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## EDUCATION

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University of Texas at Austin, Ph.D., Condensed Matter Physics, December 2002

University of Texas at Austin, M.A., Condensed Matter Physics, December 1999

University of Texas at Austin, B.S., Physics, May 1996

## EXPERIENCE

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### *NIH NRSA Post-Doctoral Research Fellow*

September 2003 – Present

My primary interest is to understand how the diversity of conformation and structure in complex molecules and materials contribute to and modify their function. Single molecule spectroscopy, and specifically, time-correlated single photon counting (TCSPC) with femto- and picosecond pulsed lasers allow one to observe these molecules as they thermally fluctuate through their conformational states. Both bulk and single molecule fluorescence, rotational anisotropy, and Stokes shift provide detail about molecular motions due to solvation, ligand-binding, and protein folding/fluctuations. These experiments make use of thoughtful fluorescent labeling schemes and micro- and nanofluidics for confinement of molecules to the microscope confocal volume without hindering natural behavior. I have made the first implementation of hidden Markov model (HMM) analysis on photon streams to maximize use of the information provided. See <http://talaga.rutgers.edu>.

### **Rutgers, the State University of New Jersey**

Piscataway, NJ

### *Post-Doctoral Research Associate*

February 2003 – September 2003

I developed electronic sensing techniques for biological discrimination without the need for chemical or physical sample alteration. Microfluidic tectonics was used to create novel parallel-plate devices for dielectric spectroscopy of biological materials (e.g., DNA, proteins, and E. coli cells) over the range 0.05-40 GHz. Other research was aimed at multi-analyte detection for binding assays of molecular and cellular biological materials using the Coulter resistive pulse technique. See <http://sohnlab.me.berkeley.edu>.

### **Princeton University**

Princeton, NJ

### *Graduate Research Assistant*

January 1997 – January 2003

Yttrium and lanthanum were discovered in 1996 to transition from a metallic mirror to a transparent insulator upon hydrogenation to the trihydride phase (YH<sub>3</sub> and LaH<sub>3</sub>). I have looked into steric effects upon this transition by substituting isoelectronic scandium for yttrium. Scandium maximally forms dihydride (ScH<sub>2</sub>), and therefore, does not exhibit this transition. My experience includes ultra-high vacuum (UHV), electron beam, thermal, and sputtering film deposition, optical spectroscopy, SQUID magnetometry, electronic transport measurements, NMR, AFM, SEM, x-ray diffraction, iodometric titration, solid-state reaction, and thermal gravimetric analysis (TGA). A pdf of my dissertation, "Steric Effects in the Metallic-Mirror to Transparent Insulator Transition of YH<sub>x</sub>" can be downloaded at <http://www.themessinas.net/dissertation.pdf>.

### **The University of Texas at Austin**

Austin, TX

### *Semiconductor Industry Intern*

June 1997 – April 2002

I conducted research as an intern for the International 300mm Initiative (I300I) and International Sematech (ISMT) in parallel with my dissertation studies. These companies are consortia from the semiconductor industry to eliminate cost-bearing and technological obstacles within the industry. Research included analysis of production capability of 300 mm silicon wafers and metrology tools as compared to state-of-the-art 200 mm technology, developing mathematical models for the International Technology Roadmap for Semiconductors (ITRS) Starting Materials division, and thermal stability and wet etch capability of high- $\kappa$  dielectric materials (ZrO<sub>2</sub> and HfO<sub>2</sub>) to replace SiO<sub>x</sub>. Wet etch studies enabled ISMT to file for a patent on the film removal process. The techniques used include FTIR, ellipsometry, ion implantation, and surface particle and flatness scanners. See <http://www.sematech.org>.

### **International Sematech/I300I**

Austin, TX

*Contract Engineer*

July 2000 – December 2001

Designed, constructed, and used a chemical vapor deposition (CVD) system for growth of carbon nanotubes (CNTs). CNTs were grown using a precursor catalyst method, and analyzed with scanning electron microscopy (SEM). Growth conditions were tailored to obtain single, straight CNT on an ultrasensitive crystal silicon cantilever for scanning force microscopy. See <http://www.xidex.com>.

**Xidex Corporation**

Austin, TX

**TEACHING**

- Mathematics Grader, Calculus I – II, 1995 – 1996
- Teaching Assistant, Physics for Poets, University of Texas, 1997
- Teaching Assistant, Pseudoscience, University of Texas, 1997
- Teaching Assistant, Mechanics Physics Laboratory, University of Texas, 1998 – 1999
- Teaching Assistant, Electricity & Magnetism Physics Laboratory, University of Texas, 2000 – 2001
- Research In Science and Engineering (R.I.S.E.) Mentor, Rutgers University 2005
- Experience-Based Education Mentor, Rutgers University 2004 – 2006

**HONORS/AWARDS**

- NIH Ruth L. Kirschstein NRSA Post-Doctoral Fellowship, 2004–present
- Molecular Biophysics Minisymposium Poster Prize, 2006
- Best Student Paper Award, SPIE 2001: MEMS Components and Applications to Industry, 2001

**SKILLS**

- *Biology* Molecular Cloning, PCR, Fluorescent Labeling, FPLC, HPLC, Gel Electrophoresis
- *Programming Languages*: C, C++, Igor Pro, IDL, Basic, HTML, CSS, Flash
- *Tools*: Ultra-High Vacuum, Thin Film Deposition (sputtering, e-beam, thermal, CVD), AFM, SEM, Ellipsometry, SQUID Magnetometry, Time-Correlated Single Photon Counting, Confocal Microscopy, FTIR, Electronic Transport
- *Operating Systems*: MacOS X, Linux, Windows
- *Software*: Hidden Markov Model (HMM) software for TCSPC in C++ and Igor Pro (<http://www.singlemolecule.net>)

**MEMBERSHIPS**

- American Physical Society, 1995 – present
- American Chemical Society, 2003 – present

**REFERENCES**

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## PUBLICATIONS

1. T. C. Messina and D. S. Talaga, "Conformational Dynamics of Glucose/Galactose Binding Protein", submitted to *Nature* see preprint <http://talaga.rutgers.edu/wiki/index.php/Writing> (2006).
2. T. C. Messina, H. Kim, J. T. Giurleo, and D. S. Talaga, "Hidden Markov Model Analysis of Multichromophore Photobleaching", *J. Phys. Chem. B* **110**, 16366-16376 (2006).
3. J.-H. Choi, T. C. Messina, J. Yan, G. I. Drandova, and J. T. Markert, "Thermal Conductivity and  $^{89}\text{Y}$  NMR of  $\text{Ca}_{2+x}\text{Y}_{2-x}\text{Cu}_5\text{O}_{10}$ ", *J. of Magn. Mag. Mat.* **272**, 970-971 (2004).
4. T. C. Messina, L. N. Dunkleberger, G. A. Mensing, A. S. Kalmbach, R. Weiss, D. Beebe, and L. L. Sohn, "A Novel High-Frequency Sensor for Biological Discrimination", in the International Conference on Miniaturized Chemical and Biochemical Analysis Systems 2003, Kluwer Academic Publishers (2003).
5. C. W. Miller, U. Mirsaidov, T. C. Messina, J. T. Markert, "External Field Effects on Characteristics of Magnetically-Capped Oscillators for Magnetic Resonance Force Microscopy", *J. App. Phy.* **93**, 6572 (2003).
6. T. C. Messina, C. W. Miller, J. T. Markert, "Steric Effects in the Metal-Insulator (Mirror-Transparent) Transition in  $\text{YHx}$ ", *J. Alloys and Compounds* **356-357**, 181 (2003).
7. J. T. Markert, T. C. Messina, B. Dam, J. Huijbregste, J. H. Rector, and R. Griessen, Infinite-Layer Copper-Oxide Laser-Ablated Thin Films: Substrate, Buffer-Layer, and Processing Effects, *IEEE Transactions on Applied Superconductivity*, **13**, 2684 (2003).
8. G. I. Drandova, T. C. Messina, J. T. Markert, "NMR of  $^{89}\text{Y}$  in the Copper-Oxide Spin-Chain Compound  $\text{Ca}_{2+x}\text{Y}_{2-x}\text{Cu}_5\text{O}_{10}$ ", *J. Low Temperature Physics* **131**, 305 (2003).
9. K. Mochizuki, J.-H. Choi, T. C. Messina, Y. Ando, K. Nakamura, J. T. Markert, "Extreme Smallness of the Transverse Force on Moving Vortices", *Physica C* **388-389**, 705 (2003).
10. J. Barnett, D. Riley, T. Messina, P. Lysaght, "Wet Etch Enhancement of  $\text{HfO}_2$  Films by Implant Processing", *Solid State Phenomena* **92**, 11 (2003).
11. P. S. Lysaght, P. J. Chen, R. Bergmann, T. Messina, R. W. Murto and H. R. Huff, "Experimental Observations of the Thermal Stability of High- $\kappa$  Gate Dielectric Materials on Silicon", *Journal of Non-Crystalline Solids* **303**, 54 (2002).
12. M. D. Chabot, T. C. Messina, V. Manicevski, C. W. Miller, J. T. Markert, "Single-Crystal Silicon Triple-Torsional Micro-Oscillators for Use in Magnetic Resonance Force Microscopy", *SPIE-Int. Soc. Opt. Eng. Proceedings of Spie - the International Society for Optical Engineering* **4559**, 24 (2001).
13. J. T. Markert, T. C. Messina, B. Dam, J. Huijbregste, J. Rector, R. Griessen, "Observation of Step-Flow Growth in Laser-Ablated thin films of the T-Phase compound  $\text{Pr}_2\text{CuO}_4$ ", *Physica C* **341-348**, 2355-56 (2000).
14. J. T. Markert, T. C. Messina, B. Dam, J. Huijbregste, J. H. Rector, R. Griessen, "Laser-Ablated Thin Films of Infinite-Layer Compounds and Related Materials", *Proceedings of SPIE* **4058**, 141 (2000).
15. T. Ono, G. A. Rozgonyi, C. Au, T. C. Messina, R. Goodall, H. R. Huff, "Oxygen Precipitation Behavior in 300mm Polished Czochralski Silicon Wafers", *J. Electrochem. Soc.* **146**, 3807 (1999).
16. H. R. Huff, D. McCormack Jr., C. Au, T. C. Messina, K. Chan, R. Goodall, "Current Status of 200mm and 300mm Silicon Wafers", *Proceedings of the Intl. Solid State Devices and Materials (ISSDM 97)*, Japan, p. 456 and Conference Abstracts p.575, (1997) also published in *Jpn J. Appl Phys* **37**, (1998) Pt.1, No.3B.
17. C. Au, T. C. Messina, R. Goodall, H. R. Huff, "Characterization of 300mm Polished Silicon Wafers", *Proceedings of the 8th International Symposium on Silicon Materials and Technology* **1**, p.641, (1998).
18. T. C. Messina, C. Au, S. Shih, Z. Yang, R. Goodall, H. R. Huff, "Current Status of 300mm Wafer Characterization", *Proceedings of the International Mechanical Engineering Conference and Exposition (IMECE 98)*, p.825, (1998).
19. S. Shih, C. Au, Z. Yang, T. C. Messina, R. Goodall, H. R. Huff, "Characterization of 300mm Silicon-Polished and Epi Wafers", *Microelectronic Engineering* **45**, 169 (1999).
20. J. T. Markert, K. Mochizuki, T. C. Messina, B. C. Dunn, A. V. Elliott, "Studies of Infinite-Layer, T-Phase, and 1-D Ladder Copper-Oxide Compounds", *Physics and Materials Science of High Temperature Superconductor, IV. Proceedings of the NATO Advanced Research Workshop*, Kluwer Academic Publishers. 1997, pp.151.