

Scott T. Retterer

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Nanofabrication Research Laboratory
Center for Nanophase Materials Sciences
Biosciences Division
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Education

University of Illinois, Chicago	Mechanical Engineering	B.S., 2000
Cornell University	Biomedical Engineering	Ph.D., 2005

Professional Experience

2006–present	Research Staff Member, Biosciences Division and Center for Nanophase Materials Sciences, ORNL
2000–present	NSF Graduate Fellow, Cornell University, Ithaca, NY
2005–2006	Postdoctoral Fellow, Oak Ridge Associated Universities/ORNL
2003 – 2004	Microfabrication Consultant/Process Engineer, Center for Innovative Visual Rehabilitation, Boston, MA
1999–2000	Graduate Research Assistant, University of Illinois–Chicago
1999–2000	Branch Engineer Simpson Strong-Tie Company Inc., Addison, IL
1998–1999	Undergraduate Research Assistant, University of Illinois–Chicago
1997–1998	Mechanical Engineering Co-Op, RR Donnelley & Sons, Dwight, IL

Professional and Synergistic Activities

2009	Battelle Multi-Scale Toxicology Initiative
2008–2009	NCI/NIH Review Panel, Innovative Molecular Analysis Technologies, Emerging Technologies, Cancer Sample Preparation
2008–2009	Technologies, Cancer Sample Preparation
2003–2005	Biomedical Engineering Society
2002–2005	Cornell Nanobiotechnology Center
1999	Pi Tau Sigma, Mechanical Engineering Society–President
1998	Tau Beta Pi, Engineering Honors Society

Honors and Awards

2000	University Honors, University of Illinois–Chicago
1999	Harold A. Simon Memorial Award, UIC Mechanical Engineering Department

Publications (Over 50 articles in refereed journals and books).
Full publication list follows CV.

Research Synopsis

1. *Multi-scale fluidic environments for interfacing with biological systems*

This work focuses integrating and assembling nanostructured materials into fluidic networks as a means of controlling the flow of materials, information and energy within and between biological systems. These environments are used as model systems to understand fundamental aspects of cellular communication and proliferation and are being adapted into functional platforms for applied work in microbial screening, controlling the development of complex tissue constructs, and performing high-throughput screening pharmaceuticals.

2. *Nanostructure fabrication and assembly*

Fundamental aspects of bio-inspired nanostructure fabrication and assembly are being explored through a combination of electron beam lithography, chemical etching and patterning, as well as block co-polymer synthesis. The impact of these structures on molecular and optical transport has been a primary focus along with biologically directed assembly of synthetic materials.

Graduate and Postdoctoral Advisors:

Graduate Advisors: Michael S. Isaacson, UC Santa Cruz, Jack Baskin School of Engineering

Postdoctoral Advisor: Mitchell J. Doktycz, ORNL

Thesis Advisor and Postgraduate-Scholar Sponsor:

Students: Brian Sanders, University of Georgia; Jonathan Sutton, University of Delaware, Kevin Ye, University of Pennsylvania, Cristen Petersen, Cornell University

Postdoctoral Scholars: Rajesh Pareta, Wake Forest; Morgan Abney, Engineer/Scientist Lexmark International Inc., Ninell Mortensen (Current), Juan-Pablo Hinestrosa (Current), Meng Lian (Current), Elizabeth Vargis (Current), Prakash Nallathamby (Battelle Memorial Institute), Bernadeta Srijanto, University of Tennessee

Total Graduate Students Advised: 4

Total Postdoctoral Scholars Advised: 8

Publications

Scott T. Retterer, Ph. D.

Center for Nanophase Materials Sciences

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- 1 Addae-Mensah, K. A. *et al.* Cryogenic Etching of Silicon: An Alternative Method for Fabrication of Vertical Microcantilever Master Molds. *Journal of Microelectromechanical Systems* **19**, 64-74 (2010).
- 2 Allison, D. P., Sullivan, C. J., Mortensen, N. P., Retterer, S. T. & Doktycz, M. Bacterial immobilization for imaging by atomic force microscopy. *J Vis Exp*, doi:2880 [pii] 10.3791/2880.
- 3 Bhandari, D., Wells, S. M., Retterer, S. T. & Sepaniak, M. J. Characterization and Detection of Uranyl Ion Sorption on Silver Surfaces Using Surface Enhanced Raman Spectroscopy. *Analytical Chemistry* **81**, 8061-8067 (2009).
- 4 Caggana, M. *et al.* Prototype microfluidic devices for cell fractionation and isolation. *American Journal of Human Genetics* **71**, 375-375 (2002).
- 5 Choi, C. K. *et al.* Surface Charge- and Space-Dependent Transport of Proteins in Crowded Environments of Nanotailored Posts. *Acs Nano* **4**, 3345-3355 (2010).
- 6 Collier, P., Jung, S. Y. & Retterer, S. Towards the smallest chemical reactors: On-demand generation and fusion of femtoliter-volume aqueous droplets. *Abstracts of Papers of the American Chemical Society* **241** (2011).
- 7 Doktycz, M. J., Hildebrand, M., Retterer, S. T. & Allison, D. P. POLY 264- Understanding silica nanostructure formation using natural structures and bio-inspired techniques. *Abstracts of Papers of the American Chemical Society* **234** (2007).
- 8 Edwards, A. N. *et al.* Characterization of cell surface and extracellular matrix remodeling of *Azospirillum brasilense* chemotaxis-like 1 signal transduction pathway mutants by atomic force microscopy. *Fems Microbiology Letters* **314**, 131-139 (2011).
- 9 Fletcher, B. L. *et al.* Effects of ultramicroelectrode dimensions on the electropolymerization of polypyrrole. *Journal of Applied Physics* **105** (2009).
- 10 Fletcher, B. L. *et al.* Actuatable membranes based on polypyrrole-coated vertically aligned carbon nanofibers. *Acs Nano* **2**, 247-254 (2008).
- 11 Folven, E., Scholl, A., Young, A., Retterer, S. T., Boschker, J. E., Tybell, T., Takamura, Y., Grepstad, J. K. Crossover from Spin-Flop Coupling to Collinear Spin Alignment in Antiferromagnetic/Ferromagnetic Nanostructures. *Nano Letters* **12** (5), (2012).
- 12 Fowlkes, J. D. *et al.* Size-selectivity and anomalous subdiffusion of nanoparticles through carbon nanofiber-based membranes. *Nanotechnology* **19** (2008).
- 13 Fowlkes, J. D. *et al.* Molecular transport in a crowded volume created from vertically aligned carbon nanofibres: a fluorescence recovery after photobleaching study. *Nanotechnology* **17**, 5659-5668 (2006).
- 14 Gai, Z., Zhang, X. G., Kravchenko, I. I., Retterer, S. T., Wendelken, J. F. Quenching of Initial Ac Susceptibility in Single-Domain Ni Nanobars. *Physical Review B* **85** 2 (2012).
- 15 Guan, Y. F., Fowlkes, J. D., Retterer, S. T., Simpson, M. L. & Rack, P. D. Nanoscale lithography via electron beam induced deposition. *Nanotechnology* **19** (2008).
- 16 Hatab, N. A. *et al.* ANYL 372-Exploring the effect of gap and density of bowties on surface enhanced Raman scattering. *Abstracts of Papers of the American Chemical Society* **238** (2009).

- 17 Hatab, N. A. *et al.* Free-Standing Optical Gold Bowtie Nanoantenna with Variable Gap Size for Enhanced Raman Spectroscopy. *Nano Letters* **10**, 4952-4955 (2010).
- 18 Hatab, N. A. *et al.* An integrated portable Raman sensor with nanofabricated gold bowtie array substrates for energetics detection. *Analyst* **136**, 1697-1702 (2011).
- 19 Jung, S. Y., Collier, C. P. & Retterer, S. Triggering confined chemical reactions by controlled fusion of individual femtoliter droplets. *Abstracts of Papers of the American Chemical Society* **241** (2011).
- 20 Jung, S. Y., Retterer, S. T. & Collier, C. P. On-demand generation of monodisperse femtolitre droplets by shape-induced shear. *Lab on a Chip* **10**, 2688-2694 (2010).
- 21 Jung, S. Y., Retterer, S. T. & Collier, C. P. Interfacial tension controlled fusion of individual femtolitre droplets and triggering of confined chemical reactions on demand. *Lab on a Chip* **10**, 3373-3376 (2010).
- 22 Karig, D. K. *et al.* Model for biological communication in a nanofabricated cell-mimic driven by stochastic resonance. *Nano Commun Netw* **2**, 39-49, doi:10.1016/j.nancom.2011.03.001.
- 23 Klein, K. L. *et al.* Surface characterization and functionalization of carbon nanofibers. *Journal of Applied Physics* **103** (2008).
- 24 Kumar, A., Mortensen, N. P., Mukherjee, P. P., Retterer, S. T. & Doktycz, M. J. Electric field induced bacterial flocculation of enteroaggregative Escherichia coli 042. *Applied Physics Letters* **98** (2011).
- 25 Mishra, N. N. *et al.* On-chip micro-biosensor for the detection of human CD4(+) cells based on AC impedance and optical analysis. *Biosensors & Bioelectronics* **21**, 696-704 (2005).
- 26 Oran, J. M., Hinde, R. J., Abu Hatab, N., Retterer, S. T. & Sepaniak, M. J. Nanofabricated periodic arrays of silver elliptical discs as SERS substrates. *Journal of Raman Spectroscopy* **39**, 1811-1820 (2008).
- 27 Retterer, S. T., Melechko, A., Hensley, D. K., Simpson, M. L. & Doktycz, M. J. Positional control of catalyst nanoparticles for the synthesis of high density carbon nanofiber arrays. *Carbon* **46**, 1378-1383 (2008).
- 28 Retterer, S. T., Siuti, P., Choi, C. K., Thomas, D. K. & Doktycz, M. J. Development and fabrication of nanoporous silicon-based bioreactors within a microfluidic chip. *Lab on a Chip* **10**, 1174-1181 (2010).
- 29 Retterer, S. T. *et al.* Model neural prostheses with integrated microfluidics: A potential intervention strategy for controlling reactive cell and tissue responses. *Ieee Transactions on Biomedical Engineering* **51**, 2063-2073 (2004).
- 30 Retterer, S. T. *et al.* Constant pressure fluid infusion into rat neocortex from implantable microfluidic devices. *Journal of Neural Engineering* **5**, 385-391 (2008).
- 31 Russo, A. P. *et al.* Direct casting of polymer membranes into microfluidic devices. *Separation Science and Technology* **39**, 2515-2530 (2004).
- 32 Shain, W. *et al.* Controlling cellular reactive responses around neural prosthetic devices using peripheral and local intervention strategies. *Ieee Transactions on Neural Systems and Rehabilitation Engineering* **11**, 186-188 (2003).
- 33 Shin, D. H., Lee, S. H., Choi, C. K. & Retterer, S. The evaporation and wetting dynamics of sessile water droplets on submicron-scale patterned silicon hydrophobic surfaces. *Journal of Micromechanics and Microengineering* **20** (2010).
- 34 Shin, D. H., Lee, S. H., Retterer, S. & Choi, C. K. Evaporation Characteristics of Sessile Droplets on Nano-Patterned Hydrophobic Surfaces. *Journal of Heat Transfer-Transactions of the Asme* **132** (2010).
- 35 Shire, D. B. *et al.* Design and fabrication of an ab-externo retinal prosthesis. *Investigative Ophthalmology & Visual Science* **45**, U380-U380 (2004).

- 36 Siuti, P., Retterer, S. T., Choi, C. K. & Doktycz, M. J. Enzyme Reactions in Nanoporous, Picoliter Volume Containers. *Anal Chem*, **84** (2) (2012).
- 37 Siuti, P., Retterer, S. T. & Doktycz, M. J. Continuous protein production in nanoporous, picolitre volume containers. *Lab on a Chip* **11**, 3523-3529 (2011).
- 38 Spataro, L. *et al.* Dexamethasone treatment reduces astroglia responses to inserted neuroprosthetic devices in rat neocortex. *Experimental Neurology* **194**, 289-300 (2005).
- 39 Srijanto, B. R., Retterer, S. T., Fowlkes, J. D. & Doktycz, M. J. Nanostructured silicon membranes for control of molecular transport. *Journal of Vacuum Science & Technology B* **28**, C6p48-C46p52 (2010).
- 40 Stolee, J. A., Walker, B. N., Pickel, D. L., Retterer, S. & Vertes, A. ANYL 379-Internal energy control in nanophotonic ion production from tailored nanopost arrays. *Abstracts of Papers of the American Chemical Society* **238** (2009).
- 41 Sullivan, C. J., Venkataraman, S., Retterer, S. T., Allison, D. P. & Doktycz, M. J. Comparison of the indentation and elasticity of E-coli and its spheroplasts by AFM. *Ultramicroscopy* **107**, 934-942 (2007).
- 42 Szarowski, D. H. *et al.* Brain responses to micro-machined silicon devices. *Brain Research* **983**, 23-35 (2003).
- 43 Thompson, D., Banerjee, A., Banerjee, P., DeFanti, T. & Retterer, S. Tele-immersive product evaluation: a review and an implementation framework. *Robotics and Computer-Integrated Manufacturing* **16**, 181-190 (2000).
- 44 Walker, B. N., Stolee, J. A., Pickel, D. L., Retterer, S. & Vertes, A. ANYL 378-Nanopost array (NAPA) photonic ion sources for soft laser desorption ionization. *Abstracts of Papers of the American Chemical Society* **238** (2009).
- 45 Walker, B. N., Stolee, J. A., Pickel, D. L., Retterer, S. T. & Vertes, A. Assessment of laser-induced thermal load on silicon nanostructures based on ion desorption yields. *Applied Physics a-Materials Science & Processing* **101**, 539-544 (2010).
- 46 Walker, B. N., Stolee, J. A., Pickel, D. L., Retterer, S. T. & Vertes, A. Tailored Silicon Nanopost Arrays for Resonant Nanophotonic Ion Production. *Journal of Physical Chemistry C* **114**, 4835-4840 (2010).
- 47 Wei, X. *et al.* Grating couplers on porous silicon planar waveguides for sensing applications. *Journal of Applied Physics* **104** (2008).
- 48 Wells, S. M., Retterer, S. D., Oran, J. M. & Sepaniak, M. J. Controllable Nanotabrication of Aggregate-like Nanoparticle Substrates and Evaluation for Surface-Enhanced Raman Spectroscopy. *Acs Nano* **3**, 3845-3853 (2009).
- 49 Williams, S. S. *et al.* High-Resolution PFPE-based Molding Techniques for Nanofabrication of High-Pattern Density, Sub-20 nm Features: A Fundamental Materials Approach. *Nano Letters* **10**, 1421-1428 (2010).
- 50 Wu, M. J., Xiao, F., Johnson-Paben, R. M., Retterer, S. T., Yin, X. L., Neeves, K. B. Single-and Two-Phase Flow in Microfluidic Porous Media Analogs Based on Voronoi Tessellation. *Lab on a Chip* **12** 2 (2012).
- 51 Xiao, K. *et al.* INOR 460-Patterned growth of single-crystal Ag-TCNQF4 nanowires for 1-D electron transport measurement. *Abstracts of Papers of the American Chemical Society* **236** (2008).
- 52 Xiao, K. *et al.* Growth, Patterning, and One-Dimensional Electron -Transport Properties of Self-Assembled Ag-TCNQF(4) Organic Nanowires. *Chemistry of Materials* **21**, 4275-4281 (2009).
- 53 Xiao, K. *et al.* Selective Patterned Growth of Single-Crystal Ag-TCNQ Nanowires for Devices by Vapor-Solid Chemical Reaction. *Advanced Functional Materials* **18**, 3043-3048 (2008).

- 54 Xiao, Y. S., Retterer, S. T., Thomas, D. K., Tao, J. Y. & He, L. Impacts of Surface Morphology on Ion Desorption and Ionization in Desorption Ionization on Porous Silicon (DIOS) Mass Spectrometry. *Journal of Physical Chemistry C* **113**, 3076-3083 (2009).