Nathan C. Emley

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OBJECTIVE

Position in R&D to work on challenging MEMS or nanomagnetics-based projects requiring broad expertise in process integration, nanofabrication, nanocharacterization, measurement and analysis, and materials.

EDUCATION

PhD (1/2006, GPA 3.86) and **MS** (6/2003):Cornell Univ., Dept. of App. & Eng. Physics, Ithaca, NY
BS (6/1998, GPA 3.99): Univ. of Massachusetts, Dept. of Physics., Amherst, MA

RESEARCH EXPERIENCE

Postdoctoral Appointment - Dept. Elect. Eng. & Comp. Sci., Univ. of Cal., Berkeley **(12/2005 – present)**

"Piezoelectric Cantilevers for Microscale Energy Scavenging Devices" – Prof. Paul Wright
Successfully adapted a chemical solution deposition method of lead zirconate titanate (PZT) piezoelectric thin films. Responsible for leading a team of two graduate students that designs, simulates, and fabricates these energy scavenging devices. Our focus for the energy scavengers is on engineering a broadband frequency response while maximizing output power through device design and materials optimization.

"Droplet-on-demand Systems for Maskless Lithography Applications" – Prof. Jeff Bokor
Responsible for design and fabrication of a device for generating sub-micron diameter fluidic droplets, where MEMS-based actuation occurs via piezoelectric-induced deflection of a thin dielectric membrane that squeezes reservoir fluid through a microscopic nozzle. Experience with MEMS flexure plates, silicon micromachining, microfluidic dynamics of droplet formation, piezoelectric thin-film deposition, and finite-element-modeling (FEM) of fluidic devices.

"Nanomagnetic Ensembles for Logic Operations" – Prof. Jeff Bokor
Co-advising and oversight responsibilities for project to develop logic gates based on interactions between nanopatterned magnetic elements. Through micromagnetic simulations, achieved a successful design of universal logic gate and magnetic signal propagation and fan-out.

Graduate Research Assistant - Dept. Appl. & Eng. Physics, Cornell Univ. **(8/2000 – 11/2005)**

"Spin Transfer Effects in Magnetic Multilayer Nanostructures" – Prof. Robert Buhrman
Conducted DC and GHz-frequency studies of current-induced excitations in sub-200nm diameter magnetic multilayer nanopillars from 4.2 – 300K, focusing on how the composition and temperature affect excitations. Expertise in wide range of nanofabrication techniques for mastering and modifying nanopillars. Taught others the complex nanofabrication process.

TECHNICAL SKILLS

Nanofabrication:

Thin Film Deposition – DC magnetron and RF sputtering, ion beam deposition, thermal and electron beam evaporation, low-pressure chemical vapor deposition, plasma enhanced chemical vapor deposition, chemical solution deposition of piezoelectric ternary oxides (lead zirconate titanate, PZT).
Thin Film Etching – Ion milling, plasma etching, wet chemical etching, and chemical mechanical polishing.
Lithography – Electron beam lithography (Leica VB6, Nabity system on JEOL SEM), 5x projection photolithography, contact photolithography, and photolithography mask design and fabrication.

Metrology:

GHz-frequency – Setup and control of pulse generators, < 50GHz digital sampling oscilloscopes, amplifiers, bias-T's, power dividers, semi-rigid coaxial cable, SMA, K, and 2.4mm-Connections.
Cryogenic – Handling of liquid helium and nitrogen, and experience with variable temperature cryostats.
High Vacuum – Installation and maintenance of several deposition chambers, design and construction of high vacuum mechanical components, and training personnel on tool use.
Characterization – AFM (DI3000), SEM (LEO Gemini), Profilometry (ASIQ), Thin Film Stress (Flexus), MFM (DI3000), Optical Interferometry, SQUID Magnetometry (Quantum Design), X-ray Crystallography, TEM.
Computer – LabView, Mathematica, Matlab, AutoCAD, CoventorWare, and COMSOL.

PUBLICATIONS

N. C. Emley, I. N. Krivorotov, O. Ozatay, A. G. F. Garcia, J. C. Sankey, D. C. Ralph, and R. A. Buhrman, “Time-Resolved Spin-Torque Switching and Enhanced Damping in Permalloy/Cu/Permalloy Spin-Valve Nanopillars”, Phys. Rev. Lett., vol. 96, 247204 (2006).

O. Ozatay, N. C. Emley, P. M. Braganca, A. G. F. Garcia, G. D. Fuchs, I. N. Krivorotov, R. A. Buhrman and D. C. Ralph, “Spin transfer by nonuniform current injection into a nanomagnet”, Appl. Phys. Lett., vol. 88, 202502 (2006).

J. C. Sankey, I. N. Krivorotov, S. I. Kiselev, P. M. Braganca, N. C. Emley, R. A. Buhrman , and D. C. Ralph, “Mechanisms limiting the coherence time of spontaneous magnetic oscillations driven by dc spin-polarized currents”, Phys. Rev. B, vol. 72, 224427 (2005).

P. M. Braganca, I. N. Krivorotov, O. Ozatay, A. G. F. Garcia, N. C. Emley, J. C. Sankey, D. C. Ralph, and R. A. Buhrman, “Reducing the critical current for short-pulse spin-transfer switching of nanomagnets”, Appl. Phys. Lett., vol. 87, 112507 (2005).

S. I. Kiselev, J. C. Sankey, I. N. Krivorotov, N. C. Emley, A. G. F. Garcia, R. A. Buhrman , and D. C. Ralph, “Spin-transfer excitations of permalloy nanopillars for large applied currents”, Phys. Rev. B, vol. 72, 064430 (2005).

G. D. Fuchs, I. N. Krivorotov, P. M. Braganca, N. C. Emley, A. G. F. Garcia, D. C. Ralph, and R. A. Buhrman, “Adjustable spin torque in magnetic tunnel junctions with two fixed layers”, Appl. Phys. Lett., vol. 86, 152509 (2005).

I. N. Krivorotov, N. C. Emley, J. C. Sankey, S. I. Kiselev, D. C. Ralph, and R. A. Buhrman, “Time-domain measurements of nanomagnet dynamics driven by spin-transfer torques”, Science, vol. 307, 228 (2005).

I. N. Krivorotov, N. C. Emley, A. G. F. Garcia, J. C. Sankey, S. I. Kiselev, D. C. Ralph, and R. A. Buhrman, “Temperature dependence of spin-transfer-induced switching of nanomagnets”, Phys. Rev. Lett., vol. 93, 166603 (2004).

G. D. Fuchs, N. C. Emley, I. N. Krivorotov, P. M. Braganca, E. M. Ryan, S. I. Kiselev, J. C. Sankey, D. C. Ralph, R. A. Buhrman, and J. A. Katine, “Spin-transfer effects in nanoscale magnetic tunnel junctions”, Appl. Phys. Lett., vol. 85, 1205 (2004).

S. I. Kiselev, J. C. Sankey, I. N. Krivorotov, N. C. Emley, M. Rinkoski, C. Perez, R. A. Buhrman, and D. C. Ralph, “Current-induced nanomagnet dynamics for magnetic fields perpendicular to the sample plane”, Phys. Rev. Lett., vol. 93, 036601 (2004).

O. Ozatay, P. Chalsani, N. C. Emley, I. N. Krivorotov, and R. A. Buhrman, “Magnetoresistance and magnetostriction effects in ballistic ferromagnetic nanoconstrictions”, J. Appl. Phys., vol. 95, 7315 (2004).

N. C. Emley, F. J. Albert, E. M. Ryan, I. N. Krivorotov, D. C. Ralph, R. A. Buhrman, J. M. Daughton, and A. Jander, “Reduction of spin transfer by synthetic antiferromagnets”, Appl. Phys. Lett., vol. 84, 4257 (2004)

S. I. Kiselev, J. C. Sankey, I. N. Krivorotov, N. C. Emley, R. J. Schoelkopf, R. A. Buhrman, and D. C. Ralph, “Microwave oscillations of a nanomagnet driven by a spin-polarized current”, Nature, vol. 425, 380 (2003).

F. J. Albert, N. C. Emley, E. B. Myers, D. C. Ralph, and R. A. Buhrman, “Quantitative study of magnetization reversal by spin-polarized current in magnetic multilayer nanopillars”, Phys. Rev. Lett, vol. 89, 226802 (2002).

T. Thurn-Albrecht, J. Schotter, C. A. Kastle, N. Emley, T. Shibauchi, L. Krusin-Elbaum, K. Guarini, C. T. Black, M. T. Tuominen, and T. P. Russell, “Ultrahigh-density nanowire arrays grown in self-assembled diblock copolymer templates”, Science, vol. 290, 2126 (2000).

PRESENTATIONS

"Vibrational Energy Scavenging", Wright Group Lunch Seminar Series, Berkeley, CA, March 10, 2008.

"Making nano-droplets", BSAC Lunch Seminar Series, Berkeley, CA, April 2006.

"The Effects of Temperature and Current Amplitude on the Dynamics of Spin Transfer Switching", MMM, Jacksonville, FL, November, 2004.

"Spin Transfer Effects in Magnetic Multilayer Nanopillars", CNF Annual Meeting, Ithaca, NY, October, 2004.

"Spin transfer switching in magnetic nanopillars: The effects of temperature and materials modifications", GRC on Magnetic Nanostructures, Big Sky, MT, August 2004

"Synthetic antiferromagnetic layers in spin transfer nanopillars", IRG-A Seminar, Cornell University, December 2003

"Synthetic Antiferromagnetic Layers in Spin-Transfer Nanopillars", APS, Austin, TX, March 2003.

"Studies of Spin-Transfer Switching in Magnetic Multilayer Nanopillars", MMM, Tampa, FL, November, 2002.

"Spin Transfer Effects in NOL and Alloy CPP Magnetic Nanostructures", APS, Indianapolis, IN, March 2002.

"Magnetic-Multilayer Nanowires From Polymeric Templates", APS, Atlanta, GA, March, 1999.