

Steven P. Bennett

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EDUCATION

Northeastern University, Boston MA

Ph.D. – *Interdisciplinary Engineering [Materials Science & Electrical Engineering]* *Dec 2013*

Northeastern University, Boston MA

Master of Science – *Materials Engineering* *May 2011*

Northeastern University, Boston MA

Bachelor of Science - *Mechanical Engineering* *May 2010*

SKILLS AND TECHNIQUES

- Expert in thin film deposition techniques: MBE, PLD, Sputter, Thermal/E-beam evaporation, CVD, PECVD, ALD, RIE, Ion-Milling, in-situ use of RHEED
- Expert in electrical characterization and testing: Hall effect, Anomalous Hall Effect, Magnetoresistance, Vander-Pauw, SMOKE/MOKE, high-cycle wafer-based device testing, testing of thin film photovoltaics
- Expert in lithography techniques: Photolithography, EBL, EUV
- Experienced with metallic, ceramic and polymeric processing and fabrication
- Expert in characterization methods: Polarized Neutron Reflectivity, Neutron Diffraction, EDS, XRD/XRR, MFM, AFM, XPS, VSM, SEM, TEM, UV-Vis, Raman Spectroscopy, Ellipsometry, SQUID, PPMS
- Experienced with computer code: Python, Matlab, C++, Labview
- Well experienced in analyzing and modeling thin film neutron reflectivity and powder/thin film diffraction data
- Expert with simulation and modeling with: Origin, neutron and x-ray reflectivity modeling in GENX, Rietveld refinement of x-ray and neutron diffraction data with GSAS, AutoCAD, Solidworks, FEA modeling with ANSYS

WORK EXPERIENCE

Oak Ridge National Laboratory, Oak Ridge, TN

January 2014 – (present)

The Spallation Neutron Source (SNS), Quantum Condensed Matter Division, Thin Films and Nanostructures Group, (Dr. Valeria Lauter/Dr. Michael Fitzsimmons)

Position: Postdoctoral Fellow in Quantum Condensed Matter

- Performed condensed matter materials research studying the structural & magnetic depth profiles of thin films and heterostructures on Beam Line 4A, the Magnetism Reflectometer at SNS
- Lead as principle investigator in studying piezoelectrically induced strain effects in metamagnetic FeRh thin films for spintronics and memory applications in collaboration with Ramesh Ramamoorthy, Ivan Schuller and Thomas Zac Ward
- Also performed neutron diffraction experiments on Fe₁₆N₂ rare earth free permanent magnet nano-powders on Beam Line 1B the Nanoscale-Ordered Materials Diffractometer (NOMAD), and Beam Line HB-2C the Wide Angle Neutron Diffractometer (WAND) at HFIR, in support of DOE ARPA-E REACT funded program
- Studied electric field and photocarrier induced magnetization effects of gated BaTiO₃/FeRh thin film heterostructures
- Performing continuing work with hydrogenated graphene to probe ferromagnetic spin ordering with polarized neutrons
- Awarded 5 neutron beam allocations by scientific user community via peer reviewed research proposals

Northeastern University, Boston, MA

January 2010 – December 2013

Department of Electrical & Computer Engineering

Center for Microwave Magnetic Materials and Integrated Circuits, (Prof. Vince Harris)

Position: Ph.D. Student Researcher

- Explored the use of a new bandgap engineered photoferroelectric heterostructure to enhance photocurrent in ferroelectric bismuth ferrite thin films

- Principle user for Quantum Design PPMS (Physical Property Measurement System) and NanoPLD (Pulsed Laser Deposition)
- Measured transport properties of topological insulator SnTe thin films in multi-university collaboration
- Worked on an DOE ARPA-E REACT project investigating rare-earth-free permanent magnetic materials including cobalt carbides
- Magnetic/thermomagnetic characterization of ferrite thin films and nanopowders/compacts for high frequency communication applications

Northeastern University, Boston, MA

September 2005 – January 2010

Department of Physics

Nanoscale Semiconductor Research Laboratory, (Prof. Don Heiman)

Position: Undergraduate Researcher

- MBE growth of GaAs-based thin films and nanostructures for use in spintronics device applications
- Fabrication and testing of MnAl / MgO / Co Tunnel Junctions in cooperation with Prof. Jagadeesh Moodera at the Francis Bitter Magnet Lab (MIT)
- Optical characterization of nanowire arrays in anodic porous alumina as reverse refraction dielectric
- Transport studies using 14T LHe cooled superconducting magnet
- Designed and built a custom 3-head RF/DC sputter deposition system with heated sample holder for metal/oxide depositions
- Research ranged from the fabrication and study of nanocrystalline quantum dot arrays for applications in spintronics/quantum computing, characteristics of photo-dielectrics for applications in photonics and photovoltaics, fabrication and study of magnetic nanowires and disordered epitaxial films and their magneto-electronic properties.

Protonex, Southborough, MA

January – June 2009; September 2011 – January 2012

UAV Fuel Cells Division

Position: Full-time, research co-op

- Synthesized and tested high surface area carbon based ruthenium metal catalyst for the evolution of hydrogen gas from sodium borohydride
- Performed numerous experiments that eventually lead to a catalyst that outperformed previously used, extending the operating time of the catalyst bed in unmanned aerial vehicles by twice anticipated

Nantero, Woburn, MA

January – June 2008

Government Projects Division

Position: Full-time, research co-op

- Worked on defense funded carbon nanotube device research (classified - proprietary)
- Worked with ALD for carbon nanotube device passivation
- Developed and tested innovative carbon nanotube devices using various patterning and growth techniques

SUNY - Stony Brook, Stony Brook, NY

April 2004 – October 2004

Materials Characterization Laboratory, Department of Materials Science and Engineering, (Prof. Gary Halada)

Position: STARS Program for gifted High School Students

Responsibilities:

- Fabricated and studied thermophotovoltaic characteristics of GaSb thin films deposited by femtosecond laser ablation
- This work was used for submission to national science competitions

AWARDS:

- Siemens Foundation's Competition National semifinalist
- Intel ISEF (International Science and Engineering Fair) regional finalist

Professional Activities

Memberships:

- IEEE Magnetics Society
- Materials Research Society
- Neutron Scattering Society of America
- American Vacuum Society
- American Physical Society

Active Journal Reviewer for:

- Advanced Materials Interfaces
- IEEE – Transactions on Magnetics
- Optical Materials Express
- Journal of Applied Physics
- Advanced Materials

PUBLICATIONS & TALKS

Giant Magnetization Switching Induced by Structural Phase Transitions in a Metamagnetic Artificial Multiferroic

S. P. Bennett, A. T. Wong, Z. Liu, A. G. Glavic, A. Herklotz, C. Urban, I. Valmianski, I. Schuller, M. Biegalski, H. Christen, R. Ramesh, T. Z. Ward, V. Lauter

Invited Seminars:

- The Army Research Laboratory (Weapons and Materials Directorate)

Upcoming Related conference presentations:

- Materials Research Society Fall Meeting (Boston Nov 2015)
- Magnetism and Magnetic Materials / IEEE Intermag Joint Conference (San Diego Jan 2016)

Direct Evidence of Anomalous Interfacial Magnetization in Metamagnetic Pd doped FeRh Thin Films

Steven P. Bennett, Haile Ambaye, Hwachol Lee, Patrick LeClair, Gary Mankey, Valeria Lauter
Scientific Reports **5**, 9142 (2015)

Related conference presentations:

- American Conference on Neutron Scattering (Knoxville TN 2014)
- Magnetism and Magnetic Materials Conference (Honolulu HI 2014)
- American Vacuum Society (Baltimore MD 2014)

Quantum Coherent Transport in SnTe Topological Crystalline Insulator Thin Films

B. A. Assaf, F. Katmis, P. Wei, B. Satpati, Z. Zhang, S. P. Bennett, V. G. Harris, J. S. Moodera, D. Heiman
Applied Physics Letters, 105, 102108 (2014)

Process optimization and properties of magnetically hard cobalt carbide nanoparticles via modified polyol method

M. Zamanpour, S. P. Bennett, L. Majidi, Y. Chen, V. G. Harris
Journal of Alloys and Compounds **625**, 138-143. (2015)

Thermally driven large magnetoresistance and magnetostriction in multifunctional magnetic FeGa–Tb alloys

Trifon I. Fitchorova, Steven Bennett, Liping Jiang, Guangrui Zhang, Zengqi Zhao, Yajie Chen, Vincent G. Harris
Acta Materialia, **73**, 19-26, (2014)

Nanostructured FeRh in metallic and insulating films

B. Kaeswurm, F. Jimenez-Villacorta, S.P. Bennett, D. Heiman, L.H. Lewis
Journal of Magnetism and Magnetic Materials, **354**, 284–289 (2014)

Magnetic properties and large coercivity of Mn₂Ga nanostructures

M.E. Jamer, B.A. Assaf, S.P. Bennett, L.H. Lewis, D. Heiman
Journal of Magnetism and Magnetic Materials, **358-359**, 259-262, (2014)

Process optimization and properties of magnetically hard cobalt carbide nanoparticles via modified polyol method

Mehdi Zamanpour, Steven P Bennett, Leily Majidi, Yajie Chen, Vincent G Harris
Journal of Applied Physics (2014)

[The realization of a new band gap engineered photoferroelectric photovoltaic device with high photocurrent](#)

Steven Bennett

ProQuest LLC, UMI Dissertation Publishing (2013)

Related conference presentations:

- Magnetism and Magnetic Materials Conference (Denver Co 2013)

[Magnetocrystalline Anisotropy and FMR Linewidth of Zr and Zn-Doped Ba-Hexaferrite Films Grown on MgO\(111\)](#)

B. Hu, Y. Chen, Z. Su, S. Bennett, L. Burns, G. Uddin, K. Ziemer, and V. G. Harris
IEEE Transactions on Magnetics, vol. 49, no. 7, July (2013)

Related conference presentations:

- Magnetism and Magnetic Materials Conference (Denver Co 2013)

[Crystallographically textured self-biased W-type hexaferrites for X-band microwave applications](#)

Zhijuan Su, Yajie Chen, Bolin Hu, Alexander S. Sokolov, Steven Bennett, Lee Burns, Xing Xing,
and Vincent G. Harris
J. Appl. Phys. 113, 17B305 (2013)

[Effect of Ambient Aging on Heat-Treated Mechanically Alloyed Mn-Al-C Powders](#)

Ogheneyunume Obi, Lee Burns, Yajie Chen, Steven Bennett, Mathew Sawicki, Daniel Kaplan, Ana M. Arango,
Laura H. Lewis, and Vincent G. Harris
IEEE Transactions on Magnetics, vol. 49, no. 7, (2013)

Related conference presentations:

- Magnetism and Magnetic Materials Conference (Denver Co 2013)

[Magnetic and Magnetotransport Characteristics of Nanostructures and Nanostructured Semiconductor Systems](#)

Steven Bennett

ProQuest LLC, UMI Dissertation Publishing (2012)

[Large Coercivity in Nanostructured Rare-earth-free \$Mn_xGa\$ Films](#)

T. J. Nummy, S. P. Bennett, T. Cardinal, and D. Heiman
Appl. Phys. Lett. 99, 252506 (2011)

[Universal Properties of Linear Magnetoresistance in Strongly Disordered Semiconductors](#)

[H. G. Johnson](#), [S. P. Bennett](#), [R. Barua](#), [L. H. Lewis](#), and [D. Heiman](#)
Phys. Rev. B 82, 085202 (2010)

[Determining magnetic nanoparticle size distributions from thermomagnetic measurements](#)

R. S. DiPietro, H. G. Johnson, S. P. Bennett, T. J. Nummy, L. H. Lewis, and D. Heiman
Appl. Phys. Lett. 96, 222506 (2010)

Related conference presentations:

- Materials Research Society's Fall Conference (Boston MA 2010)

[Negative Index Metamaterials Based on Metal-Dielectric Nanocomposites for Imaging Applications](#)

L. Menon, W. T. Lu, A. L. Friedman, S. P. Bennett, D. Heiman, and S. Sridhar
Appl. Phys. Lett. 93, 123117 (2008)

Magnetic Properties of GaMnAs Nanodot Arrays Fabricated using Porous Alumina Templates

S. P. Bennett, L. Menon, and D. Heiman
J. Appl. Phys. 104, 024309 (2008)

Invited Seminars:

- NIST (National Institute of Standards and Technologies)
- The U.S. Air Force Research Lab (sensors division)

Related conference presentations:

- Materials Research Society's Fall Conference (Boston MA 2007, 2008)
- The American Physical Society's Annual Conference (New Orleans LA 2008)
- Northeastern's Undergraduate Research Expo (Boston MA 2006, 2007, 2008)
- The Colonial Academic Alliance (Boston MA 2008)

PATENTS

“[Rare-earth-free or noble metal-free large magnetic coercivity nanostructured films](#)” Patent Pub. # US
20130236720 A1, Pub Date Sep 12, 2013

HOBBIES AND INTERESTS

- ❖ Though my hobbies change frequently some have stuck around: I.e. Sailboat Racing, Autocross, Ceramic Arts, Martial Arts (Muay Thai) & Hiking