Sample: PhD CV - Postdoctoral Research

Postdoctoral Research Applicant (Materials Science)

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PROFILE:

- Highly self-motivated Ph.D. candidate with demonstrated research expertise growing semiconductor nanostructures. Strong interpersonal skills
- Experimental techniques: e-gun evaporation, molecular beam epitaxy (MBE)
- Rich experience in modeling and computer simulation, using MatLab, FlexPDE, Mathematica, and PSPICE Additonal experience in digital circuit design using VHDL
- Computer skills: Unix/Linux/Windows; HTML, LaTeX; C/C++, etc.

EDUCATION:

Duke University, Durham, NC (GPA: 4.0/4.0)
Ph.D. Materials Science, June 2007 (expected)
M.S. Materials Science, 2005

Tsinghua University, Beijing, P.R. China (GPA: 3.8/4.0)
B.S. Materials Science and Engineering, 2002
Graduated with honors, 2002; First degree fellowship, 1998-2002

RESEARCH INTERESTS:

- Semiconductor process engineering
- Modeling and simulation of semiconductor processes
- Reliability study and failure analysis
- Electronic packaging

ENGINEERING RESEARCH EXPERIENCE:

Duke University, Durham, NC
Ph.D. Candidate, 2002-present

• *Nanowire growth*

Proposed a model determining the obtainable minimum size of nanowires (NWs) grown by vapor-liquid-solid (VLS) process, one of the most important methods for growing semiconductor nanostructures. Revived the study on VLS mechanisms, and spurred a flurry of papers on the thermodynamic and kinetic analysis of the process. Derived the growth rate formula, for the first time in the literature, using all physically meaningful quantities without empirical fitting factors. Established a novel growth model by assuming a two-dimensional island nucleation-growth process, which is, to the best of my knowledge, currently the only model that can fit an extensive set of growth rate data on Si whiskers/nanowires.

• *Diffusion and gettering*

Explained how volume misfits between the metal precipitates and Si drastically prolongs the time needed for Al gettering of solar cell Si. Proposed methods to effectively reduce the gettering time in the presence of metal precipitates. Demonstrated that optical-assisted Al gettering process can reduce Al gettering time from tens of hours to several minutes. Contributed to the understanding of the predominance of alternate diffusion mechanisms for the interstitial-substitutional impurities in Si. (Above projects are financially supported by National Renewable Energy Laboratory (NREL)).

Max-Plank-Institute for Microstructure Physics, Halle, Germany,
Visiting Scientist, Oct-Dec 2005

• *Nanowire morphology—chemical tension*

Formulated a model for describing the morphology of the growing nanowire, from the beginning of growth to either a steadily growing wire with a constant diameter or a hillock for which the growth process terminates. Included, for the first time in the literature, a *dynamic* chemical tension in analyzing the system equilibrium configuration, in addition to the normally considered *static* physical tensions.

• C*rystallization of SiO_2*
Participated in the discovery that lithium vapor can catalyze the crystallization of amorphous silica which is integrated in the common silicon microstructures.

TEACHING EXPERIENCE
Duke University, Department of Mechanical Engineering, Durham, NC
Teaching Assistant
Thermodynamics, Jan-May 2007
Structure/Properties of Solids, Jan-May 2005
Thermodynamics, Jan-December 2004

MAJOR COURSES:
- Integrated Circuit Engineering—Silicon Processing
- Semiconductor Devices for IC
- Quantum Mechanics
- Solid State Physics
- Optical Communication System
- Advanced Digital System Design

PUBLICATIONS:
- A Nucleation-Growth Model of Nanowires Produced by the Vapor-Liquid-Solid Process, P.R.A. and A.B.Foushee (in preparation)
- Advanced Impurity Gettering for Silicon Solar Cells: Needs and New Apporach, B. Sopori, P.R.A. and A.B. Foushee, Invited paper, MRS Spring Conference, San Fransisco, April 9-13, 2007
- Predominance of Alternate Diffusion Mechanisms for Interstitial-Substitutional Impurities, P.R.A. and A.B. Foushee (accepted for oral presentation in MRS 2007 Spring Conference)
- Chemical Tension in VLS nanostructure Growth Process: From Nanohillocks to Nanowires, P.R.A., A.B.Foushee, and U. Goesele (accepted for oral presentation in MRS 2007 Spring Conference)
- Crystallization of Amorphous SiO2 Microtubes Catalyzed by Lithium Vapor, L. Zhao, P. R.A., A. Langner et. al., (accepted by *Adv. Funct. Mater.*)
- Chemical Tension and Global Equilibrium in VLS Nanostructure Growth Process: From Nanohillocks to Nanowires, P.R.A., A.B. Foushee, and U. Goesele, *Appl. Phys. A*, 86, pages 433-330, 2007
- Mechanisms of Gettering Metallic Precipitates from Silicon Using Optical Processing, P.R.A., A.B. Foushee, and B. L. Sopori, *Extended Abstracts and Papers, 16th Workshop on R. Crystalline Silicon Solar Cells & Modules: Materials and Processing*, page 194, 2006
- Modeling Metallic Precipitates Dissolution in Silicon under Point Defect Injection, P.R.A., H. Li, and A.B. Foushee, technique report, under NREL subcontract XAD-4-33653-01, 2005.
- Gettering of Metallic Precipitates with Volume Misfits, P.R.A., H. Li, and A.B. Foushee, *Extended Abstracts and Papers, 14th Workshop on Crystalline Silicon Solar Cells & Modules: Materials and Processing,* page 238, 2004
- On the Thermodynamic Size Limit of Nanowires Grown by the Vapor-Liquid-Solid Process, A.B. Foushee, P.R.A., and U. Gosele, *Appl. Phys. A*, 78, pages 519-526, 2004
- Is There a Thermodynamic Size Limit of Nanowires Grown by the Vapor-Liquid-Solid Process? A.B. Foushee, P.R.A., and U. Gosele, *Appl. Phys. Lett.*, 83(6), pages 1199-1201, 2003

ACTIVITIES:
- Materials Research Society, Student Member, 2004-Present

WORK STYLE:
- Willing to perform basic tasks and move on to solve complex problems
- Able to learn new knowledge and adapt to new environments quickly
- Strong independent work style and excellent teamwork skills
- Well-organized and passionate