B. Burgner¹, N.J. Miller², K.L. Turner¹, and S.W. Shaw²
¹*University of California, Santa Barbara, USA* and ²*Michigan State University, USA*
- OP18 **PIEZORESISTIVE VS. PIEZOELECTRIC MICROCANTILEVERS FOR CONTACT MODE SCANNING PROBES**
J.C. Doll and B.L. Pruitt
Stanford University, USA
- OP19 **QUARTZ RESONATOR ARRAY FOR CALORIMETRIC (BIO)CHEMICAL SENSING APPLICATIONS**
K. Ren, P. Kao, M.B. Pisani, and S. Tadigadapa
Pennsylvania State University, USA
- OP20 **QUARTZ RESONATOR MEMS ARRAYS FOR ROOM TEMPERATURE INFRARED IMAGING**
M.B. Pisani, K. Ren, P. Kao, and S. Tadigadapa
Pennsylvania State University, USA
- OP21 **THROUGH-SILICON VIAS FORMED BY SOLDER-PUMP PRINTING**
J. Gu, W. Pike, and W. Karl
Imperial College London, UK
- OP22 **TOBACCO MOSAIC VIRUS BIOTEMPLATED NANOSTRUCTURES FOR SMALL-SCALE ENERGY STORAGE APPLICATIONS**
K. Gerasopoulos¹, M. McCarthy², X. Chen¹, J. Culver¹, C. Wang¹, and R. Ghodssi¹
¹*University of Maryland, USA* and ²*Massachusetts Institute of Technology, USA*