

Erik C. Garnett

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EDUCATION

Stanford University	Postdoctoral Fellow, Sept. 2009-July '12
University of California, Berkeley	Ph.D. in Chemistry, May 2009
University of Illinois, Urbana-Champaign	B.S. in Chemistry, May 2004

RESEARCH EXPERIENCE

Group Leader, FOM-AMOLF Institute, Amsterdam

- Launched new research direction for AMOLF in solar energy conversion – first of 3 new faculty

Dr. Mark Brongersma, Dr. Mike McGehee, Dr. Yi Cui groups, Stanford University – Postdoctoral Fellowship

- Nanostructured inorganic, organic and hybrid tandem photovoltaics with photonic enhancement
- Plasmonics for self-limited nanowelding and light trapping

Dr. Peidong Yang group, University of California, Berkeley, CA – PhD student

- Silicon nanowire synthesis, doping, and structural characterization
- Nanowire transistor, solar cell and capacitor device fabrication and testing

Dr. David Ginley group, National Renewable Energy Lab, Golden, CO – internship

- Combinatorial corrosion cell (Summer 2003); Ink-jet printed PEDOT/PSS films (Summer 2004)

Dr. Andrzej Wieckowski group, University of Illinois, Urbana-Champaign – internship

- Analyzed Pt/Ru and Pt/Pd nanoparticle fuel cell catalyst activity via electrochemical techniques

PUBLICATIONS (>7,700 citations; h-index=20 from Google Scholar)

“Grain boundary effects on halide perovskite carrier diffusion length and lifetime” Haralds Abolins, Sarah Britttman, Gede Adhyaksa, Pim Veldhuizen, Ruud Schropp, Erik C. Garnett, in preparation

“Reversible polarization effects on photoluminescence in purely inorganic and hybrid halide perovskite microcrystals” Parisa Khoram, Sarah Britttman, David Fenning, Erik Garnett, in preparation

“Green’s function analytical calculations applied to nanowire optoelectronics” Eric Johlin, Sander A. Mann and Erik C. Garnett, in preparation

“Interfacial engineering of metal-insulator-semiconductor junctions for efficient and stable photoelectrochemical water oxidation” Ibadillah A. Digdaya, Gede W.P. Adhyaksa, Bartek J. Trzesniewski, Erik C. Garnett and Wilson A. Smith, submitted (2017)

“Nanoscale back contact perovskite solar cell design for improved tandem efficiency” Gede W.P. Adhyaksa, Eric Johlin and Erik C. Garnett, submitted (2017)

“Monocrystalline nanopatterns made by nanocube assembly and epitaxy” Beniamino Sciacca, Annemarie Berkhout, Benjamin J.M. Brenny, Sebastian Z. Oener, Marijn A. van Huis, Albert Polman and Erik C. Garnett, submitted (2017)

"Benchmarking photoactive thin-film materials using a laser-induced steady-state photocarrier grating" L.W. Veldhuizen, G.W.P. Adhyaksa, M. Theelen, E.C. Garnett and R.E.I. Schropp, submitted (2017)

"Integrating sphere microscopy for direct absorption measurements of single nanostructures" Sander A. Mann, Beniamino Sciacca, Yunyan Zhang, Jia Wang, Evgenia Kontoleta, Huiyun Liu and Erik C. Garnett, *ACS Nano*, DOI: 10.1021/acsnano.6b06534 (2017)

"Indirect to direct bandgap transition in methylammonium lead halide perovskite under pressure" Tianyi Wang, Benjamin Daiber, Jarvist M. Frost, Sander A. Mann, Erik C. Garnett, Aron Walsh and Bruno Ehrler, *Energy & Environmental Science*, DOI: 10.1039/C6EE03474H (2017)

"3D multi-energy deconvolution electron microscopy" Michiel de Goede, Eric Johlin, Beniamino Sciacca, Faysal Boughorbel and Erik C. Garnett, *Nanoscale*, **9**, 684 (2017)

"Super-resolution imaging of light-matter interactions near single semiconductor nanowires" Eric Johlin, Jacopo Solari, Sander A. Mann, Jia Wang, Tom S. Shimizu and Erik C. Garnett, *Nature Communications*, **7**, 13950 (2016)

"Boosting solar cell photovoltage via nanophotonic engineering" Y. Cui, D. van Dam, S.A. Mann, N.J.J. van Hoof, P.J. van Veldhoven, E.C. Garnett, E.P.A.M. Bakkers, J.E.M. Haverkort, *Nano Letters*, **16**, 6467 (2016)

"Preparation of organometal halide perovskite photonic crystal films" S. Schunemann, K. Chen, S. Brittman, E.C. Garnett and H. Tuysuz, *ACS Applied Materials & Interfaces*, **8**, 25489 (2016)

"Opportunities and limitations for nanophotonic structures to exceed the Shockley-Queisser limit" Sander A. Mann, Richard R. Grote, Richard M. Osgood, Jr., Andrea Alu and Erik C. Garnett, *ACS Nano*, **10**, 8620 (2016)

"Quantifying losses and thermodynamic limits in nanophotonic solar cells" Sander A. Mann, Sebastian Z. Oener, Alessandro Cavalli, Erik P.A.M. Bakkers, Jos E.M. Haverkort and Erik C. Garnett, *Nature Nanotechnology*, Advanced Online Publication (2016)

"AgFeS₂ Modified BiVO₄ Photoanode for Photoelectrochemical Water Splitting", Xiuzhen Zheng, Beniamino Sciacca, Erik C. Garnett, Liwu Zhang, *ChemPlusChem*, **81**, 1075 (2016)

"Diffusion lengths in hybrid perovskites: processing, composition, aging and surface passivation effects" Gede W.P. Adhyaksa, Leon W. Veldhuizen, Yinghuan Kuang, Sarah Brittman, Ruud E.I. Schropp and Erik C. Garnett, *Chemistry of Materials*, **28**, 5259 (2016)

"Generalized anti-reflection coatings for complex bulk metamaterials", Ruben Maas, Sander A. Mann, Dimitrios L. Sounas, Andrea Alu, Erik C. Garnett and Albert Polman, *Phys. Rev. B*, **93**, 195433 (2016)

"Metal-insulator-insulator-semiconductor nanowire network solar cells" Sebastian Z. Oener, Jorik van de Groep, Bart Macco, Paula C. P. Bronsveld, W.M. M. Kessels, Albert Polman, Erik C. Garnett, *Nano Letters*, **16**, 3689 (2016)

"Engineering the kinetic and interfacial energetics of Ni/Ni-Mo catalyzed amorphous silicon carbide photocathodes in alkaline media" Ibadillah A. Digdaya, Paula Perez Rodriguez, Ming Ma, Gede W. P. Adhyaksa, Erik C. Garnett, Arno H.M. Smets, Wilson A. Smith, *J. Materials Chem. A*, **4**, 6842 (2016)

"Photovoltaic materials - present efficiencies and future challenges" Albert Polman, Mark Knight, Erik C. Garnett, Bruno Ehrler and Wim C. Sinke, *Science*, **352**, 307 (2016)

- "Growth and Characterization of PDMS-Stamped Halide Perovskite Single Microcrystals" Parisa Khoram, Sarah Brittan, Wojciech I. Dzik, Joost N. H. Reek, and Erik C. Garnett, *J. Phys. Chem. C.*, **120**, 6475 (2016)
- "Measuring n and k at the Microscale in Single Crystals of $\text{CH}_3\text{NH}_3\text{PbBr}_3$ " Sarah Brittan, Sander Mann and Erik C. Garnett, *J. Phys. Chem. C.*, **120**, 616 (2016)
- "Solution-grown silver nanowire ordered arrays as transparent electrodes" Beniamino Sciacca, Jorik van de Groep, Albert Polman and Erik C. Garnett, *Advanced Materials*, **28**, 905 (2016)
- "Resonant nanophotonic spectrum splitting for ultra-thin multijunction solar cells" Sander A. Mann and Erik C. Garnett, *ACS Photonics*, **2**, 816 (2015)
- "Transformation of Ag Nanowires into Semiconducting AgFeS_2 Nanowires" Beniamino Sciacca, Anil O. Yalcin and Erik C. Garnett, *J. Amer. Chem. Soc.*, **137**, 4340 (2015).
- "The Expanding World of Hybrid Perovskites: Materials Properties and Emerging Applications" Sarah Brittan, Gede W.P. Adhyaksa, Erik C. Garnett, *MRS Communications*, **5**, 7 (2015)
- "Au- Cu_2O core-shell nanowire photovoltaics" Sebastian Z. Oener, Sander A. Mann, Beniamino Sciacca, Cristina Sfiligoj, John Hoang, Erik C. Garnett, *Applied Physics Letters*, **106**, 023501 (2015).
- "Solution-phase epitaxial growth of quasi-monocrystalline cuprous oxide on metal nanowires" Beniamino Sciacca, Sander A. Mann, Frans D. Tichelaar, Henny W. Zandbergen, Marijn A. van Huis, Erik C. Garnett, *Nano Letters*, **14**, 5891 (2014).
- "Metamaterial mirrors in optoelectronic devices" Majid Esfandyarpour, Erik C. Garnett, Yi Cui, Michael D. McGehee, Mark L. Brongersma, *Nature Nanotechnology*, **9**, 542 (2014).
- "Extreme Light Absorption in Thin Semiconducting Films Wrapped around Metal Nanowires" Sander A. Mann and Erik C. Garnett, *Nano Letters*, **13**, 3173 (2013).
- "Large-Area Free-Standing Ultrathin Single-Crystal Silicon as Processable Materials" Shuang Wang, Benjamin D. Weil, Yanbin Li, Ken Xingze Wang, Erik Garnett, Shanhui Fan, Yi Cui, *Nano Letters*, **13**, 4393 (2013)
- "Optimization of non-periodic plasmonic light-trapping layers for thin-film solar cells" Ragip A. Pala, John S.Q. Liu, Edward S. Barnard, Daulet Askarov, Erik C. Garnett, Shanhui Fan, Mark L. Brongersma, *Nature Communications*, **4**, 2095 (2013).
- "Passivation coating on electrospun copper nanofibers for stable transparent electrodes" Po-Chun Hsu, Hui Wu, Tom J. Carney, Matt T. McDowell, Yuan Yang, Erik C. Garnett, M. Li, Liangbing Hu, Yi Cui, *ACS Nano*, **6**, 5150-5156 (2012).
- "Hybrid Si Nanocone-Polymer Solar Cells" Sangmoo Jeong, Erik C. Garnett, Shuang Wang, Zongfu Yu, Shanhui Fan, Mark L. Brongersma, Michael D. McGehee, Yi Cui, *Nano Letters*, **12**, 2971-2976 (2012)
- "Self-limited plasmonic welding of silver nanowire junctions" Erik C. Garnett, Wenshan Cai, Judy J. Cha, Fakhruddin Mahmood, Stephen T. Connor, M. Greyson Cristoforo, Yi Cui, Michael D. McGehee and Mark L. Brongersma, *Nature Materials*, **11**, 241-249 (2012).
- "Absorption of Light in a Single-nanowire Silicon Solar Cell Decorated with an Octahedral Silver Nanocrystal" Sarah Brittan, Hanwei Gao, Erik C. Garnett and Peidong Yang, *Nano Letters*, **11**, 5189-5195 (2011).

“Nanowire Solar Cells” (Invited Review) Erik C. Garnett, Mark L. Brongersma, Yi Cui and Michael D. McGehee, *Annual Review of Materials Research*, **41**, 269-295 (2011).

“Silicon nanowire hybrid photovoltaics” Erik C. Garnett, Craig Peters, Mark Brongersma, Yi Cui, Mike McGehee, *Proceedings of the 2010 35th IEEE Photovoltaic Specialists Conference*, 00934, June 20-25, 2010.

“Fast and Scalable Printing of Large Area Monolayer Nanoparticles for Nanotexturing Applications” Sangmoo Jeong, Liangbing Hu, Hye-Ryoung Lee, Erik Garnett, Jang-Wook Choi and Yi Cui. *Nano Letters*, **10**, 2989-2994 (2010).

“Light Trapping in Silicon Nanowire Solar Cells” Erik Garnett and Peidong Yang. *Nano Letters*, **10**, 1082-1087 (2010).

“Oligo- and Polythiophene/ZnO Hybrid Nanowire Solar Cells” Alejandro L. Briseno, Thomas W. Holcomb, Akram I. Boukai, Erik C. Garnett, Steve W. Shelton, Jean J.M. Frechet, and Peidong Yang. *Nano Letters*, **10**, 334-340 (2010).

“Dopant profiling and surface analysis of silicon nanowires using capacitance-voltage measurements” Erik C. Garnett, Yu-Chih Tseng, Devesh Khanal, Junqiao Wu, Jeffrey Bokor and Peidong Yang. *Nature Nanotechnology*, **4**, 311-314 (2009).

“Silicon Nanowire Radial p-n Junction Solar Cells” Erik C. Garnett and Peidong Yang. *J. Amer. Chem. Soc.* **130**, 9224-9225 (2008).

“Enhanced thermoelectric performance of rough silicon nanowires” Allon I. Hochbaum, Renkun Chen, Raul Diaz Delgado, Wenjie Liang, Erik C. Garnett, Mark Najarian, Arun Majumdar and Peidong Yang. *Nature* **451**, 163-167 (2008).

“Growth and Electrical Characteristics of Platinum-Nanoparticle-Catalyzed Silicon Nanowires” Erik Garnett, Wenjie Liang, and Peidong Yang. *Advanced Materials* **19**, 2946-2950 (2007).

“Effects of Nafion as a binding agent for unsupported nanoparticle catalysts” M.S. McGovern, E.C. Garnett, C. Rice, R.I. Masel, A. Wieckowski. *Journal of Power Sources*, **115**, 35-39 (2003).

INVITED TALKS

- MRS Conference, Phoenix, U.S.A., April 18, 2017
- OSA Light, Energy and Environment Congress, Leipzig, Germany, November 15, 2016
- EOSAM 2016, Berlin, Germany, September 30, 2016
- Eindhoven Technical University, Department of Applied Physics, Netherlands, September 19, 2016
- Fotonica, Utrecht, Netherlands, June 2, 2016
- Debye Nanoscience Institute Spring school on energy, Utrecht University, April 19, 2016
- MRS Conference, Boston, U.S.A., December 1, 2015
- EMRS Conference, Lille, France, May 14, 2015
- Utrecht University, Department of Chemistry, Netherlands, November 20, 2014
- European PVSEC, Amsterdam, Netherlands, September 24, 2014
- EMRS Conference, Warsaw, Poland, September 15, 2014
- *Next Generation Photovoltaics workshop*, Imperial College, London, England, July 22, 2014
- Max Planck Institute for Coal Research, Mulheim, Germany, May 19, 2014
- University of Houston, Materials Science Department, Houston, Texas, USA, May 7, 2014
- Rice University, Department of Electrical Engineering, Houston, Texas, USA, May 6, 2014
- SPIE Photonics Europe Conference, Brussels, Belgium, April 16, 2014

- TU Delft, Department of Chemical Engineering, Netherlands, January 27, 2014
- *Next Generation Photovoltaics* Conference, Erlangen, Germany, December 9-11, 2013
- *Nanowires 2013* Conference, Weizmann Institute, Israel, November 12-15, 2013
- Leiden University, Department of Physics, Netherlands, November 1, 2013
- *Focus Workshop on Nanowires*, TUM-IAS, Munich, Germany, October 28-29, 2013
- *Fysica 2013*, TU Delft, Netherlands, April 19, 2013
- *SUNday 2012*, Pecha Kucha lunchtime seminar, Den Bosch, Netherlands, November 7, 2012
- *Cleantech 2012* Conference, Santa Clara Convention Center, CA, USA, June 21, 2012
- Columbia University Chemistry Department, USA, February 10, 2012
- University of Texas Chemical Engineering Department, USA, February 1, 2012
- MIT Chemistry Department, January 12, USA, 2012
- *Next Generation Photovoltaics – from ideas to applications* Conference, Erlangen, Germany, December 10-12, 2011
- Boston College Chemistry Department, USA, December 1, 2011
- *Global Climate & Energy Project Annual Review*, Stanford University, USA, October 4-5, 2011
- University of Washington Electrical Engineering Department, USA, April 21, 2011
- *SPIE Advanced Lithography Panel on Nanotechnology and Energy*, San Jose, CA, USA, February 28, 2011
- Columbia University Mechanical Engineering Department, USA, February 17, 2011
- Harvard University Chemistry Department, USA, January 28, 2011
- University of Minnesota Chemical Engineering and Materials Science Department, USA, January 18, 2011
- *Printed Electronics USA and Photovoltaics USA* Conference, Santa Clara, CA, December 1-2, 2010
- "Solar Cell Tutorial" *Printed Electronics USA and Photovoltaics USA* Conference, Santa Clara, CA, December 1-2, 2010
- *University of Massachusetts, Amherst*, IGERT Nanotechnology Seminar Series, USA, October 21, 2010
- *Applied Materials* Advanced Research Projects Group, Santa Clara, CA, USA, August 3, 2010
- *American Chemical Society* Meeting, San Francisco, CA, USA, March 25, 2010
- *Materials Research Society* Meeting, Boston, MA, USA, November, 30, 2009 (in place of Prof. Peidong Yang)

AWARDS

- NWO VIDI Grant – €800,000 personal grant awarded by the Dutch government (2016)
- AMOLF-DIFFER Collaboration Grant – program manager of €1.5 Million awarded by FOM (2014)
- ERC Starting Grant – €1.5 Million personal grant awarded by the European Union (2013)
- Global Climate & Energy Project Distinguished Student Lecturer Award (2011)
- Materials Research Society Graduate Student Award Gold Medalist (Spring 2009)
- Computational Nanoscience Innovation, 1st Place, \$5,000 – Bears Breaking Boundaries Contest, http://contest.berkeley.edu/main_pages/7 (2008)
- Barry M. Goldwater Scholarship - \$7,500 for academic excellence and future promise (2003)

ACADEMIC SERVICE

- 2017 Materials for Sustainability funding committee member (overseeing distribution of €12 million)
- 2017 Israeli Science Foundation reviewer (Israeli grant for €300,000)
- 2016 ERC Starting Grant reviewer (European grant for €1.5 million)
- 2016 DFG solar proposal reviewer (German science foundation grant for €250,000)

- 2015 SunShot proposal reviewer (USA Department of Energy grant for ~\$4 million)
 - 2015 NWO Veni evaluation committee member (Dutch research grant for up to €250,000)
 - FOM Physics@Veldhoven 2015 scientific advisory and planning committee
 - Manuscript Reviewer: *Science*, *Nature Photonics*, *Nature Nanotechnology*, *Nano Letters*, *Advanced Materials*, *Advanced Optical Materials*, *Advanced Energy Materials*, *ACS Nano*, *Journal of the American Chemical Society*, *Energy & Environmental Science*, *ACS Applied Materials & Interfaces*, *IEEE Transactions on Electron Devices*, *Journal of Photonics for Energy*, 2008-present
 - Research Proposal Reviewer, California Energy Commission, 2010-2011
 - Research Proposal Reviewer, TKI Solar (Netherlands), 2013
 - Research mentor, Center for Advanced Molecular Photovoltaics (CAMP)/King Abdullah University of Science and Technology (KAUST) summer internship program, Stanford University, Summer 2010
 - AMOLF “open day” solar energy activity developer and presenter, 2012-2014
 - “Nano-Raspberry Solar Cells” activity developer/presenter, Community in the Classroom (CIC), May 30, 2008 and May 28, 2009 – led 200 8th grade students in making solar cells from Raspberry juice and TiO₂ nanoparticles with each student succeeding to make a working device
 - “Electricity and Food” activity developer/presenter, Community in the Classroom (CIC), various elementary school classes in Berkeley and Oakland, CA, 2006-2009
 - “Blackberry Solar Cells” activity leader, Exploration in Nanoscience and Technology, Johns Hopkins Center for Talented Students in conjunction with Center of Integrated Nanomechanical Systems (COINS), Berkeley, CA, October 27, 2007
 - “Nanoscience and Energy” presenter/advisor, COINS summer workshop, Berkeley, CA, Summer 2007
 - “Introduction to nanowire electronics” workshop, Nanoscience summer camp, Lawrence Hall of Science, Berkeley, CA, August 2007
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TEACHING EXPERIENCE

- Photovoltaics (graduate course, 6 lectures), University of Amsterdam (Fall 2012, 2013, Spring 2015, 2016)
 - Nanoscience and Nanotechnology (graduate course, 1 lecture), Stanford (Spring 2011)
 - Solar Cells (graduate course, 2 lectures), Stanford (Fall 2009, 2010)
 - Analytical Chemistry (senior course, led lab and discussion sections), Berkeley (Spring 2007)
 - Solid State Chemistry (graduate course, developed and graded homework and exams), Berkeley (Spring 2006)
 - Introduction to Chemistry (freshman course for engineers, led lab and discussion sections), Berkeley (Fall 2004)
 - Introduction to Chemistry II (freshman course for chemistry majors, led discussion section), Illinois (Spring 2004)
 - Introduction to Chemistry I (freshman course for chemistry majors, led discussion section), Illinois (Fall 2003)
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REFERENCES

Professor dr. Albert Polman
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