

Paul L. Stiles Ph.D.

Scientific Curriculum Vitae

stiles.paul@gmail.com

EDUCATION

Postdoctoral Fellow Northwestern University, 2006 – 2007

Surface enhanced raman spectroscopy, Scanning tunneling microscopy, atomic force microscopy, and nanoscale plasmonic surface fabrication

Advisor: Professor Richard P. Van Duyne

Ph.D. Chemical Physics University of North Carolina, Chapel Hill

Thesis: High-Resolution Infrared Spectroscopy of Small Metal Cluster-Adsorbate Systems Using Superfluid Helium Droplet Spectroscopy

Defense Date: Feb. 22, 2006

Advisor: Professor Roger E. Miller

B.S. Chemistry. San Francisco State University, 1999

Research Advisor: Professor Ursula Simonis

PUBLICATIONS, PATENTS, AND PROCEEDINGS

Paul L. Stiles, Saju Nettikadan, Ruby Lam, and Jae-Won Jang. “METHODS FOR FORMING HYDROGELS ON SURFACES AND ARTICLES FORMED THEREBY.” *US Patent Application 20110014436* **July 13, 2010.**

Paul L. Stiles. “Direct deposition of micro- and nanoscale hydrogels using Dip Pen Nanolithography (DPN).” *NATURE METHODS* **7**, I-II (2010). ISSN 1548-7091.

Gary E. Douberly, Paul L. Stiles, Roger E. Miller, Roman Schmied, and Kevin K. Lehmann. “(HCN)(m)-M(n) (M = K, Ca, Sr): Vibrational Excitation Induced Solvation and Desolvation of Dopants in and on Helium Nanodroplets.” *JOURNAL OF PHYSICAL CHEMISTRY A* **114**, 3391–3402 (2010). ISSN 1089-5639.

Jae-Won Jang, Alexander Smetana, and Paul Stiles. “Multiplexed Dip Pen Nanolithography (R) patterning by simple desktop nanolithography platform.” In Becker, H and Wang, W (Editor), *MICROFLUIDICS, BIOMEMS, AND MEDICAL MICROSYSTEMS VIII*, volume 7593 of *Proceedings of SPIE-The International Society for Optical Engineering* (2010). ISBN 978-0-8194-7989-1. ISSN 0277-786X. Conference on Microfluidics, BioMEMS, and Medical Microsystems VIII, San Francisco, CA, JAN 25-27, 2010.

Paul L. Stiles, Gary E. Douberly, and Roger E. Miller. “High-resolution infrared spectroscopy of Mg-HF and Mg-(HF)(2) solvated in helium nanodroplets.” *JOURNAL OF CHEMICAL PHYSICS* **130** (2009). ISSN 0021-9606.

Jae-Won Jang, Alexander Smetana, and Paul Stiles. “Multi-Ink Pattern Generation by Dip-Pen Nanolithography (R).” *SCANNING* **32**, 24–29 (2010). ISSN 0161-0457.

Tom Levesque, Jae-Won Jang, Alexander Smetana, and Paul Stiles. “Dip Pen Nanolithography (R) (DPN (R)) and the Deposition of Multiple Materials in Nanopatterning.” In Ovchinnikov, V (Editor), *FOURTH INTERNATIONAL CONFERENCE ON QUANTUM, NANO AND MICRO TECHNOLOGIES: ICQNM 2010, PROCEEDINGS*, pp. 48–52 (2010). ISBN 978-0-7695-3952-2. 4th International Conference on Quantum, Nano and Micro Technologies, St Maarten, NETH ANTILLES, FEB 10-16, 2010.

Jason R. Haaheim, Omkar A. Nafday, Jae-Won Jung, Paul Stiles, and Tom Levesque. “PHYS 146-Desktop nanofabrication with DPN-generated large-area nanoscale templates.” *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **237** (2009). ISSN 0065-7727.

- Robert J. Stokes, Jennifer A. Dougan, Eleanore Irvine, Jason Haaheim, Paul Stiles, Tom Levesque, and Duncan Graham. "Fabrication of biosensor arrays via DPN, and detection by surface enhanced resonance Raman scattering - art. no. 70320W." In Stockman, MI (Editor), *PLASMONICS: METALLIC NANOSTRUCTURES AND THEIR OPTICAL PROPERTIES VI*, volume 7032 of *PROCEEDINGS OF THE SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS (SPIE)*, p. W320 (2008). ISBN 978-0-8194-7252-6. ISSN 0277-786X. Conference on Plasmonics - Metallic Nanostructures and their Optical Properties VI, San Diego, CA, AUG 10-14, 2008.
- Paul L. Stiles and Richard P. Van Duyne. "PRES 56-Engineering single molecule detection devices." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **235** (2008). ISSN 0065-7727. 235th American-Chemical-Society National Meeting, New Orleans, LA, APR 06-10, 2008.
- Paul L. Stiles, Jon A. Dieringer, Nilain C. Shah, and Richard R. Van Duyne. "Surface-Enhanced Raman Spectroscopy." *ANNUAL REVIEW OF ANALYTICAL CHEMISTRY* **1**, 601–626 (2008). ISSN 1936-1327.
- Jeremy M. Merritt, Gary E. Douberly, Paul L. Stiles, and Roger E. Miller. "Infrared spectroscopy of prereactive aluminum-, gallium-, and indium-HCN entrance channel complexes solvated in helium nanodroplets." *JOURNAL OF PHYSICAL CHEMISTRY A* **111**, 12304–12316 (2007). ISSN 1089-5639.
- Paul L. Stiles and Roger E. Miller. "High-resolution infrared spectroscopy of HCN-Ag- n ($n=1-4$) complexes solvated in superfluid helium droplets." *JOURNAL OF PHYSICAL CHEMISTRY A* **111**, 7382–7390 (2007). ISSN 1089-5639.
- Paul L. Stiles and Roger E. Miller. "Structures and bonding nature of small monoligated copper clusters (HCN-Cu- n , $n=1-3$) through high-resolution infrared spectroscopy and theory." *JOURNAL OF PHYSICAL CHEMISTRY A* **110**, 10225–10235 (2006). ISSN 1089-5639.
- PL Stiles and RE Miller. "High-resolution infrared spectroscopy of HCN-Zn- n ($n=1-4$) clusters: Structure determination and comparisons with theory." *JOURNAL OF PHYSICAL CHEMISTRY A* **110**, 5620–5628 (2006). ISSN 1089-5639.
- M. Y. Choi, G. E. Douberly, T. M. Falconer, W. K. Lewis, C. M. Lindsay, J. M. Merritt, P. L. Stiles, and R. E. Miller. "Infrared spectroscopy of helium nanodroplets: novel methods for physics and chemistry." *INTERNATIONAL REVIEWS IN PHYSICAL CHEMISTRY* **25**, 15–75 (2006). ISSN 0144-235X.
- CM Lindsay, P Stiles, JM Merritt, WK Lewis, GE Douberly, and RE Miller. "Liquid helium droplets: 0.4 Kelvin nanoscale test tubes." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **228**, 178–PHYS (2004). ISSN 0065-7727. 228th National Meeting of the American-Chemical-Society, Philadelphia, PA, AUG 22-26, 2004.
- CM Lindsay, PL Stiles, JM Merritt, WK Lewis, GE Douberly, and RE Miller. "Liquid helium droplets: 0.4 Kelvin nanoscale test tubes." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **228**, 012–AEI (2004). ISSN 0065-7727. 228th National Meeting of the American-Chemical-Society, Philadelphia, PA, AUG 22-26, 2004.
- PL Stiles, GE Douberly, JM Merritt, WK Lewis, CM Lindsay, and RE Miller. "Superfluid helium droplet spectroscopy: Chemistry at ultra-low temperatures." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **228**, 588–PHYS (2004). ISSN 0065-7727. 228th National Meeting of the American-Chemical-Society, Philadelphia, PA, AUG 22-26, 2004.
- PL Stiles, DT Moore, and RE Miller. "Structures of HCN-Mg- n ($n=2-6$) complexes from rotationally resolved vibrational spectroscopy and ab initio theory." *JOURNAL OF CHEMICAL PHYSICS* **121**, 3130–3142 (2004). ISSN 0021-9606.
- PL Stiles, DT Moore, and RE Miller. "Infrared spectroscopy of the isomers of magnesium-HCN formed in helium nanodroplets: Comparisons with ab initio calculations." *JOURNAL OF CHEMICAL PHYSICS* **118**, 7873–7881 (2003). ISSN 0021-9606.

- PL Stiles, K Nauta, and RE Miller. "Dipole moments of molecules solvated in helium nanodroplets." *PHYSICAL REVIEW LETTERS* **90** (2003). ISSN 0031-9007.
- M Vermathen, P Stiles, SJ Bachofer, and U Simonis. "Investigations of monofluoro-substituted benzoates at the tetradecyltrimethylammonium micellar interface." *LANGMUIR* **18**, 1030–1042 (2002). ISSN 0743-7463. 216th National Meeting of the American-Chemical-Society, BOSTON, MA, AUG 21-27, 1998.
- RE Miller, K Nauta, D Moore, and P Stiles. "Molecular orientation in liquid helium nanodroplets studied by high resolution infrared laser spectroscopy." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **222**, 358–PHYS (2001). ISSN 0065-7727.
- K Nauta, DT Moore, PL Stiles, and RE Miller. "Probing the structure of metal cluster-adsorbate systems with high-resolution infrared spectroscopy." *SCIENCE* **292**, 481–484 (2001). ISSN 0036-8075.
- SJ Bachofer, U Simonis, and P Stiles. "Effects of ortho substituents on the formation of cationic TTA plus benzoate micelles." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **219**, 268–COLL (2000). ISSN 0065-7727.
- P Stiles, K Skidmore, and U Simonis. "NMR studies to investigate the electronic structure of low-spin iron(III) porphyrins." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **219**, 551–INOR (2000). ISSN 0065-7727.
- J Marquez, K Skidmore, JB Luzar, PL Stiles, and U Simonis. "Advances of paramagnetic NMR spectroscopy for probing the electronic structure of model hemes." *JOURNAL OF INORGANIC BIOCHEMISTRY* **74**, 298 (1999). ISSN 0162-0134.
- JB Luzar, KM Skidmore, PL Stiles, and U Simonis. "Importance of substituent effects probed by model heme complexes." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **216**, 376–INOR (1998). ISSN 0065-7727.
- PL Stiles, K Skidmore, JB Luzar, and U Simonis. "Importance of substituent effects in modulating the NMR resonance patterns of model heme complexes." *ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY* **216**, 019–PRES (1998). ISSN 0065-7727.

RESEARCH AND PROFESSIONAL EXPERIENCE

Business Development Manager NanoInk, Ink, 2007 – Present

Identified new technology markets that NanoInk's products have unique solutions too. Restructured divisions sales and marketing message to speak to the emerging field of biomaterials and cell engineering. Established an internal training program for understanding the competition. Focused the instrument sales division to fewer, but larger, markets. Primary inventor of two patents that have since become the cornerstones for a new division at NanoInk

Senior Sales Engineer NanoInk, Ink, 2007 – 2009

Discovered emerging applications for Nanoink's technology and provided technical sales support to North America's sales team and world-wide distributors

Founder MarketTurbulence.com, 2005 – 2007

Founded an online company dedicated to the sale of third-party add-ons to various stocks and commodities technical analysis software packages. Customer demand led to the inclusion of paid services such as custom programming, market advice, and technical analysis webinars.

TEACHING EXPERIENCE

Interim Research Advisor, University of North Carolina, Chapel Hill 2005 – 2006

Performed and guided research for a full year after the death of Professor Miller leading to multiple publications for myself and subordinate lab members

Teaching assistant, University of North Carolina, Chapel Hill 2000-2001.

Trained advanced undergraduate students in the use of computer software to model chemical systems. Instructed and supervised a light scattering experiment for advanced chemistry undergraduates.

Teaching assistant, San Francisco State University 1999-2000.

Taught freshman chemistry laboratory. Lectured two hours per week and prepared and graded laboratory exams, graded laboratory reports and notebooks.

HONORS AND AWARDS

Venable Fellowship, UNC 2000

One of three graduate students awarded \$5000 out of a pool of all chemistry graduate school applicants to the University of North Carolina, Chapel Hill Department of Chemistry

Beckman Scholar 1998-1999

One of 120 undergraduates in chemistry or biology awarded \$17,600 out of a nation-wide pool of applicants. Award given to outstanding undergraduates while attending universities that have established excellence in undergraduate research

Hypercube Scholarship, SFSU 1998

Awarded by Hypercube, Inc. to one selected undergraduate in the Department of Chemistry at San Francisco State University. This award was given to the undergraduate student with the most outstanding academic record

Achievement Award, SFSU 1998

This award is presented by the San Francisco State Department of Chemistry to one outstanding undergraduate researcher

PRESENTATIONS

Gordon Research Conference Biointerface Science

Les Diablerets, Switzerland September 5 – 10, 2010

Contributed Poster, "Single Cell Drug Delivery using Micro and Nanoscale Hydrogels"

Gordon Research Conference Biomaterials: Biocompatibility and Tissue Engineering

Holderness, NH July 19 – 24, 2009

Contributed Poster, "Direct deposition of micro and nanoscale hydrogels"

Departmental Seminar Stevens Institute

Hoboken, NJ October 21, 2009

Invited Talk, "Tip-based lithography: New applications and markets"

ICN+T 2008 Keystone, Colorado, July 21, 2008

Invited Talk, "Massively parallel direct depositions using 2D tip arrays"

Pacificchem 2005 Honolulu, HI, December 15, 2005

Invited Talk, "Building large metal clusters one atom at a time"

Gordon Research Conference. Aussois, France, 2004

Contributed poster, "High Resolution Infrared Spectroscopy of Adsorbate-Metal Cluster Systems in Superfluid Helium Droplets."

60th Int. Symposium on Molecular Spectroscopy. Columbus, OH, 2005.

Contributed Talk, "Chemistry at 0.4 Kelvin."

American Chemical Society National Meeting. Philadelphia, PA, 2004

Contributed talk, "High Resolution Infrared Spectroscopy of Adsorbate-Metal Cluster Systems in Superfluid Helium Droplets."

- 59th Int. Symposium on Molecular Spectroscopy.** Columbus, OH, 2004.
Contributed Talk, "Infrared Spectroscopy of Three Adenine-Magnesium Isomers in Superfluid Helium Droplets."
- Department of Chemistry, UNC Chapel Hill, NC, 2004.**
Contributed Talk, "Small Gold Clusters: When is gold not noble?"
- 58th Int. Symposium on Molecular Spectroscopy.** Columbus, OH, 2003.
Contributed Talk, "Vibrational Red Shifts of HCN Adsorbed on Small Neutral Copper Clusters in Superfluid Helium Droplets."
- 57th Int. Symposium on Molecular Spectroscopy.** Columbus, OH, 2002.
Contributed Talk, "Experimental and Theoretical Study of HCN Complexed to Small Magnesium Clusters."
- 57th Int. Symposium on Molecular Spectroscopy.** Columbus, OH, 2002.
Contributed Talk, "High Resolution Infrared Spectroscopy of HCN-Zn_n Clusters."
- 56th Int. Symposium on Molecular Spectroscopy.** Columbus, OH, 2002.
Contributed Talk, "Metal Cluster Formation in Helium Nanodroplets."
- 56th Int. Symposium on Molecular Spectroscopy.** Columbus, OH, 2002.
Contributed Talk, "High Resolution Infrared Spectroscopy of HCN-Mg_n Clusters."
- 4th Annual Beckman Scholars Symposium.** Irvine, CA, 2002.
Invited Talk, "Superfluid Helium Droplets: The Ideal Spectroscopic Medium."
- First Annual Beckman Scholars Symposium.** Irvine, CA, 1999.
Invited poster, "Structure of Ortho and Para-substituted Tetraphenylporphyrins, Determined by NMR Spectroscopy."
- American Chemical Society National Meeting.** Boston, Mass, 1998.
Contributed poster, "Probing the Structure of Model Heme Complexes Through NMR Spectroscopy."

LABORATORY/COMPUTER SKILLS

- ◇ **Scanning Probe Lithography** Expert in the tip-based lithography method commonly known as Dip Pen Nanolithography (DPN). Particular expertise in depositing liquid biomaterials and polymers.
- ◇ **Scanning Probe Microscopy** Design, construction, and operation of scanning tunneling microscopes (room temperature and low temperature), atomic force microscopes, and tip-enhanced Raman methods associated with both SPM techniques
- ◇ **High-resolution infrared spectroscopy.** Extensive experience in CW infrared lasers such as F-Center, diode and PPLN-OPO lasers. Experienced in single and double resonance experiments.
- ◇ **High and Ultrahigh vacuum.** Operation, maintenance, design and construction.
- ◇ **Molecular beams.** Expertise in state-of-the-art molecular beam techniques and their detection with liquid helium cooled bolometers and mass spectrometers.
- ◇ **Cryogenic techniques.** Design and operation of instruments requiring cryogenic temperatures.
- ◇ **Construction/Design.** Corel Draw, basic machining skills, soldering, basic electronics.
- ◇ **Quantum chemistry.** Thorough knowledge of Gaussian 03 and Molpro with particular expertise in transition metal clusters.
- ◇ **Code.** C/C++, Fortran, UNIX/Linux, LabVIEW
- ◇ **Productivity Software.** Origin, Mathematica, L^AT_EX, Word, Excel, Powerpoint, etc.