

# NNT Conference Program Schedule

## December 3-5, 2003

### Boston, Massachusetts

#### Wednesday, December 3, 2003

##### **Commercial Session**

4:00 pm - 7:00 pm

##### **Reception**

6:00 pm - 7:00 pm

#### Thursday, December 4, 2003

##### **Welcome**

8:00 am - 8:10 am

Conference Chair: Christie Marrian, IBM

Program Chair: Stephen Chou, Princeton University

##### **Plenary Session 8:10 am - 10:55 am (Session Chairs: Stephen Chou, Christie Marrian)**

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|--------------------|-----|---|
| 8:10 am - 8:40 am  | PL1 | <b>(Invited) Mechanical transfer techniques in cell engineering</b> , Chris Wilkinson, <i>University of Glasgow</i>   |
| 8:40 am - 9:10 am  | PL2 | <b>(Invited) Nanoimprint and mo(o)re: new initiative in Europe</b> , Helmut Schiff, <i>Laboratory for Micro- and Nanotechnology, Paul Scherrer Institut</i> |
| 9:10 am - 9:40 am  | PL3 | <b>(Invited) New progress of nanoimprint development in Japan</b> , Shinji Matsui, <i>Himeji Institute of Technology</i>                                    |
| 9:40 am - 10:10 am | PL4 | <b>(Invited) Status of step and flash nanoimprint lithography</b> , Grant Willson, <i>University of Texas at Austin</i>                                     |

##### **Break 10:10 am - 10:40 am**

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| 10:40 am - 11:10 am | PL5 | <b>(Invited) Nanoimprint lithography in volume semiconductor manufacturing: what will it take?</b> , Kevin Kemp, <i>International Sematech</i> |
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##### **A. Nanoimprint Masks 11:10 am - 12:10 pm (Session Chairs: Fabian Pease, Heinrick Kurz)**

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|---------------------|----|--|
| 11:10 am - 11:30 am | A1 | <b>Template fabrication for sub-80 nm contact hole patterning using step and flash imprint lithography</b> , Douglas Resnick, David Mancini, Kathleen Gehoski, William Dauksher, Kevin Nordquist, <i>Motorola</i> ; Philip Schumaker, Ian McMackin, <i>Molecular Imprints Inc.</i> |
| 11:30 am - 11:50 am | A2 | <b>A new anti-adhesive coating for nickel stamps</b> , Sunggook Park, Helmut Schiff, Celestino Padeste, Bernhard Schnyder, Rüdiger Kötz, Jens Gobrecht, <i>Paul Scherrer Institut</i>  |
| 11:50 am - 12:10 pm | A3 | <b>Triangle-profiled nanoimprint molds for large-scale production of nano-gratings</b> , Zhaoning Yu, Stephen Y. Chou, <i>Princeton University</i>   |

##### **Lunch on your own 12:10 pm - 1:15 pm**

##### **B. Nanoimprint Tools & Alignments 1:15 pm - 4:00 pm (Session Chairs: Cindy Hanson, C. Sotomayer Torres)**

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| 1:15 pm - 1:45 pm | B1 | <b>(Invited) Interferometric-spatial phase imaging for nanometer-level alignment and gap control</b> , Hank Smith, <i>MIT</i>  |
| 1:45 pm - 2:05 pm | B2 | <b>Photo-nanoimprinter employing active orientation head</b> , H. Hiroshima, M. Komuro, Y. Kurashima, S. Kim, <i>National Institute of Advanced Industrial Science and Technology</i> ; and T. Muneishi, <i>Kyocera</i>  |
| 2:05 pm - 2:25 pm | B3 | <b>In-Situ alignment in UV based nanoimprint</b> , A. Fuchs, B. Vratzov, W. Henschel, H. Kurz, <i>Advanced Microelectronic Center Aachen - AMICA / AMO GmbH</i>  |
| 2:25 pm - 2:45 pm | B4 | <b>Dispensing of low viscosity liquids for step and repeat UV nanoimprint technology</b> , Van Truskett, Jin Choi, Chris Mackay, Ian McMackin, Philip Schumaker, Daniel Babbs, S.V. Sreenivasan, Michael Watts, Norman Schumaker, <i>Molecular Imprints, Inc</i> |
| 2:45 pm - 3:05 pm | B5 | <b>High-resolutions and high throughput commercial nanoimprinters</b> , Hua Tan, Linshu Kong, Mingtao Li, Colby Steere, Lin Hu, Larry Koecher, <i>Nanonex Corporation</i>  |

##### **Break 3:05 pm - 3:20 pm**

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| 3:20 pm - 3:40 pm | B6 | <b>Thermal imprinting stepper with ultrasonic vibration mechanism and rapid temperature control system</b> , H. Kishi, H. Yoshioka, Y. Jianguo, N. Sumiyoshi, H. Goto, <i>Device Nanotech Res. Inst.</i> ; Y. Murakoshi, R. Maeda, <i>Nat. Inst. of Adv. Indust. Sci. &amp; Tech</i> |
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3:40 pm - 4:00 pm B7 **Evaluation of different alkoxysilanes for UV-based step and repeat nanoimprint lithography**, M. Otto, F. Richter, B. Spangenberg, H. Kurz, *Aachen University*; M. Bender, *Advanced Microelectronic Center Aachen*, T. Kliem, *Raith GmbH*

**C. Nanoimprint Materials and Simulations 4:00 pm - 5:10 pm (Session Chairs: Dan Herr, Yoshihiko Hirai)**

4:00 pm - 4:30 pm C1 **(Invited) Simulating the mechanical characteristics of step-and-flash imprint lithography**, Roxann Engelstad, *University of Wisconsin at Madison*

4:30 pm - 4:50 pm C2 **Stabilisation of imprinted pattern after warm embossing by UV curing**, M. Wissen, H. Schultz, N. Bogdanski, H.-C. Sheer, *Univ. of Wuppertal*, Y. Hirai, H. Kikuta, *Osaka Prefecture Univ.*, G. Ahrens, H. Reuther, K. Pfeiffer, *GmbH*, T. Glinsner, *EV Group*

4:50 pm - 5:10 pm C3 **Patterning of a highly UV-transparent and chemically resistant thermoplast, Topas, by nanoimprint lithography**, Theodor Nielsen, Daniel Nilsson, Oliver Geschke, and Anders Kristensen, *Mikroelektronik Centre (MIC), Technical University of Denmark (DTU)*

**Poster Session 5:10 pm - 6:45 pm**

**Wine and Cheese Served**

**Conference Dinner 6:45 pm**

**Friday, December 5, 2003**

**D. Nanoimprint Process 8:00 am - 10:20 am (Session Chairs: Dave Patterson, Lars Montelius)**

8:00 am - 8:20 am D1 **Soft nanoimprint lithography**, E.Roy, D.Decanini, Y.Chen, *Laboratoire de Photonique et de Nanostructures, CNRS*; B. Vratzov, A. Fuchs, *AMICA/AMO*; T. Glinsner, *EV Group*

8:20 am - 8:40 am D2 **Full wafer scale UV based nano-imprinting lithography**, Heon Lee, *Pohang University of Science and Technology*; J.S. Park, J.S. Bae, S-U. Kwak, S. Lee, *NND*

8:40 am - 9:00 am D3 **8" wafers printed by nanoimprint lithography: uniformity and mold deformation**, C. Gourgon, C. Perret, F. Lazzarino, J. Tallal, O. Joubert, *Laboratoire de Photonique et de Nanostructures, CNRS*; R. Pelzer, *CEA-LETI*; S. Landis, *EV Group*

9:00 am - 9:20 am D4 **How to avoid nonuniformity and dynamic defects in hot embossing lithography**, H. Schultz, M. Wissen, N. Bogdanski, H.-C. Scheer, *University of Wuppertal*

9:20 am - 9:40 am D5 **Fabrication of 5 nm line width and 14 nm pitch features by nanoimprint lithography**, Michael D. Austin, Haixiong Ge, Wei Wu, Dan Wasserman, Stephen Lyon, and Stephen Y. Chou, *Princeton University*

9:40 am - 10:00 am D6 **Polymeric structures with definite undercuts prepared by hot embossing**, Nicolas Bogdanski, Hubert Schultz, Matthias Wissen, Hella-C. Sheer, *University of Wuppertal*, Joachim Zajadacz, Klaus Zimmer, *Institute of Surface Modification*

10:00 am - 10:20 am D7 **New template material for high-resolution pattern formation and materials-transfer printing**, Charles D. Schaper, *Stanford University*

**Break 10:20 am - 10:40 am**

**E. Metrology 10:40 am - 12:30 pm (Session Chairs: S.V. Sreenivasan, Hella-Christin Scheer)**

10:40 am - 11:10 am E1 **(Invited) Defect inspection considerations of nanoimprint template**, Neil Richardson, *KLA-Tencor*

11:10 am - 11:30 am E2 **Test structures and metrology for benchmarking nanoimprint lithography techniques**, H.C. Scheer, *University of Wuppertal*, C. Schafer, *EV Group*, G. Grutzner, *Micro Resist Technology GmbH*, U. Behringer, *UBC Microelectronics*

11:30 am - 11:50 am E3 **CD-SAXS: A Metrology for sub-100 nm patterning and processing**, Ronald L. Jones, Tengjiao Hu, Christopher L. Soles, Eric K. Lin, Wen-li Wu, *NIST*

11:50 am - 12:10 pm E4 **Study on shear rate dependency in imprint lithography**, T. Yoshikawa, N. Takagi, T. Kanakugi, Y. Hirai, *Osaka Prefecture University*, H. Schulz, H-C. Scheer, *University of Wuppertal*

12:10 pm - 12:30 pm E5 **Mechanical studies of nanoimprinting: residual stresses in a filled cavity**, Graham L. W. Cross, Barry S. O'Connell, Richard M. Langford, and John B. Pethica, *SFI Nanoscience Lab, Trinity College*

**Lunch on your own 12:30 pm - 1:45 pm**

**F. Nanoimprint Applications 1:45 pm - 4:50 pm (Session Chairs: Shinji Matsui, Yong Chen)**

1:45 pm - 2:15 pm F1 **(Invited) Micro and nanofluidic applications**, Yong Chen, *Centre National de la Recherche Scientifique*

2:15 pm - 2:35 pm	F2	<b>Nanoimprint lithography of polymer micro cavity dye lasers</b> , Daniel Nilsson, Theodore Nielsen and Anders Kristensen, <i>Microelectronic Center, Technical University of Denmark</i>
2:35 pm - 2:55 pm	F3	<b>Surface patterning for motor protein by NIL</b> , Lars Montelius, Richard Bunk, Patrick Carlberg, <i>Lund University</i> ; Alf Månsson, <i>University of Kalmar, Sweden</i>
2:55 pm - 3:15 pm	F4	<b>Fabrication of nano-structures using novel nano/micro contact printing technique</b> , K. Yamada, Y.H. Cho, B.J. Kim, <i>CIRMM, Institute of Industrial Science, University of Tokyo</i>
3:15 pm - 3:35 pm	F5	<b>Size reduction lithography (SRL) and nanoimprint lithography (NIL) for the fabrication of platinum nanocatalysts: a reaction study</b> , J. Grunes, J. Zhu, A. Contreras, Y.K. Choi, J. Bokor, and G.A. Somorjai, <i>UC Berkeley and Lawrence Berkeley National Lab</i>
<b>Break 3:35 pm - 3:50 pm</b>		
3:50 pm - 4:10 pm	F6	<b>Fabrication of micro optical elements on glass surface</b> , Tsubouchi, T. Yamaguchi, K. Yao, S. Kitagawa, <i>Nalux Co</i> ; T. Kanakugi and Y. Hirai, <i>Osaka Prefecture Univ., Mechanical Systems Eng.</i>
4:10 pm - 4:30 pm	F7	<b>Nanoimprint lithography defined cantilevers for integration on CMOS chips</b> , Patrick Carlberg, Sara G Nilsson, Lars Montelius, <i>Lund University</i>
4:30 pm - 4:50 pm	F8	<b>Fabrication of digital drug delivery chip</b> , K. Morimatsu, N. Takagi, <i>Osaka Prefecture University</i> ; H. Hasuda, Y. Ito, Y. Hirai, <i>Kanagawa Academy of Science and Technology</i>

**Poster Sessions Breaks and Thursday 5:10 - 6:45 pm (Session Chairs: Doug Resnick, Peter Crawley)**

**A. Nanoimprint Masks**

- P1 **Fabrication of step and flash imprint lithography templates using a variable shaped beam exposure tool**, Doug J. Resnick, William J. Dauksher, David Mancini, Kevin Nordquist, *Mororola*; Peter Hudek, Dirk Beyer, Tim Groves, Olaf Fortagne, *Leica Microsystems*
- P2 **Fabrication of nano-patterned imprinting stamp based on conventional CMOS recess**, Heon Lee, *Pohang University of Science and Technology*

**B. Nanoimprint Tools & Alignments**

- P3 **Sub-100 nm alignment accuracy in nanoimprint lithography using moiré fringe method**, Nianhua Li, Wei Wu, Stephen Y. Chou, *Princeton University*

**C. Nanoimprint Materials and Simulations**

- P4 **Effect of volumetric shrinkage in nanoimprint lithography**, Chien-Hung Lin, Rongshun Chen, *Institute of Microelectromechanical System, National Tsing Hua University*, Hung-Yin Tsai, *Industrial Technology Research Institute*
- P5 **Simulating fabrication distortions in step-and-flash imprint lithography (SFIL) templates**, L. Zheng, A. Y. Abdo, A. R. Mikkelson, R. L. Engelstad, and E. G. Lovell, *University of Wisconsin-Madison*
- P6 **Controlling imprinting distortions in step and flash imprint lithography templates**, S. D. Schuetter, G. A. Dicks, G. F. Nellis, R. L. Engelstad, E. G. Lovell, and B. F. Schulteis, *University of Wisconsin-Madison*

**D. Nanoimprint Process**

- P7 **Ultrafast planarization of 200 nm period copper grating by pulsed laser**, Bo Cui, Chris Keimel, Zhaoning Yu, Wei Wu, and Stephen Chou, *Princeton University*
- P8 **Pattern uniformity in room-temperature imprint lithography**, P.S. Hong, S.Y. Park, J.Y. Paik and H.H. Lee, *Seoul National University*
- P9 **An analysis of LADI nanostructures**, K. P. Cooper, *Naval Research Lab*, C. Keimel and S. Y. Chou, *Princeton University*
- P10 **Nanoimprinting of high aspect ratio polymer structures**, Proyag Datta, Jost Goettert, Michael C. Murphy, Steven A. Soper, Lin Wang, *Louisiana State University*
- P11 **Fabrication of high aspect ratio, 50 µm deep polymer gratings with smooth sidewalls using nanoimprint lithography**, Shufeng Bai, Haixiong Ge, Qiangfei Xia, Xinyu Huang, and Stephen Y. Chou, *Princeton University*
- P12 **Bi-layer method for room-temperature nanoimprint lithography**, Shinji Matsui, Ken-ichiro Nakamatsu, Keichiro Watanabe, Nad Katsuhiko Tone, *Himeji Institute of Technology*
- P13 **Nano-contact printing technology using h-PDMS stamp**, Jeongdai Jo, Taik-Min Lee, Kwang-Young Kim, and Eung-Sug Lee, *Korea Institute of Machinery and Materials*

P14 **Nanopillars fabricated on 6-inch wafer by high aspect nanoprint technology**, Akihiro Miyauchi, Masahiko Ogino, Takuji Ando, Kosuke Kuwabara, *Hitachi Research Laboratory, Hitachi Ltd.*

#### E. Metrology

P15 **Residual thickness characterization of UV nanoimprinted polymer film using nanoindenter**, J.H. Kim, H.J. Lee, S. G. Ko, S. Hur and J.H. Jeong, *Micro System & Structural Mechanics Group, KIMM (Korea Institute of Machinery & Materials)*

P16 **Recovery of nanoscale indentations in a shape memory polymer**, Brent A. Nelson, William P. King, *Georgia Institute of Technology*, Ken Gall, *University of Colorado*

P17 **Mechanical properties and polymer confinement issues for nanoimprint lithography**, Christopher L. Soles, Ronald L. Jones, Wen-li Wu, Eric K. Lin, *NIST Polymers Division*, Alexei P. Sokolov, *University of Akron*

#### F. Nanoimprint Applications

P18 **Polymer microring resonator biosensor fabricated by nanoimprint**, Chung-Yen Chao and L. Jay Guo, *University of Michigan*

P19 **Site-specific fabrication of nanorod heterostructures: local modification of GaN nanowires using electrochemical dip-pen nanolithography**, Benjamin W. Maynor, Jianye Li, Chenguang Lu, and Jie Liu, *Duke University*

P20 **Fabrication of organic light-emitting diode arrays on plastic substrate by imprinting method**, Chiao-Yang, Chang; Franklin Chau-Nan Hong, *National Cheng Kung University*

P21 **Fabrication of high-quality conductive transparent layer on to the heat-sensitive plastic substrate by adhesive printing method**, Chiao-Yang, Chang; Franklin Chau-Nan Hong, *Department of Chemical Engineering, National Cheng Kung University*

P22 **Direct printing of nanoparticles and spin-on-glasses by offset liquid embossing**, Eric Wilhelm and Joseph Jacobson, *MIT Media Lab*

P23 **Nanoimprint technology of GaInAs/InP circuits based on ballistic junctions**, I. Maximov, P. Carlberg, D. Wallin, H. Q. Xu and L. Montelius, *Lund University*

P24 **Nanoimprint lithography for contact guidance nerve growth experiments**, Patrick Carlberg, Fredrik Johansson, Martin Kanje, Lars Montelius, *Lund University*

P25 **Lift-off by local laser lithography for stamp manufacturing**, Esko Forsén, Anja Boisen, *MIC, Technical University of Denmark*, Patrick Carlberg, Lars Montelius, *Lund University*

P26 **Large area orientation of microphase separation in 21nm period diblock copolymer gratings**, P. Deshpande, L. Zhuang, C. Harrison, D.E. Angelescu, L. Klapp, R.A. Register, P.M. Chaikin, S.Y. Chou, *Princeton University*

P27 **A novel all-optical switch fabricated by nanoimprint lithography**, Allan S.P. Chang, Han Cao, Wei Wu, and Stephen Y. Chou, *Princeton University*

P28 **Fabrication of nanowire cross-bar structure by imprinting lithography**, Gun Young Jung, Sivapackia Ganapathiappan, Douglas A. A. Ohlberg, *Hewlett-Packard Laboratories*

P29 **Nanoscale protein patterning by nanoimprint lithography**, J. Damon Hoff, Larry Cheng, Alan J. Hunt and L. Jay Guo, *University of Michigan*

P30 **Nanodot arrays by nanoimprinting using anodic aluminum oxide template**, M. T Wu, I. C. Leu, F. C. N. Hong, M. H. Hon, *National Cheng Kung University and Kuan Shan University of Technology*

P31 **Redox cycling in nanometer sized interdigitated sensor structures: A case for nanoinprint lithography**, L. Montelius, M. Beck, F. Persson, P. Carlberg and T.G.I Ling, *Lund University*

P32 **Fabrication of subwavelength surface plasmon mirrors by nanoimprint lithography**, Xinya Lei, Bo Cui, Haixiong Ge, and Stephen Y. Chou, *Princeton University*

P33 **3D patterning by means of nanoimprinting and x-ray lithography**, M. Tormen, F. Romanato, L. Businaro, M. Altissimo, Di Fabrizio, *LILIT-NNL (National Nanotechnology Laboratory)*