

RYAN M. BRIGGS

HTTP://WWW.ITS.CALTECH.EDU/~RBRIGGS

EDUCATION

CALIFORNIA INSTITUTE OF TECHNOLOGY PASADENA, CA

Cumulative GPA: 4.0/4.0

PhD in Materials Science, Advisor: Prof. Harry A. Atwater, 2008 - 2011 (expected)

Thesis: *Light emitters, modulators, and plasmonic structures for integrated silicon photonics*

MS in Applied Physics, 2006 - 2008

COLORADO SCHOOL OF MINES GOLDEN, CO

Cumulative GPA: 4.0/4.0

MS in Engineering Systems, Mechanical Specialty, Advisor: Prof. Cristian V. Ciobanu, 2005 - 2006

Thesis: *Recent developments in the physics of high-index semiconductor surfaces*

BS in Engineering Physics with Highest Honors, 2001 - 2005

AWARDS

National Defense Science and Engineering Graduate Fellowship, 2006 - 2009

Viola Coulter Foundation Graduate Fellowship, 2005

Colorado School of Mines Physics Faculty Distinguished Graduate Award, 2005

Colorado School of Mines President's Scholarship, 2001 - 2005

RESEARCH

Integration of plasmonic waveguides with silicon photonics: Demonstrated coupling between single-mode silicon-on-insulator waveguides and plasmonic waveguides with 1 dB insertion loss; observed whispering-gallery modes with quality factors in excess of 100 in silicon-waveguide-coupled plasmonic ring resonators

Vanadium dioxide-based silicon photonic waveguide modulators: Integrated VO₂, a thermochromic phase transition material, with silicon waveguides to create a compact, thermally driven absorption modulator; demonstrated greater than 6 dB modulation over a device length of 2 μm with an insertion loss of 2 dB

Silicon slot waveguides with integrated light emitters: Fabricated multi-layer single-crystal silicon slot waveguides with 25-nm thick amorphous slot layers by wafer bonding; showed that the radiative emission rate of erbium-doped glass can be strongly enhanced in slot waveguide structures

Evolutionary algorithms for determining atomic structure of semiconductor surfaces: Developed novel algorithms for identifying the lowest-energy structure of surface reconstructions and one-dimensional defects on high-index silicon and germanium surfaces

SELECTED PUBLICATIONS

R.M. Briggs, J. Grandier, Stanley P. Burgos, Eyal Feigenbaum, and H.A. Atwater, *Efficient coupling between dielectric-loaded plasmonic and silicon photonic waveguides*, Nano Letters **10**, 4851-4857 (2010).

R.M. Briggs, I.M. Pryce, and H.A. Atwater, *Compact silicon photonic waveguide modulator based on the vanadium dioxide metal-insulator phase transition*, Optics Express **18**, 11192-11201 (2010).

R.M. Briggs, G.M. Miller, and H.A. Atwater, *Modifying the radiative quantum efficiency of erbium-doped glass in silicon slot waveguides*, Proceedings of the 6th IEEE Conf. on Group IV Photonics, 223-225 (2009).

R.M. Briggs, M. Shearn, A. Scherer, and H.A. Atwater, *Wafer-bonded single-crystal silicon slot waveguides and ring resonators*, Applied Physics Letters **94**, 021106 (2009).

R.M. Briggs and C.V. Ciobanu, *Evolutionary approach for finding the atomic structure of steps on stable crystal surfaces*, Physical Review B **75**, 195415 (2007).

ADDITIONAL PUBLICATIONS

I.M. Pryce, K. Aydin, Y.A. Kelaite, R.M. Briggs, and H.A. Atwater, *Highly strained compliant optical metamaterials with large frequency tunability*, Nano Letters **10**, 4222-4227 (2010).

G.M. Miller, R.M. Briggs, and H.A. Atwater, *Achieving optical gain in waveguide-confined nanocluster-sensitized erbium by pulsed excitation*, Journal of Applied Physics **108**, 063109 (2010).

M.C. Putnam, S.W. Boettcher, M.D. Kelzenberg, D.B. Turner-Evans, J.M. Spurgeon, E.L. Warren, R.M. Briggs, N.S. Lewis, and H.A. Atwater, *Si microwire-array solar cells*, Energy and Environmental Science **3**, 1037-1041 (2010).

M.D. Kelzenberg, S.W. Boettcher, J.A. Petykiewicz, D.B. Turner-Evans, M.C. Putnam, E.L. Warren, J.M. Spurgeon, R.M. Briggs, N.S. Lewis, and H.A. Atwater, *Enhanced absorption and carrier collection in Si wire arrays for photovoltaic applications*, Nature Materials **9**, 239-244 (2010).

Y.C. Jun, R.M. Briggs, H.A. Atwater, and M.L. Brongersma, *Broadband enhancement of light emission in silicon slot waveguides*, Optics Express **17**, 7479-7490 (2009).

C.V. Ciobanu and R.M. Briggs, *Stability of strained H:Si(105) and H:Ge(105) surfaces*, Applied Physics Letters **88**, 133125 (2006).

C.V. Ciobanu, A. Barbu and R.M. Briggs, *Interactions of carbon atoms and dimer vacancies on the Si(001) surface*, Journal of Engineering Materials and Technology (ASME Transactions) **127**, 462-467 (2005).

PRESENTATIONS

R.M. Briggs, *Pushing silicon photonics beyond silicon*, invited talk for the Northrop Grumman Aerospace Research Laboratories seminar series, 2010.

R.M. Briggs, I.M. Pryce, and H.A. Atwater, *Compact silicon photonic waveguide modulator based on the vanadium dioxide metal-insulator phase transition*, talk at SPIE Optics + Photonics, 2010.

R.M. Briggs, J. Grandidier, and H.A. Atwater, *Efficient coupling between plasmonic and photonic waveguides*, poster at SPIE Optics + Photonics, 2010.

R.M. Briggs, G.M. Miller, and H.A. Atwater, *Modifying the radiative quantum efficiency of erbium-doped glass in silicon slot waveguides*, talk at the 6th IEEE Conf. on Group IV Photonics, 2009.

R.M. Briggs, M. Shearn, G.M. Miller, and H.A. Atwater, *Silicon slot waveguides: Integrating low-index erbium-doped gain materials with silicon photonics*, talk at the 2008 Materials Research Society Fall Meeting.

R.M. Briggs and C.V. Ciobanu, *Stability of strained monohydride H:Si(105) and H:Ge(105) surfaces*, poster at the 2005 Materials Research Society Fall Meeting.

TEACHING EXPERIENCE

Mentored two students in the Caltech Summer Undergraduate Research Fellowship Program, 2009 - 2010

Teaching Assistant for *Solid State Physics*, California Institute of Technology, 2009

Teaching Assistant for *Kinetic Processes in Materials*, California Institute of Technology, 2008

SKILLS

Device fabrication: Electron-beam lithography, photolithography, plasma-assisted etching and deposition ("super user" for ICP-RIE and PECVD systems -- in charge of recipe development and system maintenance), focused ion-beam milling, wafer bonding, DC ion-beam/RF-magnetron sputter deposition, lapping/polishing

Measurement techniques: Fiber-coupled and free-space laser optics, photonic waveguide testing (designed and built custom waveguide testing platform), spectroscopic ellipsometry, atomic force microscopy, time-resolved photoluminescence spectroscopy, scanning electron microscopy, electrical device testing

Electromagnetic simulation: Finite-element and finite-difference time domain methods (COMSOL, Lumerical); developed Mathematica code for calculating waveguide modes, waveguide-coupled spontaneous emission rates, and waveguide-integrated diffraction grating parameters

Atomic structure calculations: Empirical potential modeling of semiconductor crystals; wrote evolutionary algorithms in Fortran to determine low-energy bond configurations of structures on silicon/germanium surfaces