Timothy P. Spila

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Education:

Ph.D. in Materials Science and Engineering, College of Engineering, University of Illinois at Urbana-Champaign, Urbana, IL 61801, December 2001.
Cumulative GPA: 3.67/4.00

B.S. in Engineering Science, College of Engineering, Pennsylvania State University, University Park, PA 16802, May 1992. (Minor: Engineering Mechanics)
Cumulative GPA: 3.60/4.00

Work Experience:

Senior Research Scientist in Materials Characterization
Center for Microanalysis of Materials at the University of Illinois at Urbana-Champaign,
104 S. Goodwin Ave., Urbana, IL 61801
March 2004 to Present
Supervisor: William Wilson 217-333-1371

- Primary researcher responsible for the Cameca ims-5f SIMS and PHI TRIFT III TOF-SIMS
- Wrote and maintain computer programs for facility billing and generation of reports
- Coordinate, supervise, and execute industrial projects for the Center

Interim Director MRL Central Research Facilities
Materials Research Laboratory at the University of Illinois at Urbana-Champaign,
104 S. Goodwin Ave., Urbana, IL 61801
September 2010 to October 2011 and May 2015 to August 2015
Supervisor: Jennifer Lewis 617-496-0233 (9-2010 to 10-2011)
Supervisor: John Rogers 217-333-1370 (5-2015 to Present

- Supervised 15 employees, including the integration of multiple new employees
- Assisted in the preparation of NSF-MRI proposal
- Main facility contact for NSF DIBBS project

Post-doctoral Researcher/Visiting Lecturer
University of Illinois at Urbana-Champaign, 104 S. Goodwin Ave., Urbana, IL 61801
January 2002 to March 2004
Supervisors: Joe Greene 217-333-0747 and Angus Rockett 217-333-0417

- Growth and analysis of extremely-high P doped Si layers by gas-source molecular beam epitaxy
- Train and assist graduate and undergraduate students on research projects
- Assist in organizing, lecturing, and grading undergraduate and graduate courses

Graduate Research Assistant
University of Illinois at Urbana-Champaign, 1101 W. Springfield Ave., Urbana, IL 61801
August 1992 to January 2002
Advisor: Joe Greene 217-333-0747

- Growth of $Si_{1-x}Ge_x$ alloy layers by gas-source molecular beam epitaxy
- Analysis of roughening evolution by atomic force microscopy, reflection high energy electron diffraction, and x-ray reflectivity

- Analysis of strain state in $Si_{1-x}Ge_x$ alloys by high resolution x-ray diffraction
- Responsible for upkeep of the research group's network of computers
- Senior Research Associate of the Laser Assisted Growth Laboratory, with responsibilities for maintaining the gas-source molecular beam epitaxy system and toxic gas safety system

Silicon Research Consortium Engineering Intern
Motorola, Semiconductor Products Sector, 3501 Ed Bluestein Blvd., Austin, TX 78721
May 1998 to August 1998
Supervisor: Phil Tobin 512-933-7960

- Roughening analysis of graded $Si_{1-x}Ge_x$ alloy layers grown by ultra-high vacuum chemical vapor deposition for use in high mobility metal-oxide-semiconductor field effect transistor devices
- Develop process for measuring threading dislocation density in $Si_{1-x}Ge_x$ alloy layers

Analytical Techniques

Expert: Secondary Ion Mass Spectrometry, Scanning Probe Microscopy, X-ray Diffraction
Knowledgeable: Transmission Electron Microscopy, Scanning Electron Microscopy, Auger Electron Spectroscopy, X-ray Photoelectron Spectroscopy, Rutherford Backscattering, Dynamic Mechanical Analysis

Thin Film Deposition Techniques

Expert: Gas-source Molecular Beam Epitaxy/Chemical Vapor Deposition
Knowledgeable: Sputtering

Selected List of Invited Talks:

1. **T. Spila**, P. Desjardins, H. Kim, N. Taylor, D.G. Cahill, J.E. Greene, "Hydrogen-mediated surface morphological evolution in $Si_{0.7}Ge_{0.3}$/Si(001) layers grown by hydride gas-source molecular beam epitaxy." 46th National Symposium of the American Vacuum Society (1999).
2. **T. Spila**, P. Desjardins, H. Kim, N. Taylor, David G. Cahill, S. Guillon, R.A. Masut, and J.E. Greene, "Hydrogen-mediated surface morphological evolution in $Si_{0.7}Ge_{0.3}$/Si(001) layers grown by hydride gas-source molecular beam epitaxy. " NATO-Advanced Study Institute, Kaunas, Lithuania (2001).
3. **T. Spila**, "Hydrogen-mediated surface morphological evolution in Si0.7Ge0.3/Si(001) layers grown by hydride gas-source molecular beam epitaxy." Center for Microanalysis of Materials, Frederick Seitz Materials Research Laboratory, University of Illinois, Urbana, IL. (2002).
4. **T. Spila**, P. Desjardins, J. D'Arcy-Gall, R.D. Twesten, J.E. Greene, "Effect of crosshatch formation on the kinetics of $Si_{1-x}Ge_x$ growth on Si(001) from hydride precursors." 50th National Symposium of the American Vacuum Society (2003).

Publications:

1. H. Kim, G. Glass, S.Y. Park, **T. Spila**, N. Taylor, J.R. Abelson, and J.E. Greene, "Effects of B doping on hydrogen desorption from Si(001) during gas-source molecular-beam epitaxy from Si_2H_6 and B_2H_6." Appl. Phys. Lett. **69**, 3869, (1996).
2. H. Kim, N. Taylor, **T. Spila**, G. Glass, S.Y. Park, J.E. Greene, and J.R. Abelson, "Structure of the Si(011)-(16x2) surface and hydrogen desorption kinetics investigated using temperature-programmed desorption." Surf. Sci. **380**, L496 (1997).
3. H. Kim, G. Glass, **T. Spila**, N. Taylor, S.Y. Park, J.R. Abelson, and J.E. Greene, "Si(001):B gas-source molecular-beam epitaxy: Boron surface segregation and its effect on film growth kinetics." J. Appl. Phys. **82**, 2288 (1997).
4. Q. Lu, M.R. Sardela, N. Taylor, G. Glass, T.R. Bramblett, **T. Spila**, J.R. Abelson, and J.E. Greene, "B incorporation and hole transport in fully strained heteroepitaxial $Si_{1-x}Ge_x$ grown on Si(001) by gas-source MBE from Si_2H_6, Ge_2H_6, and B_2H_6." J. Cryst. Growth **179**, 97 (1997).

5. Chinkyo Kim, I.K. Robinson, **T. Spila**, and J.E. Greene, "Local strain relaxation in $Si_{0.7}Ge_{0.3}$ on Si(001) induced by Ga^+ irradiation." J. Appl. Phys. **83**, 7608 (1998).
6. N. Taylor, H. Kim, **T. Spila**, J.A. Eades, G. Glass, P. Desjardins, and J.E. Greene, "Growth of $Si_{1-x}Ge_x$(011) on Si(011)16×2 by gas-source molecular beam epitaxy: Growth kinetics, Ge incorporation, and surface phase transitions." J. Appl. Phys. **85**, 501 (1999).
7. P. Desjardins, **T. Spila**, O. Gurdal, N. Taylor, and J.E. Greene, "Hybrid surface roughening modes during low-temperature heteroepitaxy: Growth of fully-strained metastable $Ge_{1-x}Sn_x$ alloys on Ge(001)2×1." Phys. Rev. B **60**, 15993 (1999).
8. G. Glass, H. Kim, P. Desjardins, N. Taylor, **T. Spila**, Q. Lu, and J.E. Greene, "Ultrahigh B doping ($\leq 10^{22}$ cm^{-3}) during Si(001) gas-source molecular-beam epitaxy: B incorporation, electrical activation, and hole transport." Phys. Rev. B **61**, 7628 (2000).
9. H. Kim, **T. Spila** and J. E. Greene, "Si(113) hydrogen desorption kinetics: a temperature programmed desorption study." Surf. Sci. **490**, L602 (2001).
10. **T. Spila**, P. Desjardins, A. Vailonis, H. Kim, N. Taylor, D.G. Cahill, J.E. Greene, S. Guillon, and R.A. Masut, "Hydrogen-mediated quenching of strain-induced surface roughening during gas-source molecular beam epitaxy of fully-coherent $Si_{0.7}Ge_{0.3}$ layers on Si(001)." J. Appl. Phys. **91**, 3579 (2002).
11. D. Gall, C.-S. Shin, **T. Spila**, M. Odén, M. Senna, J.E. Greene, and I. Petrov, "Growth of single-crystal CrN on MgO(001): Effects of low-energy ion-irradiation on surface morphological evolution and physical properties." J. Appl. Phys. **91**, 3589 (2002).
12. **T. Spila**, P. Desjardins, J. D'Arcy-Gall, R.D. Twesten, and J.E. Greene, "Effect of steady-state hydrogen coverage on the evolution of crosshatch morphology during $Si_{1-x}Ge_x$/Si(001) growth from hydride precursors." J. Appl. Phys. **93**, 1918 (2003).
13. K.A. Bratland, Y.L. Foo, J.A.N.T. Soares, **T. Spila**, P. Desjardins, and J.E. Greene, "Mechanism for epitaxial breakdown during low-temperature Ge(001) molecular beam epitaxy." Phys. Rev. B **67**, 125322 (2003).
14. S. Hong, Y.L. Foo, K.A. Bratland, **T. Spila**, K. Ohmori, M.R. Sardela Jr., J.E. Greene, and E. Yoon, "Smooth relaxed $Si_{0.75}Ge_{0.25}$ layers on Si(001) via *in situ* rapid thermal annealing." Appl. Phys. Lett. **83**, 4321 (2003).
15. D.W. Moon, H.I. Lee, B. Cho, Y.L. Foo, **T. Spila**, S. Hong, and J.E. Greene, "Direct measurements of strain depth profiles in Ge/Si(001) nanostructures." Appl. Phys. Lett. **83**, 5298 (2003).
16. K.A. Bratland, Y.L. Foo, **T. Spila**, H.-S. Seo, R.T. Haasch, P. Desjardins, and J.E. Greene, "Sn-mediated Ge/Ge(001) growth by low-temperature molecular-beam epitaxy: surface smoothening and enhanced epitaxial thickness." J. Appl Phys. **97**, 044904 (2005).
17. I.K. Robinson, Y. Da, **T. Spila**, J.E. Greene, "Coherent diffraction patterns of individual dislocation strain fields." J. Phys. D **38**, A7 (2005).
18. B.E. Jurczyk, D.A. Alman, E.L. Antonsen, M.A. Jaworski, M.J. Williams, D.N. Ruzic, **T. Spila**, G. Edwards, S. Wurm, O. Wood, and R.L. Bristol, "The effect of debris on collector optics, its mitigation and repair: next-step a gaseous Sn EUV DPP source." Proceedings of the SPIE, **5751**, 572 (2005).
19. D.A. Alman, H. Qiu, K.C. Thompson, E.L. Antonsen, J.B. Spencer, M.R. Hendricks, B.E. Jurczyk, D.N. Ruzic, **T. Spila**, G. Edwards, S. Wurm, O. Wood, and R. Bristol, "UIUC collector erosion and optical lifetime project results: time dependent exposures." Proceedings of the SPIE, **5751**, 1118 (2005).
20. H. Qiu, D.A. Alman, K.C. Thompson, M.D. Coventry, J.B. Spencer, M.R. Hendricks, E.L. Antonsen, B.E. Jurczyk, D.N. Ruzic, **T.P. Spila**, G. Edwards, S. Wurm, O. Wood, and R. Bristol, "Characterization of collector optic material samples before and after exposure in LPP and DPP EUV sources." Proceedings of the SPIE, **5751**, 1211 (2005).
21. H. Qiu, D.A. Alman, K.C. Thompson, J.B. Spencer, E.K. Antonsen, B.E. Jurczyk, D.N. Ruzic, and **T.P. Spila**, "Characterization of collector optic material samples before and after exposure in laser produced plasma and discharge produced plasma extreme ultraviolet sources." J. Microlith., Microfab., Microsyst. **5**, 033006 (2006).
22. J.M. Purswani, **T. Spila**, and D. Gall, "Growth of epitaxial Cu on MgO(001) by magnetron sputter

deposition." Thin Solid Films **515**, 1166 (2006).

23. D.A. Alman, H. Qiu, **T. Spila**, K.C. Thompson, E.L. Antonsen, B.E. Jurczyk, D.N. Ruzic, "Characterization of collector optic material samples exposed to a discharge-produced plasma extreme ultraviolet light source." J. Micro/Nanolith. MEMS MOEMS **6**, 013006 (2007).
24. B. Cho, J. Bareño, Y.L. Foo, S. Hong, **T. Spila**, I. Petrov, and J.E. Greene, "Phosphorus incorporation during Si(001):P gas-source molecular beam epitaxy: Effects on growth kinetics and surface morphology." J. Appl Phys. **103**, 123530 (2008).
25. D.P. Abraham, **T. Spila**, M.M. Furczon, and E. Sammann, "Evidence of Transition-Metal Accumulation on Aged Graphite Anodes by SIMS." Electrochemical and Solid-State Letters **11**, A226 (2008).
26. B.M. Howe, E. Sammann, J.G. Wen, **T. Spila**, J.E. Greene, L. Hultman, I. Petrov, "Real-time control of AlN incorporation in epitaxial $Hf_{1-x}Al_xN$ using high-flux, low-energy (10-40 eV) ion bombardment during reactive magnetron sputter deposition from a $Hf_{0.7}Al_{0.3}$ alloy target." Acta Materialia **59**, 421-428 (2011).
27. K.A. Bratland, **T. Spila**, D.G. Cahill, J.E. Greene, and P. Desjardins, "Continuum model of surface roughening and epitaxial breakdown during low-temperature Ge(001) molecular beam epitaxy." J. Appl. Phys. **109**, 063513 (2011).
28. M. Bettge, Y. Li, B. Sankaran, N.D. Rago, **T. Spila**, R.T. Haasch, I. Petrov, D.P. Abraham, "Improving high-capacity Li1.2Ni0.15Mn0.55Co0.1O2-based lithium-ion cells by modifying the positive electrode with alumina." J. Power Sources **233**, 346-357 (2013).
29. J.W. Tashman, J.H. Lee, H. Paik, J.A. Moyer, R. Misra, J.A. Mundy, **T. Spila**, T.A. Merz, J. Schubert, D.A. Muller, P. Schiffer, and D.G. Schlom, "Epitaxial growth of VO_2 by periodic annealing." Appl. Phys. Lett. **104**, 063104 (2014).
30. J.S. Sadhu, H. Tian, **T. Spila**, J. Kim, B. Azeredo, P. Ferreira, and S. Sinha, "Controllable doping and wrap-around contacts to electrolessly etched silicon nanowire arrays." Nanotechnology **25**, 375701 (2014).
31. J. Chang, R.T. Haasch, J. Kim, **T. Spila**, P.V. Braun, A.A. Gewirth, and R.G. Nuzzo, "Synergetic role of Li^+ during Mg electrodeposition/dissolution in borohydride diglyme electrolyte solution: voltammetric stripping behaviors on a Pt microelectrode indicative of Mg−Li alloying and facilitated dissolution." ACS Appl. Mater. Interfaces **7**, 2494 (2015).
32. H. Paik, J.A. Moyer, **T. Spila**, J.W. Tashman, J.A. Mundy, E. Freeman, N. Shukla, J.M. Lapano, R. Engel-Herbert, W. Zander, J. Schubert, D.A. Muller, S. Datta, P. Schiffer, and D.G. Schlom, "Transport properties of ultra-thin VO_2 films on (001) TiO_2 grown by reactive molecular-beam epitaxy." Appl. Phys. Lett. **107**, 163101 (2015).
33. J.A. Gilbert, J. Bareño, **T. Spila**, S.E. Trask, D.J. Miller, B.J. Polzin, A.N. Jansen, and D.P. Abraham, "Cycling Behavior of NCM523/Graphite Lithium-Ion Cells in the 3-4.4 V Range: Diagnostic Studies of Full Cells and Harvested Electrodes." J. Electrochem. Soc., **164**, A6054 (2017).

Patents:

1. C.W. Lim, Y.-L. Foo, S. Hong, K.A. Bratland, T. Spila, B. Cho, K. Ohmori, J. Greene, "Method for forming a strained semiconductor substrate." U.S. Patent No. 2004/0224469 (11 Nov. 2004).