

SUNDAY, AUGUST 18

18:00 - WELCOME RECEPTION & REGISTRATION
20:00

MONDAY, AUGUST 19

08:30 **OPENING WELCOME**
Workshop Co-Chairs:
David Ricketts, *North Carolina State University, USA*
S.V. Sreenivasan, *University of Texas, Austin, USA*

09:00 **PLENARY SPEAKER I**
Chair: T. Kenny, *Stanford University, USA*

MAKING CHIPS, THE DIGITAL FUTURE OF MANUFACTURING
Thomas R. Kurfess
Georgia Institute of Technology, USA

10:00 **SHOTGUN ORAL POSTER SESSION A**
Chair: J. Randall, *Zyvex Labs, USA*

10:30 **POSTER SESSION A AND BREAK**

Transformative Fabrication Techniques for Rapid Innovation

P01.A NANOFABRICATION OF CILIATED MICROPILLAR ARRAY FOR LIPID VESICLE ISOLATION
Z. Wang¹, X.J. Zhang¹, and X. Liu²
¹*University of Texas, Austin, USA* and ²*Methodist Hospital Research Institute, USA*

P02.A FABRICATION OF 2-D ULTRASOUND TRANSDUCER ARRAYS WITH THROUGH-SILICON VIAS USING DIRECT WAFER BONDING
B.T. Khuri-Yakub, K.K. Park, A. Nikoozadeh, N. Apte, B.C. Lee, and H.-S. Yoon
Stanford University, USA

P03.A FABRICATION OF 3D LIGHTWEIGHT CELLULAR STRUCTURES WITH NANOSCALE FEATURES BASED ON PROJECTION MICROSTEREOLITHOGRAPHY AND NANOSCALE COATINGS
X. Zheng¹, J. Deotte¹, J. Vericella¹, M. Shusteff¹, E. Duoss¹, J. Kuntz¹, M. Biener¹, T. Weisgraber¹, H. Lee², N. Fang², and C.M. Spadaccini¹
¹*Lawrence Livermore National Laboratory, USA* and ²*Massachusetts Institute of Technology, USA*

- P04.A GAP REDUCTION VIA OXIDATION AND ALD PARTIAL-FILLING FOR HIGH-Q ON CHIP MEMS RESONATORS**
I.F. Rivera and J. Wang
University of South Florida, USA
- P05.A HIGH PERFORMANCE FLEXIBLE 30 μ m THIN CRYSTALLINE SILICON TRANSISTORS**
Y. Zhai¹, L. Mathew², R. Rao², and S.K. Banerjee¹
¹*University of Texas, Austin, USA* and ²*Applied Novel Devices, Inc., USA*
- P06.A MICRO-MASONRY FOR SMALL BATCH PROCESSING OF SUSPENDED MEMS STRUCTURES**
H. Keum¹, Y. Zhang¹, D. Dezest², Z. Yang¹, F. Mathieu², L. Nicu², T. Leïchl  ², and S. Kim¹
¹*University of Illinois at Urbana-Champaign, USA* and ²*Universit   de Toulouse, FRANCE*
- P07.A PROCESS MONITORING IN A UNIVERSITY FACILITY FOR ROBUST SILICON PHOTONICS PROTOTYPING**
R.J. Bojko and K.F. Lawler
University of Washington, USA
- P08.A SCALABLE BONDING OF POLYTETRAFLUOROETHYLENE (ePTFE) NANOFIBROUS MEMBRANES ON MICROSTRUCTURES**
M. Mortazavi and S. Moghaddam
University of Florida, USA
- P09.A TOWARDS ATOMIC-LEVEL PRECISION IN MANUFACTURING MULTILAYER STRUCTURES**
E. Moon¹ and R.F. Pease²
¹*Massachusetts Institute of Technology, USA* and ²*Stanford University, USA*

Top-Down Nanomanufacturing

- P10.A FABRICATION OF LARGE-AREA FLEXIBLE ROLLER-IMPRINT MOLD WITH SUB-30NM-FEATURE LOW-COST MANUFACTURING**
H. Chen, Q. Zhang, and S.Y. Chou
Princeton University, USA
- P11.A HIGH-THROUGHPUT FOCUSED-ION-BEAM LITHOGRAPHY USING DOUBLY CHARGED IONS**
N. Garraud¹, J. Fridmann², B.P. Gila¹, and D.P. Arnold¹
¹*University of Florida, USA* and ²*Raith USA, Inc., USA*
- P12.A NANOSCALE MAGNIFICATION AND SHAPE CONTROL SYSTEM FOR PRECISION OVERLAY IN JET AND FLASH IMPRINT LITHOGRAPHY (J-FIL)**
A. Cherala^{1,2}, P.D. Schumaker², B. Mokaberi³, K. Selinidis², J. Choi², M. Meissl², N. Khusnatdinov², D. LaBrake², and S.V. Sreenivasan^{1,2}
¹*University of Texas, Austin, USA*, ²*Molecular Imprints, Inc., USA*, and ³*Samsung Semiconductor, USA*

P13.A SCALE UP OF ROLL-TO-ROLL NANOIMPRINT LITHOGRAPHY

R.T. Bonnecaze and A. Jain
University of Texas, Austin, USA

Directed Nanomanufacturing

P14.A ATOMIC LAYER DEPOSITION FOR BIOMEDICAL SCIENCE AND ENGINEERING APPLICATIONS

Y.W. Kim, M.T. Meyer, H. Ben-Yoav, M. Gnerlich, and R. Ghodssi
University of Maryland, USA

P15.A RAPID, LOCAL DEPOSITION OF CARBON NANOMATERIALS USING A MICROCOMBUSTOR

S. Prakash, B.M. Kellie, R. Snodgrass, A.C. Silleck, and K. Bellman
Ohio State University, USA

P16.A TMV BIOFABRICATION TECHNOLOGY FOR CHEMICAL/BIOLOGICAL SENSING AND ENERGY STORAGE APPLICATIONS

M. Gnerlich, H. Ben-Yoav, X.Z. Fan, F. Zang, E. Pomerantseva, and R. Ghodssi
University of Maryland, USA

Nano-Precision Instruments and Metrology

P17.A IN-SITU ELECTRO-OPTICAL CHARACTERIZATION AND PROCESSING OF MATERIALS AT THE NANOSCALE

F.I. Allen^{1,2}, E. Kim², S. Ryu², B. Ozdol¹, C.P. Grigoropoulos², and A.M. Minor^{1,2}
¹*Lawrence Berkeley National Laboratory, USA* and ²*University of California, Berkeley, USA*

P18.A SELF-SENSING CONTACT DETECTION FOR ACTUATED SYSTEMS

D. Amin-Shahidi and D.L. Trumper
Massachusetts Institute of Technology, USA

11:45 LUNCH

13:00 INVITED SPEAKER I

Chair: W. Carter, HRL Laboratories, LLC, USA

THE ZERO-MODE WAVEGUIDE AND PACIFIC BIOSCIENCES' SINGLE MOLECULE, REAL-TIME DNA SEQUENCING: TRANSLATION OF DISCOVERY INTO A PRODUCT

Stephen W. Turner
Pacific Biosciences, USA

13:45 **INVITED SPEAKER II**
Chair: T. Halbouty, Pioneer Natural Resources, USA

**HOW COULD PURSUIT OF MOORE'S LAW POSSIBLY STIFLE
INNOVATION AT THE MICRO/NANO-SCALE?**

Martin A. Schmidt
Massachusetts Institute of Technology, USA

14:30 **BREAK**

14:45 **ROUNDTABLE DISCUSSION TOPIC I**
Opportunities for Rapid Innovation
Chair: S. Manning, Pioneer Natural Resources, USA

17:30 - **NON-HOSTED NETWORKING RECEPTION**
19:00

TUESDAY, AUGUST 20

08:45 **OPENING REMARKS**

Workshop Co-Chair: John N. Randall, *Zyvex Labs, USA*

09:00 **PLENARY SPEAKER II**

Chair: S. Chou, Princeton University, USA

COLLABORATIVE EFFORTS IN NEW NANOMANUFACTURING TECHNOLOGY DEVELOPMENT AND COMMERCIALIZATION – A PERSPECTIVE

C. Mark Melliar-Smith

Molecular Imprints, Inc., USA

10:00 **SHOTGUN ORAL POSTER SESSION B**

Chair: D. Ricketts, North Carolina State University, USA

10:30 **POSTER SESSION B AND BREAK**

Transformative Fabrication Techniques for Rapid Innovation

P01.B CURVILINEARLY STIFFENED PANEL USING 3D PRINTING

R.K. Kapania and S.B. Mulani

Virginia Polytechnic Institute and State University, USA

P02.B ELECTRON BEAM LITHOGRAPHY FOR SUB-250nm FEATURE SIZE PROTOTYPING IN MICROBOLOMETERS

G.D. Skidmore, C. Howard, and C. Li

DRS Technologies, USA

P03.B INK-JET TECHNOLOGY: A MICROSCALE MANUFACTURING TOOL FOR HIGH-VALUE NANOSTRUCTURED MATERIALS

D.B. Wallace

MicroFab Technologies, Inc., USA

P04.B NANOPARTICLE ASSEMBLY VIA ELECTROPHORETIC DEPOSITION

M.A. Worsley¹, A.J. Pascall¹, K.T. Sullivan¹, L. Zepeda-Ruiz¹, J.S. Park²,

D. Saintillan², and J.D. Kuntz¹

Lawrence Livermore National Laboratory, USA

P05.B RAPID PROTOTYPING OF EXTREMELY PRECISE NANOIMPRINT TEMPLATES

J.B. Ballard, J.H.G. Owen, E. Fuchs, J.R. Von Ehr, J. Alexander, W. Owen, and J.N. Randall
Zyvex Labs, USA

P06.B REPRODUCIBLE HIGH RESOLUTION ION-BEAM LITHOGRAPHY FOR WAFER-SCALE NANOFABRICATION AND DEVICE PROTOTYPING

A. Linden¹, A. Nadzeyka², and J. Fridmann¹

¹*Raith USA Inc., USA* and ²*Raith GmbH, GERMANY*

P07.B SURFACE NANOTOPOGRAPHY MITIGATION USING HIGH-SPEED PROGRAMMABLE NANOSCALE FILM DEPOSITION

S. Singhal and S.V. Sreenivasan
University of Texas at Austin, USA

P08.B TRANSFER-FREE, WAFER-SCALE FABRICATION OF SUSPENDED GRAPHENE NANOELECTROMECHANICAL STRUCTURES

M.A. Cullinan and J.J. Gorman
National Institute of Standards and Technology, USA

Top-Down Nanomanufacturing

P09.B A FLEXIBLE SYSTEM FOR MICROFLUIDIC PARTICLE LITHOGRAPHY AND REAL-TIME SHAPE IDENTIFICATION

C.R. Oliver¹ and A.J. Hart²
¹*University of Michigan, USA* and ²*Massachusetts Institute of Technology, USA*

P10.B EFFECT OF MOLECULAR WEIGHT CUT-OFF OF CELLULOSE MEMBRANES ON HIGH YIELD PRODUCTION OF GOLD/GOLD SULFIDE NANOPARTICLES

K.T. James¹, M.G. O'Toole¹, D. Patel², A.M. Gobin³, and R.S. Keynton¹
¹*University of Louisville, USA*, ²*Energy Delivery Systems, USA*, and ³*TPC Group, USA*

P11.B OPTICAL NANOPATTERNING BEYOND THE FAR-FIELD DIFFRACTION LIMIT VIA WAVELENGTH-SELECTIVE PHOTOCHEMISTRY

P. Cantu¹, F. Masid¹, A. Majumder¹, T.L. Andrew², and R. Menon¹
¹*University of Utah, USA* and ²*University of Wisconsin, USA*

P12.B SOLUTION-BASED PROCESSING FOR ROLL-TO-ROLL FABRICATION OF NANOSTRUCTURED MATERIALS AND DEVICES

J. Watkins and J. Morse
University of Massachusetts, Amherst, USA

P13.B SUB-30NM ROLLER NANOIMPRINT MANUFACTURING USING HIGH FIDELITY FLEXIBLE MOLD AND APPLICATIONS TO LARGE-AREA HIGH-PERFORMANCE NANOPLASMONIC SENSORS AND SOLAR CELLS

Q. Zhang, H. Chen, and S.Y. Chou
Princeton University, USA

Directed Nanomanufacturing

P14.B A SCALABLE NANOMANUFACTURING PROCESS FOR NANOCOMPOSITE MAGNETIC MICROSTRUCTURES

X. Wen, J.D. Starr, J.S. Andrew, and D.P. Arnold
University of Florida, USA

- P15.B DIRECTED INTEGRATION OF SEMICONDUCTOR NANOWIRES BY LOCALIZED LASER IRRADIATION**
S.-G. Ryu¹, E. Kim¹, D.J. Hwang², J.-H. Yoo¹, O.D. Dubon¹,
A.M. Minor¹, and C.P. Grigoropoulos¹
¹University of California, Berkeley, USA and ²Stony Brook University, USA
- P16.B SCALABLE NANOMANUFACTURING USING SELF-ASSEMBLED BIOLOGICAL TEMPLATES**
M. Rahman, E. Olceroglu, and M. McCarthy
Drexel University, USA
- P17.B UNIFORMITY OF SUB-15 NANOMETER PLASMA ENHANCED ATOMIC LAYER DEPOSITION PLATINUM FILMS**
T.S. English¹, F. Purkl^{2,3}, J. Provine¹, G. Yama², A. Feyh², G. O'Brien², O. Ambacher³,
and T.W. Kenny¹
¹Stanford University, USA, ²Robert Bosch LLC, USA, and ³University of Freiburg, GERMANY

Nano-Precision Instruments and Metrology

- P18.B NON-DESTRUCTIVE QUANTITATIVE METROLOGY OF CARBON NANOTUBES FOR ADVANCED MANUFACTURING**
M. Bedewy¹ and A.J. Hart^{1,2}
¹University of Michigan, USA and ²Massachusetts Institute of Technology, USA
- P19.B SINGLE-CHIP SCANNING PROBE MICROSCOPES**
N. Sarkar^{1,2}, G. Lee^{1,2}, M. Azizi¹, and R.R. Mansour^{1,2}
¹University of Waterloo, CANADA and ²ICSPI Corp., CANADA

Late News

- P20.B THE MIG TECHNOLOGY DEVELOPMENT PROCESS TEMPLATE**
V. Marty¹, D. Ortloff², and D. DiPaola³
¹Hewlett-Packard, USA, ²Process Relations GmbH, GERMANY, and
³DiPaola Consulting LLC, USA
- P21.B TOWARDS CHIP-SCALE ELECTRON BEAMS FOR LITHOGRAPHY**
J. Hwang, V. Ostwal, J. Anumula, Y. Shi, S. Ardanuç, and A. Lal
Cornell University, USA
- P22.B EXPERIMENTAL INVESTIGATION OF FORCE, CONDUCTION AND GROWTH IN NANO-OXIDATION USING SCANNING PROBE MICROSCOPY**
O. Ozcan¹, W. Hu¹, M. Sitti¹, J.A. Bain¹, and D. Ricketts²
¹Carnegie Mellon University, USA and ²North Carolina State University
- P23.B NANOFABRICATION AT SUB-10 NM LENGTH SCALE USING INERT IONS**
B. Singh
Carl Zeiss Microscopy, USA

11:45 LUNCH

13:00 **INVITED SPEAKER III**
Chair: R. Bonnacaze, University of Texas, Austin, USA

**FABRICATION OF LARGE ARRAYS OF ~10 NM FEATURES
FOR PATTERNED MEDIA**

Thomas R. Albrecht
Hitachi Global Storage Technologies, Inc. (HGST), USA

13:45 **INVITED SPEAKER IV**
Chair: A. Linden, Raith USA, Inc., USA

**DESIGN PRINCIPLES FOR PRECISION MOTION CONTROL
IN NANOFABRICATION TOOLS**

David L. Trumper
Massachusetts Institute of Technology, USA

14:30 **BREAK**

14:45 **ROUNDTABLE DISCUSSION TOPIC II**
Tools/Access Needed for Rapid Innovation for Opportunities Identified on Monday
Chair: S.V. Sreenivasan, University of Texas, Austin, USA

17:30 - **WORKSHOP BANQUET**
19:30

WEDNESDAY, AUGUST 21

08:30 **PLENARY SPEAKER III**

Chair: S.V. Sreenivasan, University of Texas, Austin, USA

FORMFACTOR; LESSONS FROM A MEMS STARTUP COMPANY

Benjamin N. Eldridge

FormFactor, Inc., USA

09:30 **INVITED SPEAKER V**

Chair: G. Skidmore, DRS Technologies, USA

**MASKLESS PHOTOLITHOGRAPHY: CHANGING THE GAME
IN MICRO AND NANO MANUFACTURING**

Michael Walsh

LumArray, Inc., USA

10:15 **INVITED SPEAKER VI**

Chair: N. Sarkar, University of Waterloo, CANADA

**TOWARDS WAFER-SCALE MANUFACTURING OF NANODEVICES:
MASSIVELY PARALLEL ETCHING OF NANOSTRUCTURE ARRAYS**

H. Pat Gillis, S.J. Anz, and W.A. Goddard, III

Systine, Inc., USA

11:00 **BREAK**

11:15 **ROUNDTABLE DISCUSSION TOPIC III**

Call to Action - Recommendations to Enable Nanofabrication for Rapid Innovation

Chair: D. Ricketts, North Carolina State University, USA

12:30 **WORKSHOP ADJOURNS**