Erik Verlage

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EDUCATION

California Institute of Technology, Pasadena, CA 06/2017
Ph.D. in Materials Science
Dissertation: High-Efficiency Solar Fuel Devices – Protection and Light Management Utilizing TiO_2
M.S. in Materials Science

Massachusetts Institute of Technology, Cambridge, MA 06/2011
B.S. in Physics, APS Minority Scholar

RESEARCH EXPERIENCE

MIT, AIM Photonics Academy, Cambridge, MA 07/2017 - *present*
Postdoctoral Associate – Advisor: Prof. Lionel C. Kimerling

- Leading a multidisciplinary team to design a digital learning platform for workforce training in photonics.
- Managing a team of software developers, graphic designers, content experts, and undergraduate students to create a library of educational simulations for integration with the edX platform using Unity C# and EPDA software tools—completed 3 interactive modules, with 6 currently in production.
- Developing curriculum for blended learning bootcamps using hands-on and virtual lab exercises.
- Assisting with the production of two MITx online courses and a series of interactive learning modules.
- Co-authored successful proposal for a 2019 MIT-JWEL higher education grant focusing on curriculum development; currently writing multiple federal grant proposals including NSF-ATE and ONR-MEEP.

Caltech, Joint Center for Artificial Photosynthesis, Pasadena, CA 2012-17
Doctoral Researcher – Advisor: Prof. Harry A. Atwater

- Researched the integration of TiO_2 protection layers on III-V solar fuel devices for water electrolysis and CO_2 reduction, creating two novel devices with >10% efficiency and record stability.
- Explored the optical and electronic properties of dielectric nanocone waveguides using FDTD simulations, demonstrating >90% broadband transmission through thick metal contacts.
- Developed expertise in semiconductor cell processing including photolithography, chemical etching, reactive ion etching, electroplating, PVD, CVD, atomic layer deposition, and epitaxial liftoff.
- Acquired a broad overview of photovoltaics, plasmonics, metamaterials, and electrochemistry.

University of Konstanz, Department of Photovoltaics, Konstanz, Germany 2011
Research Assistant – Prof. Giso Hahn, Dr. Stefan Braun

- Conducted experiments on nickel diffusion in polycrystalline Si using transmission line measurements.

MIT Photovoltaic Research Laboratory, Cambridge, MA 2010-11
Research Assistant – Prof. Tonio Buonassisi

- Designed and conducted experiments to accurately measure the diffusivity of nickel in silicon, with a goal of replacing expensive silver contacts with nickel to reduce manufacturing costs for photovoltaics.

MIT Media Lab, Human Dynamics Group, Cambridge, MA 2010
Research Assistant – Prof. Alex 'Sandy' Pentland, Dr. Daniel Olguin

- Implemented high-level speech processing functions, including voice feature recognition software, for a new generation of sociometric badges.

MIT Media Lab, Affective Computing Group, Cambridge, MA 2008
Research Assistant – Prof. Rosalind Picard, Dr. Rich Fletcher

- Integrated wireless biosensors into games made with Scratch, a visual programming language created in the MIT Media Lab, to familiarize autistic children with social and emotional interactions.

PEER-REVIEWED PUBLICATIONS

X.Z., R.L., K.S., Y.C., **E. Verlage**, S.F., N.L., and C. Xiang. (2016) Solar-driven reduction of 1 atm of CO_2 to formate at 10% energy-conversion efficiency by use of a TiO_2-protected III–V tandem photoanode in conjunction with a bipolar membrane and a Pd/C cathode. *ACS Energy Letters*, 1, 764-770.

K.S., R.L., Y.C., **E. Verlage**, N.L., and C. Xiang. (2016) A stabilized, intrinsically safe, 10% efficient, solar-driven water-splitting cell incorporating earth-abundant electrocatalysts with steady-state pH gradients and product separation enabled by a bipolar membrane. *Advanced Energy Materials*, 6, 1600379.

E. Verlage, S.H., R.L., R.J., K.S., C.X., N.L., and H. A. Atwater. (2015) A monolithically integrated, intrinsically safe, 10% efficient, solar-driven water-splitting system based on active, stable earth-abundant electrocatalysts in conjunction with tandem III–V light absorbers protected by amorphous TiO_2 films. *Energy and Environmental Science*, 8, 3166-3172.

K.S., Y.K., **E. Verlage**, B.B., C.T., and N. S. Lewis. (2015) Sputtered NiO_x films for stabilization of p^+n-InP photoanodes for solar-driven water oxidation. *Advanced Energy Materials*, 5, 1402276.

F.S., A.C., **E. Verlage**, J.H., N.L., and M. P. Soriaga. (2014) CoP as an acid-stable active electrocatalyst for the hydrogen-evolution reaction: electrochemical synthesis, interfacial characterization and performance evaluation. *The Journal of Physical Chemistry C*, 118, 29294-29300.

J.L., D.F., D.B., **E. Verlage**, A.G., S.E., H.S., and T. Buonassisi. (2013) Nickel: A very fast diffuser in silicon. *Journal of Applied Physics*, 113, 204906.

A.K., M.M., **E. Verlage**, M.V., M.F., and A. Ramos. (2011) Microwave-induced water flow in a microchannel built on a coplanar waveguide. *Journal of Applied Physics*, 110, 064912.

Submitted for Publication:

E. Verlage,† S. Yalamanchili,† W.C., K. F., P.J., P.K., R.S., N.L., and H. A. Atwater. Near Unity Broadband Light Transmission Using Optical Waveguides in Dielectric Nanocone Arrays. *ACS Nano Letters*. Manuscript submitted for publication. († equal contribution)

In Preparation

E. Verlage, S.S., A.A., and L. C. Kimerling. Digital and blended learning bootcamps for photonics education using experimental lab exercises and virtual lab simulations.

SELECT CONFERENCE PRESENTATIONS

E. Verlage, S.S., A.A., and L. C. Kimerling. (Accepted, May 2019) Web-based interactive simulations and virtual lab for photonics education. *15th Conference on Education and Training in Optics and Photonics*, Quebec, Canada.

E. Verlage, S.S., and L. C. Kimerling. (November 2018) The AIM Virtual Design Lab for integrated photonics computation and manufacturing. *Fall IPSR Roadmap Conference*, Cambridge, MA.

E. Verlage, S.S., and L. C. Kimerling. (October 2017) Interactive simulation library and game-based learning for photonics education. *Fall IPSR Roadmap Conference*, Albany, NY.

E. Verlage, S.H., N.L., and H. A. Atwater. (April 2015) Stable III-V multijunction devices using hole-conducting TiO_2 for solar water splitting. *MRS Spring Meeting and Exhibit*, Cambridge, MA.

LEADERSHIP AND MENTORING

- Currently managing 2 Lockheed Martin Future Leader recipients in simulation of photonic circuits, and overseeing 2 undergraduate MITx course assistants — 2019
- Mentored 6 undergraduate students as part of a multidisciplinary research program at MIT and guided 1 student to expand project into an EECS undergraduate thesis — 2018
- Project lead on 4 online games for K-12 education via game development club — 2016-19
- Supervised 2 Caltech Summer Undergraduate Research Fellows (SURFs) — 2015-16
- Met weekly with 6 high school students as part of the Solar Energy Activity Lab (SEAL) outreach program, culminating in a student-led capstone research presentation — 2014-15

SKILLS

Project Management: Excellent communication skills, demonstrated experience leading multidisciplinary teams

Programming: C#/C++, Python, JavaScript, HTML5/CSS, XML/JSON, MATLAB, Mathematica

Software: Unity, GitHub, EPDA Simulation Software (Lumerical FDTD/MODE, Synopsys RSoft, KLayout), CAD Software, edX Studio, Blender, Adobe Photoshop, Adobe Illustrator

Languages: English (fluent), Spanish (fluent)

INVITED TALKS

- *CCC Content Generation for Workforce Training Workshop*, Atlanta, GA — 03/2019
- *Education and Workforce Development Workshop*, Cambridge, MA — 02/2019
- *Concord Consortium*, Concord, MA — 01/2019
- *Stonehill College*, Easton, MA — 2018
- *Lawrence Berkeley National Laboratory*, Berkeley, CA — 2016

OUTREACH AND MEDIA

- Speaker and matinée host for Caltech's K-12 outreach Reel Science series (90 participants) — 2016
- Research featured on front cover of *Energy and Environmental Science*, Issue 11, and reported by Caltech News, MIT Technology Review, Phys.org, Science Daily, and EurekAlert! — 2015
- Speaker and matinée host for Caltech's Science Saturdays series (60 participants) — 2015

ACADEMIC REFERENCES

Prof. Lionel C. Kimerling (Postdoctoral Advisor)
Thomas Lord Professor, Department of Materials Science and Engineering
Massachusetts Institute of Technology, Cambridge, MA 02139.
Phone: +1 617 253 5383. Email: lckim@mit.edu

Prof. Harry A. Atwater (Ph.D. Advisor)
Howard Hughes Professor, Department of Applied Physics and Materials Science
California Institute of Technology, Pasadena, CA 91125.
Phone: +1 626 395 2197. Email: haa@caltech.edu

Dr. Sajan Saini (Postdoctoral Advisor)
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Massachusetts Institute of Technology, Cambridge, MA 02139.
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