

David P. Fenning

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Professional Preparation

Massachusetts Institute of Technology, Mechanical Engineering, Ph. D.	2013
Massachusetts Institute of Technology, Mechanical Engineering, M.S.	2010
Stanford University, Mechanical Engineering, B.S.	2008

Research & Professional Experience

Assistant Professor, Nanoengineering Department, UC San Diego	2015-
MIT/Battelle Postdoc, Electrochemical Energy Lab	2013-2015
R&D consultant, 1366 Technologies, Bedford, MA	2013

Research Interests

Defect engineering in materials for energy conversion and storage, focused on low-cost photovoltaics and photoelectrochemistry. Current research includes high-efficiency silicon solar cells, emerging perovskite solar cell materials, CO₂ electrocatalysis, and solar fuels. Emphasis on quantifying defect and reaction kinetics, synchrotron-based X-ray microscopy, including *in situ* synchrotron-based measurements of semiconductors, catalysts, and electrode interfaces, and development of predictive modeling of material processing.

Honors and Awards

Hellman Fellowship, 2017
ACS PRF Doctoral New Investigator Award, 2015
MIT/Battelle Postdoctoral Associate Program, 2013
IEEE Photovoltaics Specialist Conference Student Award Finalist, 2013
MIT de Florez Graduate Design Award, 2012
Martin Family Fellow for Sustainability, MIT, 2011
NSF Graduate Research Fellowship, 2008
MIT Presidential Fellowship, 2008
Terman Engineering Scholastic Award, Stanford University, 2008

Tau Beta Pi Engineering Honor Society, 2007

Professional Activities

Service

International Solar Fuels Conference

Organizing Chair, ISF2 Young Conference, 2017

Organizing Committee Member, 2017

IEEE Photovoltaics Specialist Conference

Chair, Area 4: Homojunction Devices & Technologies, 2018

Sub-Chair, Area 5: Characterization, 2017

Sub-Chair, Area 4: Junction Formation, 2016

NREL Workshop on Crystalline Silicon Solar Cells & Modules

Co-Chair, Characterization Discussion, 2015

Advanced Photon Source Upgrade Project, Argonne National Laboratory

Participant, In Situ Nanoprobe & Ptychoprobe Workshop, 2017

Science case co-author, APS-U beamline concept white papers, *In Situ Nanoprobe* and *PtychoProbe* (2016)

Proposal Review:

Helmholtz Young Investigator Group (2017-)

ACS PRF Doctoral New Investigator Award, (2016-)

NSF ENG CBET, NSF DMR SSMC (2016-)

Center for Integrated Nanotechnologies National User Facility, Sandia National Laboratories (2015-)

Peer Review: ACS Applied Materials & Interfaces, Advanced Science, AIP Advances, Applied Physics Letters, Catalysts, Chemistry of Materials, Energy Reports, Frontiers in Energy, J. Applied Physics, J. Electrochemical Society, J. Materials Chemistry A, J. Materials & Design, J. Materials Research, J. Power Sources, IEEE J. Photovoltaics, J. of Visualized Experiments, Materials, Materials Science in Semiconductor Processing, NPG Asia Materials, Nano Energy, Physica Status Solidi Rapid Research Letters, Physica Status Solidi (a), Physica Status Solidi (b), Physica Status Solidi (c), Materials Science & Engineering B

Member Materials Research Society, American Chemical Society, IEEE

Mentorship

Research Mentor

(current) 7 Graduate Student Researchers, 2 Undergraduate Researchers, 1 REU

(alumni) 1 Postdoctoral Researcher, 1 M.S.

Founding Faculty Advisor Energy Club @ UCSD, 2015-
Faculty Advisor Graduate Society of Nanoengineers 2016-
Mentor Assistance Program Local High-Schooler Mentor, 2015-
Engineering Resident Tutor, Dunster House, Harvard University, 2011-2015

Mentees' Awards

Moses Kodur, Sloan Scholar Fellowship, 2017
Aubriana Morris, Ledell Family Endowed Research Scholarship for Science and Engineering, 2016
Aubriana Morris, ACS Scholar, 2016
Hannu Laine, Best Poster Award, Workshop on Crystalline Silicon Solar Cells, 2016
Yanqi Luo, Portland Cement Association Fellowship, 2016
Yanqi Luo, UC Carbon Neutrality Initiative fellowship, 2015

Teaching

(forthcoming) NANO/CENG Engineering Solar Cells at the Nanoscale, S18
NANO111 Characterization of Nanoengineering Systems, W17
NANO120B Nanoengineering Systems Design II, S16, S17
NANO203 Synthesis & Characterization of Nanomaterials, W16, W17
CENG176B Chemical Engineering Process Laboratory II, S16, S17
CENG101A Introductory Fluid Mechanics, F15

Patents

“Peristaltic pump with constrictions at fixed locations,” Patent No. 8,382,460, issued 2/26/13.

Peer-Reviewed Journal Publications

37. S. Yavuz, E. Magaña, **D. P. Fenning***, P. Bandharu*, “Enhanced power conversion efficiency of graphene/Si solar cells through electrical carrier and interface engineering,” *submitted*, 2017.
36. H. S. Laine, V. Vähänissi, Z. Liu, E. Magaña, J. Krügener, A. E. Morishige, K. Salo, B. Lai, H. Savin, **D. P. Fenning***, “Elucidation of Iron Gettering Mechanisms in Boron-Implanted Silicon,” *submitted*, 2017.

35. G. N. Hall, M. Stuckelberger, T. Nietzold, J. Hartman, J.-S. Park, J. Werner, B. Niesen, M. L. Cummings, V. Rose, C. Ballif, M. K. Y. Chan, **D. P. Fenning**, M. I. Bertoni, "Perovskites under Low Pressure: the Reversibility of Solar Cell Performance," *submitted*, 2017.
34. Y. Luo, P. Khoram, S. Brittman, Z. Zhu, B. Lai, S. P. Ong, E. C. Garnett, **D. P. Fenning***, "Direct Observation of Halide Migration and Its Effect on the Photoluminescence of $\text{CH}_3\text{NH}_3\text{PbBr}_3$ Single Crystals," *Advanced Materials*, accepted, 2017.
33. S. A. Cho, Y. J. Jang, H.-D. Lim, J. E. Lee, F. M. Mota, Y. H. Jang, **D. P. Fenning**, K. Kang, Y. Shao-Horn, D. H. Kim, "Hierarchical Porous Carbonized Co_3O_4 Inverse Opals via Combined Block Copolymer and Colloid Templating as Bifunctional Electrocatalysts in Li-O_2 Battery," *Advanced Energy Materials*, 1700391, 2017.
32. L. Kornblum*, **D. P. Fenning***, J. Faucher, J. Hwang, A. Boni, M. G. Han, M. D. Morales-Acosta, Y. Zhu, E. I. Altman, M. L. Lee, C. H. Ahn, F. J. Walker*, Y. Shao-Horn*, "Solar Hydrogen Production Using Epitaxial SrTiO_3 on a GaAs Photovoltaic," *Energy & Environmental Science*, 10, 377-382, 2017. *equal contributions
31. M. Stuckelberger, T. Nietzold, G. N. Hall, B. West, J. Werner, B. Niesen, C. Ballif, V. Rose, **D. P. Fenning**, M. I. Bertoni, "Charge Collection in Hybrid Perovskite Solar Cells: Relation to the Nanoscale Elemental Distribution," *IEEE Journal of Photovoltaics*, 7(2), 590-597, 2017.
30. Y. Luo, S. Gamliel, S. Nijem, M. Holt, B. Stripe, V. Rose, M. I. Bertoni, L. Etgar, **D. P. Fenning***, "Spatially Heterogeneous Chlorine Incorporation in Perovskite Solar Cells," *Chemistry of Materials*, 28 (18), 6526-6543, 2016.
29. J. B. Chou, X.-H. Li, Y. Wang, **D. P. Fenning**, A. Elfaer, J. Viegas, M. Jouiad, Y. Shao-Horn, S.-G. Kim, "Surface Plasmon Assisted Hot Electron Collection in Wafer-Scale Metallic-Semiconductor Photonic Crystal," *Optics Express*, 24(18), A1234-A1244, 2016.
28. S. Bernardis, S. C. Fakra, E. Dal Martello, R. B. Larsen, B. K. Newman, **D. P. Fenning**, M. Di Sabatino, T. Buonassisi, "X-ray microprobe investigation of iron during a simulated silicon feedstock extraction process," *Metallurgical and Materials Transactions B*, doi:10.1007/s11663-016-0795-6, 2016.
27. H. Laine, V. Vähänissi, A. E. Morishige, J. Hofstetter, A. Haarahiltunen, B. Lai, H. Savin, **D. P. Fenning***, "Impact of Iron Precipitation on Phosphorus-Implanted Silicon Solar Cells," *IEEE Journal of Photovoltaics*, 6(5), 1094-1102, 2016.

26. A. E. Morishige, M. A. Jensen, J. Hofstetter, P. X. T. Yen, C. Wang, B. Lai, **D. P. Fenning**, T. Buonassisi, “[Synchrotron-based investigation of transition-metal getterability in n-type multicrystalline silicon,](#)” *Applied Physics Letters*, 108, 202104, 2016.
25. M. Gauthier, T. J. Carney, A. Grimaud, L. Giordano, N. Pour, H.-H. Chang, **D. P. Fenning**, S. Lux, O. Pachos, F. Maglia, S. Lupart, P. Lamp, Y. Shao-Horn, “[The Electrode-Electrolyte Interface in Li-ion Batteries: Current Understanding and New Insights,](#)” *Journal of Physical Chemistry Letters*, **6**, 4653-4672, 2015.
24. M. A. Jensen, J. Hofstetter, A. E. Morishige, G. Coletti, B. Lai, **D. P. Fenning**, T. Buonassisi, “[Synchrotron-based analysis of chromium distributions in multicrystalline silicon for solar cells,](#)” *Applied Physics Letters*, **106**, 202104, 2015.

Before UC San Diego:

23. K. J. May, **D. P. Fenning**, T. Ming, W. T. Hong, D. Lee, K. A. Stoerzinger, M. D. Biegalski, A. M. Kolpak, Y. Shao-Horn, “[Thickness-Dependent Photoelectrochemical Water-Splitting on Ultra-Thin LaFeO₃ Films Grown on Nb:SrTiO₃,](#)” *Journal of Physical Chemistry Letters*, **6** (6), 977, 2015.
22. J. Hofstetter, **D. P. Fenning**, D. M. Powell, A. E. Morishige, and T. Buonassisi, “[Sorting metrics for customized phosphorus diffusion gettering,](#)” *IEEE Journal of Photovoltaics*, **4**(6), 1421, 2014.
21. **D. P. Fenning**, J. Hofstetter, A. E. Morishige, D. M. Powell, A. S. Zuschlag, G. Hahn, T. Buonassisi. “[Darwin at High Temperature: Advancing Solar Cell Material Design through Defect Kinetics Simulation and Evolutionary Optimization,](#)” *Advanced Energy Materials*, **4**(13), 1400459 (2014).
20. **D. P. Fenning**, A. S. Zuschlag, A. Frey, J. Hofstetter, M. I. Bertoni, G. Hahn, T. Buonassisi. “[Investigation of Lifetime-Limiting Defects After High-Temperature Phosphorus Diffusion in Silicon Solar Cell Materials,](#)” *IEEE Journal of Photovoltaics*, **4**(3), pp. 866-873 (2014).
19. J. Hofstetter, **D. P. Fenning**, D. M. Powell, A. E. Morishige, and T. Buonassisi, “[Iron Management in Multicrystalline Silicon through Predictive Simulation: Point Defects, Precipitates, and Structural Defect Interactions,](#)” *Solid State Phenomena*, **205-206**, pp.15-25 (2014).
18. D. M. Powell, J. Hofstetter, **D. P. Fenning**, R. Hao, T. S. Ravi, T. Buonassisi “[Effective lifetimes exceeding 300 microseconds in thin p-type epitaxial kerfless silicon for photovoltaics achieved via defect engineering,](#)” *Applied Physics Letters*, **103**, 263902, (2013).

17. **D. P. Fenning***, Annika Zuschlag*, M. I. Bertoni, B. Lai, G. Hahn, T. Buonassisi. “[Improved Iron Gettering in Contaminated Multicrystalline Silicon by High-Temperature Phosphorus Diffusion](#),” *Journal of Applied Physics*, **113**, 214504 (2013). *equal contributions
16. J. Lindroos, **D. P. Fenning**, D. Backlund, E. Verlage, A. Gorgulla, S. K. Estreicher, H. Savin, T. Buonassisi. “[Nickel: A Very Fast Diffuser in Silicon](#),” *Journal of Applied Physics*, **113**, 204906 (2013).
15. **D. P. Fenning**, B. K. Newman, M. I. Bertoni, S. Hudelson, S. Bernardis, M. A. Marcus, S. C. Fakra, T. Buonassisi, “[Local Melting in Silicon Driven By Retrograde Solubility](#),” *Acta Materialia*, **61**(12), 4320 (2013).
14. **D. P. Fenning**, J. Hofstetter, M. I. Bertoni, G. Coletti, B. Lai, C. del Cañizo, T. Buonassisi. “[Precipitated Iron: A Limit on Gettering Efficacy in Multicrystalline Silicon](#),” *Journal of Applied Physics*, **113**, 044251 (2013).
13. H. J. Choi, M. I. Bertoni, J. Hofstetter, **D. P. Fenning**, D. M. Powell, S. Castellanos, T. Buonassisi, “[Dislocation density reduction during impurity gettering in multicrystalline silicon](#),” *IEEE Journal of Photovoltaics*, **3** (1), pp 189-198, (2013).
12. J. Schön, A. Haarahiltunen, H. Savin, **D. P. Fenning**, T. Buonassisi, W. Warta, and M. C. Schubert, “[Analysis of the Evolution of Iron Precipitates in Multicrystalline Silicon During Solar Cell Processing](#),” *IEEE Journal of Photovoltaics*, **3** (1), pp 131-137 (2013).
11. J. Hofstetter, **D. P. Fenning**, J.F. Lelièvre, C. del Cañizo, and T. Buonassisi, “[Engineering Metal Precipitate Size Distributions to Enhance Gettering in Multicrystalline](#),” *Phys. Status Solidi (a)*, **209** (10), pp 1861-1865, (2012).
10. S. Bernardis, B. K. Newman, M. Di Sabatino, M. I. Bertoni, **D. P. Fenning**, S. C. Fakra, R. B. Larsen, and T. Buonassisi. “[Synchrotron-based Investigation of Impurities in Raw Quartz- and Carbon-Bearing Feedstock Materials for Photovoltaic Applications](#),” *Prog. Photovolt.: Res. App.*, **20**, 217-225, (2012).
9. J. Hofstetter, J.F. Lelièvre, **D. P. Fenning**, M.I. Bertoni, T. Buonassisi, and C. del Cañizo. “[Towards the tailoring of P diffusion gettering to as-grown silicon material properties](#),” *Solid State Phenomena*, **178-179**, pp. 158-165 (2011).
8. M. I. Bertoni, **D. P. Fenning**, M. Rinio, J. Maser, T. Buonassisi. “[Nanoprobe X-ray Fluorescence Characterization of Defects in Large-Area Solar Cells](#),” *Energy and Environmental Science*, **4**, pp. 4252-4257, 2011.
7. J. Hofstetter, J. F. Lelièvre, **D. P. Fenning**, M.I. Bertoni, T. Buonassisi, A. Luque, C. del Cañizo, “[Enhanced iron gettering by short, optimized low-temperature annealing after phosphorus emitter diffusion for industrial](#)

- silicon solar cell processing,” *Physica Status Solidi c*, **8** (3), pp. 759-972, (2011).
6. **D. P. Fenning**, J. Hofstetter, M. I. Bertoni, S. Hudelson, M. Rinio, J. F. Lelièvre, B. Lai, C. del Cañizo, and T. Buonassisi. “[Iron Distribution in Silicon After Solar Cell Processing: Synchrotron Analysis and Predictive Modeling](#),” *Applied Physics Letters*, **98**, 162103, 2011.
 5. V. Ganapati, **D. P. Fenning**, M.I. Bertoni, C.E. Kendrick, A.E. Fecych, J.M. Redwing, and T. Buonassisi. “[Seeding of Silicon Wire Growth by Out-Diffused Metal Precipitates](#),” *Small*, Vol. 7, Issue 5, 563-567 (2011).
 4. J. Hofstetter, **D. P. Fenning**, M. I. Bertoni, J. F. Lelièvre, C. del Cañizo, T. Buonassisi. “[Impurity-to-Efficiency Simulator: Predictive Simulation of Silicon Solar Cell Performance Based on Iron Content and Distribution](#),” *Prog. Photovolt.: Res. App.*, Vol. 19, Issue 4, 487-497 (2011).
 3. M. I. Bertoni, S. Hudelson, B. K. Newman, S. Bernardis, **D. P. Fenning**, H. F. W. Dekkers, E. Cornagliotti, A. Zuschlag, G. Micard, G. Hahn, G. Coletti, B. Lai, T. Buonassisi. “[Influence of defect type on hydrogen passivation efficacy in multicrystalline silicon solar cells](#),” *Prog. Photovolt.: Res. App.*, Vol. 19, Issue 2, 187-191 (2011).
 2. V. Shkolnikov, D. G. Strickland, **D. P. Fenning**, J. G. Santiago. “[Design and Fabrication of Porous Polymer Wick Structures](#),” *Sensors and Actuators B: Chemical*, Vol.150, Issue 2, 556-563 (2010).
 1. S. Hudelson, B. K. Newman, S. Bernardis, **D. P. Fenning**, M. I. Bertoni, M. A. Marcus, S. C. Fakra, B. Lai, T. Buonassisi. “[Retrograde Melting and Internal Liquid Gettering in Silicon](#),” *Advanced Materials* 22, 3948-3953 (2010).

Other Journal Publications

1. D. M. Powell, **D. P. Fenning**, J. Hofstetter, J. F. Lelièvre, B. Lai, C. del Cañizo, and T. Buonassisi. “[TCAD for PV: A fast method for accurately modelling metal impurity evolution during solar cell processing](#),” *Photovoltaics International*, 15th edition, April 2012.

Invited Presentations

20. (forthcoming) D. P. Fenning, “Charge Collection and Local Chemistry at the Nanoscale in Hybrid Perovskite Solar Cells,” Arab-American Frontiers of Science, Engineering & Medicine Symposium, Rabat, Morocco, November 2017.

19. (forthcoming) D. P. Fenning, "In Pursuit of Perfection: How Non-Stoichiometry at the Nanoscale Affects Perovskites Solar Cells," UC Solar Symposium, Public Utilities Commission, San Francisco, CA, October 2017.
18. D. P. Fenning, "Recycling CO₂ to Useful Products: Nanostructuring Catalysts to Shift Reaction Selectivity," Portland Cement Association Fall Congress, Chicago, IL, August 2017.
17. D. P. Fenning, "Shining X-ray Light on the Local Chemistry and Optoelectronic Properties of the Emergent Hybrid Perovskites," The Technion, Haifa, Israel, August 2017.
16. D. P. Fenning, "Revealing How Non-Stoichiometry Determines Charge Collection in Hybrid Perovskites Solar Cells using Synchrotron-Based X-ray Nanoprobes," Hebrew University of Jerusalem, Jerusalem, Israel, August 2017.
15. D. P. Fenning, "The Pursuit of Perfection: How Defects Affect Device Performance Across Solar Absorber Technologies," National Center for Photovoltaics, National Renewable Energy Laboratory, Golden, CO, July 2017.
14. D. P. Fenning, "Defects in perovskites, silicon, and other solar absorbers: how are they different and how are they the same?," Hands-on PV Experience Workshop, National Renewable Energy Laboratory, Golden, CO, July 2017.
13. D. P. Fenning, "Solar photovoltaic Research: An X-ray Window into the Local Chemistry of Solar Cell Materials," Sustainable Power and Energy Center Summit, UC San Diego, La Jolla, CA July 2017.
12. (plenary) D. P. Fenning, "A New (X-ray) Window into the Local Chemistry of the Hybrid Perovskites," APS/CNM User Meeting, Argonne, Illinois, May 2017.
11. D. P. Fenning, "Interrogating Nanoscale Defects to Enable Cost-Effective Solar Cells," TMS Meeting, San Diego, March 2017.
10. D. P. Fenning, "Understanding the Role of Defects and Heterogeneity in Efficient Organometal halide perovskite solar cells by X-ray Microscopy," Center for Nanoscale Materials Triennial DOE Review, Argonne National Lab, Argonne, IL, June 2016.
9. D. P. Fenning, "Engineering Defects to Enable Cost-Effective Solar Cells," Nanoscience and Technology Seminar, Argonne National Lab, Argonne, IL, June 2016.
8. D. P. Fenning, "Engineering Defects for Cost-Effective Solar Cells," 251st ACS Meeting, San Diego, March 2016.

7. D. P. Fenning, L. Kornblum, J. Faucher, J. Hwang, A. Boni, M.-G. Han, M. D. Morales-Acosta, Y. Zhu, E. Altman, M. L. Lee, C. H. Ahn, Y. Shao-Horn, F. J. Walker, "Integrating Crystalline Oxides on III-Vs for Solar-to-Fuels," Workshop on Compound Semiconductor Materials and Devices 2016, Tucson, AZ, February 2016.
6. D. P. Fenning, "Predictive Process Simulation Supported by Defect Characterization," QEERI Workshop on Science and Tools for Solar Energy Conversion, Doha, Qatar, April 2014.

Before UC San Diego

5. D. P. Fenning, "High-Temperature Defect Engineering for Silicon Solar Cells," UCSD Nanoengineering Seminar Series, UCSD, May 2013.
4. D. P. Fenning, J. Hofstetter, A. E. Morishige, D. M. Powell, T. Buonassisi. "Engineering Metal Impurities to Enable Low-Cost Silicon Solar Cells," Micro-Nano Seminar Series, MIT, April 2013.
3. D. P. Fenning, J. Hofstetter, D. M. Powell, A. E. Morishige, A. Zuschlag, G. Hahn, & T. Buonassisi. "Design Guidelines for Tailored Phosphorus Diffusion Gettering," 22nd NREL Workshop on Crystalline Silicon Solar Cells & Modules, Vail, CO, July 2012.
2. D. P. Fenning, J. Hofstetter, D. M. Powell, A. E. Morishige, & T. Buonassisi. "Efficient, Low-Cost Silicon Solar Cells by Predictive Process Optimization," Lab for Manufacturing & Productivity Seminar Series, MIT, April 2012.
1. D. P. Fenning, T. Buonassisi, "Engineering Metal Impurities in Silicon for High-Efficiency Industrial Solar Cells," Lab for Manufacturing & Productivity Seminar Series, MIT, May 2010.

Contributed Talks

48. (forthcoming) X. Li, Y. Luo, M. V. Holt, Z. Cai, D. P. Fenning, "Shining (X-Ray) Light on Perovskite Solar Cell Structure and Stability via Nano-Diffraction," Fall MRS Meeting, Boston, MA, November 2017.
47. Y. Luo, P. Khoram, S. Brittman, B. Lai, E. C. Garnett, D. P. Fenning, "Detection of A Shifting Bromine Concentration in Hybrid Perovskites By X-ray Fluorescence Microscopy," IEEE Photovoltaics Specialist Conference, Washington D.C., June 2017.
46. Y. Luo, B.-E. Cohen, X. Li, B. Lai, L. Etgar, D. P. Fenning, "Investigating Nanoscale Determinants of Charge Collection in Quasi-2D Perovskite Solar Cells," IEEE Photovoltaics Specialist Conference, June 2017

45. H. S. Laine, V. Vähänissi, Z. Liu, E. Magaña, A. E. Morishige, J. Krügener, K. Salo, B. Lai, H. Savin, D. P. Fenning, "Toward Effective Boron Gettering in Ion Implanted Solar Cells," IEEE Photovoltaics Specialist Conference, Washington D.C., June 2017.
44. Y. Luo, S. Aharon, M. Stuckelberger, E. Magaña, B. Lai, M. I. Bertoni, L. Etgar, D. P. Fenning, "Nanoscale Stoichiometric Variations and Local Charge Collection in Mixed-Halide Hybrid Perovskite Solar Cells," 9th International Conference on Materials for Advanced Technologies, Singapore, June 2017.
43. L. Kornblum, D. P. Fenning, J. Faucher, J. Hwang, A. Boni, M.-G. Han, M. D. Morales-Acosta, Y. Zhu, E. I. Altman, M. L. Lee, C. H. Ahn, F. J. Walker and Y. Shao-Horn, "Unlocking stable III-V solar hydrogen production with oxide epitaxy," Toward Oxide-Based Electronics Fall Meeting, Ljubljana, Slovenia, September 2016.
42. A. Morris, D. P. Fenning, "Implementation of Photoluminescence Saturation Current Density Measurement," Academic Enrichment Programs' Summer Research Conference, San Diego, CA, August 2016.
41. M. Stuckelberger, T. Nietzold, G. N. Hall, B. West, J. Werner, B. Niesen, C. Ballif, V. Rose, D. P. Fenning, M. I. Bertoni, "Elemental Distribution and Charge Collection at the Nanoscale on Perovskite Solar Cells," IEEE Photovoltaics Specialist Conference, Portland, OR 2016.
40. D. P. Fenning, L. Kornblum, J. Faucher, J. Hwang, A. Boni, M.-G. Han, M. D. Morales-Acosta, Y. Zhu, E. Altman, M. L. Lee, C. H. Ahn, Y. Shao-Horn, F. J. Walker, "Integrating Crystalline Oxides on III-Vs for Solar-to-Fuels," Spring MRS, Phoenix, CA, April 2016.
39. A. E. Morishige, R. Chakraborty, M. Ann Jensen, P. Yen, B. West, M. Stuckelberger, J. Maser, B. Lai, D. P. Fenning, M. I. Bertoni, T. Buonassisi, "Emerging *in-situ* tools for X-ray Nanoprobe Investigations of Energy Materials at the Advanced Photon Source," Denver X-ray Conference, Westminster, CO, August 2015.
38. A. E. Morishige, D. B. Needleman, M. Ann Jensen, H. Wagner, J. Hofstetter, D. P. Fenning, C. del Cañizo, T. Buonassisi, "Vertically-Integrated Defect Engineering for Photovoltaics," 25th NREL Workshop on Crystalline Silicon Solar Cells & Modules, July 2015.

Before UC San Diego

37. Jeffrey B. Chou, David P. Fenning, Yu Wang, Miguel A. M. Polanco, Jonathan Hwang, Asmaa El-Faer, Firas Sammoura, Jaime Viegas, Mahmoud Rasras, Alexie Kolpak, Yang Shao-Horn, Sang-Gook Kim, "Broadband Photoelectric Hot Carrier Collection with Wafer-Scale Metallic-Semiconductor

- Photonic Crystals” 42nd IEEE Photovoltaics Specialist Conference, New Orleans, June 2015.
36. Rafael Jaramillo, Sin Cheng Siah, Rupak Chakraborty Douglas M. Powell, Mallory Ann Jensen, Sergio Castellanos, Jörg Maser, Barry Lai, Matthew A. Marcus, David P. Fenning, Jasmin Hofstetter, Tonio Buonassisi, “Synchrotron-Based Analytical Techniques Elucidate Defect Structure-Property Relations in Silicon and Thin-Film Solar Cell Materials,” Spring MRS, San Francisco, CA, April 2015.
 35. D. P. Fenning, Yoon Hee Jang, Julia O’Donnell, Dong Ha Kim, Yang Shao-Horn “Engineering Hematite Nanostructures for Improved Photoelectrochemical Water Oxidation,” Fall MRS, Boston, MA, Dec 2014.
 34. H. Laine, V. Vähänissi, J. Hofstetter, A. E. Morishige, A. Haarahiltunen, D. P. Fenning, and H. Savin. “The size distribution of iron precipitates in phosphorous-implanted emitters,” Extended Defects in Semiconductors, Göttingen, Germany, September 2014.
 33. J. Hofstetter, A. E. Morishige, M. A. Jensen, D. M. Powell, M. M. Kivambe, S. Castellanos, D. B. Needleman, S. M. Scott, J. Mailoa, J. Z. Lee, H. Wagener, D. P. Fenning, T. Buonassisi, “Alternative Approaches for High-Efficiency Silicon Wafers,” 24th NREL Workshop on Crystalline Silicon Solar Cells and Modules, Breckenridge, CO, July 2014.
 32. D. P. Fenning, J. Hofstetter, A. E. Morishige, H. Laine, V. Vähänissi, A. Haarahiltunen, S. C. Castellanos, M. A. Jensen, B. Lai, H. Savin, “Iron Precipitation upon Gettering in Implanted Czochralski Silicon and Its Impact on Solar Cell Performance,” 40th IEEE Photovoltaics Specialist Conference, Denver, CO, June 2014.
 31. R. Jaramillo, J. Hofstetter, A. E. Morishige, R. Chakraborty, S. C. Siah, S. Castellanos, M. Ann Jensen, B. Lai, J. Maser, D. P. Fenning, M. I. Bertoni, T. Buonassisi, “Opportunities in Photovoltaic Research with a Diffraction-Limited Storage Ring,” APS User Meeting, May 2014.
 30. D. Lee, C. Kuryak, S. Lee, D. P. Fenning, C. Carlton, Y. Hu, G. Chen, Y. Shao-Horn, “Improved power factor at the interface of silicon and PEDOT:PSS,” MRS Fall Meeting, Boston, MA, December 2013.
 29. J. Hofstetter, S. Castellanos, D. P. Fenning, A. E. Morishige, M. M. Kivambe, B. Lai, M. Rinio, T. Buonassisi, “Studying metal decoration at dislocations in multicrystalline silicon using X-ray probes,” MRS Fall Meeting, Boston, MA, December 2013.
 28. D. M. Powell, J. Hofstetter, D. P. Fenning, R. Hao, T. S. Ravi, T. Buonassisi, “High Lifetime Thin Kerfless Silicon Wafers for Solar Cells,” MRS Fall Meeting, Boston, MA, December 2013.

27. D. P. Fenning, M. I. Bertoni, B. Lai, J. Maser, T. Buonassisi, “*In-situ* X-ray Nanocharacterization of Defects in Solar Cells,” Materials Science & Technology 2013, Montreal, Canada, October 2013.
26. J. Hofstetter, D. P. Fenning, D. M. Powell, A. E. Morishige, T. Buonassisi, “Iron Management in Multicrystalline Silicon through Predictive Simulation: Point Defects, Precipitates, and Structural Defect Interactions,” 15th Gettering and Defect Engineering in Semiconductor Technology (GADEST 2013), Oxford, UK, September 2013.
25. A. Akey, D. Berney Needleman, S. Castellanos, D. P. Fenning, J. Hofstetter, M. M. Kivambe, A. E. Morishige, D. M. Powell, S. C. Siah, T. Buonassisi, “Simulating defect physics to improve the cost-performance ratio of kerfless silicon-based photovoltaics,” International Conference on Defects in Semiconductors, Bologna, Italy, July 2013.
24. J. Lindroos, D. P. Fenning, D. J. Backlund, Y. Boulfrad, T. Buonassisi, S. K. Estreicher, H. Savin, “Fast-Diffusing Interstitial Cu, Fe, and Ni in Silicon,” 25th Nordic Semiconductor Meeting, Espoo, Finland, June 2013.
23. D. P. Fenning, A. S. Zuschlag, A. Frey, M. I. Bertoni, B. Lai, G. Hahn, T. Buonassisi, “Investigation of Lifetime-Limiting Defects after High-Temperature Phosphorus Diffusion in Silicon Solar Cell Materials,” 39th IEEE Photovoltaics Specialist Conference, Tampa, FL, June 2013.
22. A. E. Morishige, D. P. Fenning, J. Hofstetter, D. M. Powell, T. Buonassisi, “Moving Beyond Traditional Silicon Solar Cell Manufacturing: Optimizing for Performance and Throughput,” Lab for Manufacturing & Productivity Seminar Series, MIT, May 2013.
21. D. M. Powell, J. Hofstetter, D. P. Fenning, S. C. Siah, C. B. Simmons, T. Buonassisi, “Bulk Minority-carrier Lifetime Enhancements in Thin Kerfless Silicon,” Spring MRS, San Francisco, CA, April 2013.
20. D. P. Fenning, J. Hofstetter, A. Zuschlag, A. E. Morishige, G. Hahn, T. Buonassisi, “Iron Kinetics Simulation and Experimentation Demonstrating Potential for Novel Industrial Processing of Silicon Solar Cells,” MRS Fall Meeting, Boston, MA November 2012.
19. D. P. Fenning, M. I. Bertoni, V. Rose, J. Maser, T. Buonassisi, “Multi-scale Synchrotron-based Study of the Physics and Device Impacts of Metal-Dislocation Interactions in Silicon Solar Cell Materials,” MRS Fall Meeting, Boston, MA, November 2012.
18. H. Choi, M. Bertoni, J. Hofstetter, D. P. Fenning, S. Castellanos, D. Powell, T. Buonassisi, “Solute drag reversed? Dislocation density reduction during impurities gettering in multicrystalline silicon,” MRS Fall Meeting, Boston, MA November 2012.

17. H. Choi, M. Bertoni, J. Hofstetter, D. P. Fenning, S. Castellanos, D. Powell, T. Buonassisi, "Dislocation density reduction during impurity gettering in multicrystalline silicon," 6th International Workshop on Crystalline Silicon Solar Cells, Aix-les-bains, France, October 2012.
16. J. Hofstetter, D. P. Fenning, D. M. Powell, A. E. Morishige, A. Zuschlag, G. Hahn, & T. Buonassisi, "Design Guidelines for Tailored Phosphorus Diffusion Gettering," Challenges in PV Science, Technology, and Manufacturing: A workshop on the role of theory, modeling, and simulation, Purdue, IN, August 2012.
15. M. I. Bertoni, D. P. Fenning, G. Sarau, M. Rinio, V. Rose, J. Maser, & T. Buonassisi. "Nanoprobe-XRF and micro-Raman Studies of Metal Impurity Decoration around Dislocations," 38th Photovoltaics Specialist Conference, Austin, TX, June 2012.
14. H. Choi, M. Bertoni, J. Hofstetter, D. P. Fenning, S. Castellanos, D. Powell, & T. Buonassisi, "Effect of Dislocation-Impurity Interaction on Dislocation Annihilation in Solar-Grade Silicon," 38th IEEE Photovoltaics Specialist Conference, Austin, TX, June 2012.
13. J. Hofstetter, D. P. Fenning, J. F. Lelièvre, C. del Cañizo, & T. Buonassisi. "Engineering metal distributions to enhance gettering," EMRS Spring Meeting, Strasbourg, France, May 2012.
12. M. Bertoni, D. P. Fenning, B. K. Newman, S. Hudelson, S. Fakra, M. A. Marcus, B. Lai, V. Rose, J. Maser, & T. Buonassisi "Enabling low-cost solar cells: Synchrotron X-ray Investigation of Device-Limiting Defects," Advanced Photon Source User Meeting, Argonne, Illinois, May 2012.
11. T. Buonassisi, M. I. Bertoni, D. P. Fenning, J. Hofstetter, B. Lai, & J. Maser. "Advancing Inorganic Photovoltaics via High-Throughput in-situ X-ray Microscopy," Advanced Photon Source User Meeting, Argonne, Illinois, May 2012.
10. D. P. Fenning, B. K. Newman, S. Hudelson, T. Buonassisi. "High-Temperature Reactions of Nickel in Silicon via Synchrotron-Based Characterization Techniques," Gettering and Defect Engineering in Semiconductor Technology XIV, Loipersdorf, Austria (2011).
9. J. Hofstetter, J.F. Lelièvre, D. P. Fenning, T. Buonassisi, and C. del Cañizo. "Towards customizing the solar cell process to as-grown silicon material properties," Gettering and Defect Engineering in Semiconductor Technology XIV, Loipersdorf, Austria (2011).
8. D. P. Fenning, T. Buonassisi. "Effective Iron Gettering in Lightly-Doped Emitters," 37th IEEE Photovoltaics Specialist Conference, Seattle, WA (2011).

7. M. I. Bertoni, D. P. Fenning, M. Rinio, M. Holt, V. Rose, J. Maser, T. Buonassisi. "Nanoprobe X-ray Fluorescence Studies of Metal Impurity Decoration of Dislocations in Large-Area Solar Cells," 37th IEEE Photovoltaics Specialist Conference, Seattle, WA (2011).
6. J. Hofstetter, D. P. Fenning, M. I. Bertoni, J.F. Lelièvre, T. Buonassisi, and C. del Cañizo. "Impurity-to-Efficiency Simulator: Predictive Simulation of Solar Cell Efficiencies Based on Measured Metal Distribution and Cell Processing Conditions," 25th European Photovoltaic Solar Energy Conference, Hamburg, Germany (2010).
5. D. P. Fenning, J. Hofstetter, M I. Bertoni, J. F. Lelièvre, C. del Cañizo, T. Buonassisi. "Synchrotron-based Microanalysis of Iron Distribution after Thermal Processing and Predictive Modeling of Resulting Solar Cell Efficiency," 35th IEEE Photovoltaics Specialist Conference, Honolulu, HI (2010).
4. J. Hofstetter, J. F. Lelièvre, D. P. Fenning, M.I. Bertoni, T. Buonassisi, A. Luque, C. del Cañizo, "Enhanced iron gettering by short, optimized low-temperature annealing after phosphorus emitter diffusion for industrial silicon solar cell processing," EMRS Spring Meeting, Strasbourg, France (2010).
3. D. P. Fenning, B. Newman, M. Bertoni, S. Bernardis, S. Hudelson, S. Fakra, M. Marcus, T. Buonassisi. "Local Melting of Metal-Silicide Precipitates in Silicon Matrix upon Cooling," Spring Meeting Materials Research Society (2010).
2. M. Bertoni, S. Hudelson, B. Newman, D. P. Fenning, S. Fakra, M. Marcus and T. Buonassisi. "Synchrotron-Based Investigations of Performance-limiting Defects in Solar Cell Materials," 216th Electrochemical Society Meeting, Vienna, Austria (2009).
1. D. G. Strickland, D. Fenning, S. Litster, J. G. Santiago, "In-situ Polymerized Wicks for Passive Water Management in PEM Fuel Cell Systems," in *ES2009: Proceedings of the ASME 3rd International Conference on Energy Sustainability*, vol. 1, pp. 325-326 (2009).

Poster Presentations

49. (forthcoming) H. S. Laine, V. Vähänissi, Z. Liu, E. Magaña, J. Krügener, A. E. Morishige, K. Salo, B. Lai, H. Savin. and D. P. Fenning, "Unified Model for Iron Gettering in Boron- and Phosphorus-Implanted Silicon," Gettering and Defect Engineering in Semiconductor Technology, Lopota, Georgia, October 2017.
48. A. Kargar, R. I. Mohammed, Y. Luo, T. Kim, E. Martinez Loran, Y. Abedian, P. Shah, D. P. Fenning, "Solution-Processed Cu(OH)₂ Nanowire Ar-

- rays for Selective and Durable CO₂ Reduction,” 2nd International Solar Fuels Conference, La Jolla, CA, July 2017.
47. T. Kim, Y. Luo, A. Kargar, D. P. Fenning. “Enhanced Selectivity of CO₂ to Formate on Tin-decorated Copper,” 2nd International Solar Fuels Conference, La Jolla, CA, July 2017.
 46. J. D. Scharf, D. P. Fenning, “Quantifying Sodium Migration in Silicon Nitride for Extended Solar Module Lifetimes,” UC San Diego Research Expo, April 2017.
 45. D. P. Fenning, M. I. Bertoni, “Defect kinetics and control for module reliability,” SunShot Poster Session, IEEE Photovoltaics Specialist Conference, Washington DC, June 2017.
 44. G. Hall, M. Stuckelberger, B. West, J. Hartman, J.-S. Park, J. Werner, B. Niesen, C. Ballif, M. Chan, D. P. Fenning, M. Bertoni, “Extent of Methylammonium Lead Iodide Hydration by Atmosphere in Full Devices,” Spring MRS, Phoenix, AZ April 2017
 43. Y. Luo, S. Aharon, M. Stuckelberger, E. Magaña, B. Lai, M. I. Bertoni, L. Etgar, D. P. Fenning, “Nanoscale Halide Segregation Determines Charge Collection in Mixed-Halide Hybrid Perovskite Solar Cells,” Spring MRS, Phoenix, AZ, March 2017.
 42. H. Laine, E. Magaña, V. Vähänissi, Z. Liu, K. Salo, H. Huang, A. Morishige, B. Lai, H. Savin, D. P. Fenning, “Evaluation of Iron Gettering Mechanisms in Boron-Implanted Emitters,” Crystalline Silicon Solar Cells & Silicon Materials Joint Meeting, Tempe, AZ, October 2016. **Best Poster Award**
 41. A. Morris, K. Rimpau, D. P. Fenning, “Implementation of Photoluminescence Saturation Current Density Measurement,” 2016 SACNAS The National Diversity in STEM Conference, Long Beach, CA, October 2016.
 40. M. Stuckelberger, B. West, B. Lai, J. Maser, V. Rose, D. P. Fenning, M. I. Bertoni, “X-ray Beam Induced Current for Nanoscale Engineering of Electronic Devices,” X-ray Microscopy, Oxford, UK August 2016.
 39. Y. Luo, S. Gamliel, S. Nijem, S. Elboher, M. Holt, B. Stripe, V. Rose, M. I. Bertoni, L. Etgar, D. P. Fenning, “Spatially Heterogeneous Chlorine Incorporation in Organic-Inorganic Perovskite Solar Cells,” California Higher Education Sustainability Conference, Fullerton, CA, June 2016.
 38. Y. Luo, S. Gamliel, S. Nijem, S. Elboher, M. Holt, B. Stripe, V. Rose, M. I. Bertoni, L. Etgar, D. P. Fenning, “Spatially Heterogeneous Chlorine Incorporation in Organic-Inorganic Perovskite Solar Cells,” IEEE Photovoltaics Specialist Conference, Portland OR, June 2016.
 37. H. S. Laine, V. Vhnissi, Z. Liu, H. Huang, E. Magaña, A. E. Morishige, N. Khelifati, T. U. Naerland, S. Husein, B. Lai, M. I. Bertoni, D. Bouhafs, T. Buonassisi, D. P. Fenning, H. Savin, “Finite- vs. infinite-source emitters

- in silicon photovoltaics: Effect on transition metal gettering,” IEEE Photovoltaics Specialist Conference, Portland OR, June 2016. (*Best Poster Nominee*)
36. G. Hall, M. Stuckelberger, J. Werner, B. Niesen, C. Ballif, V. Rose, D. P. Fenning, M. I. Bertoni, “Perovskites under Pressure: Insights into the Reversibility of Solar Cell Performance,” Spring MRS, Phoenix, AZ March 2016.
 35. T. Nietzold, M. Stuckelberger, G. Hall, S Nijem, L. Etgar, B Niesen, C. Ballif, D. P. Fenning, M. I. Bertoni, “Degradation Kinetics of Perovskite Solar Cells: The Roles of Atmosphere and Light,” Spring MRS, Phoenix, AZ, March 2016.
 34. Y. Luo, S. Gamliel, S. Nijem, B. Stripe, M. Holt, V. Rose, M. I. Bertoni, Y. Shao-Horn, L. Etgar, D. P. Fenning, “Nanoscale Chemical Microscopy of Perovskite Solar Cells via Synchrotron-Based X-Ray Fluorescence,” Fall MRS, Boston, MA, December 2015.
 33. H. S. Laine, V. Vähänissi, A. E. Morishige, J. Hofstetter, B. Lai, A. Haarahiltunen, H. Savin, D. P. Fenning, ”Investigating Iron Gettering Mechanisms in Phosphorus-Implant Emitters,” 25th NREL Workshop on Crystalline Silicon Solar Cells & Modules, Keystone, CO July 2015.

Before UC San Diego

32. H. Laine, V. Vähänissi, J. Hofstetter, A. E. Morishige, A Haarahiltunen, D. P. Fenning, H. Savin, “Simulating Iron Precipitation in Phosphorus-Implanted Solar Cells”, European Photovoltaics and Solar Energy Conference, Amsterdam, The Netherlands, September 2014.
31. D. P. Fenning, K. J. May, K. A. Stoerzinger, W. T. Hong, D. Lee, M. D. Biegalski, A. M. Kolpak, Y. Shao-Horn, “Single-Nanometer Scale Thickness Dependence of Photoelectrochemical Water Splitting on Ultrathin Lanthanum Ferrite Films,” International Society of Electrochemistry 65th Annual Meeting, Lausanne, Switzerland, September 2014.
30. K. J. May, D. P. Fenning, A. M. Kolpak, Y. Shao-Horn, “Band Alignment of LaFeO₃/Nb:SrTiO₃ Heterojunctions via Spectroscopic Ellipsometry, X-ray Photoelectron Spectroscopy and First-Principles Calculation” International Society of Electrochemistry 65th Annual Meeting, Lausanne, Switzerland, September 2014.
29. D. P. Fenning, J. Hofstetter, A. E. Morishige, M. Ann Jensen, M. I. Bertoni, B. Lai, J. Maser, V. Rose, T. Buonassisi, W. T. Hong, Y. Yacoby, Z. Feng, H. Zhou, M. Biegalski, H. M. Christen, Y. Shao-Horn, “Investigating Silicon Solar Cell Impurities and Oxygen Catalyst Cation Distributions using Hard X-rays,” APS User Meeting, May 2014.

28. D. M. Powell, J. Hofstetter, D. P. Fenning, R. Hao, M. Ann Jensen, T. S. Ravi, and T. Buonassisi, "High-Lifetime Kerfless Silicon Wafers," 40th IEEE Photovoltaics Specialist Conference, Denver, CO, June 2014.
27. A. E. Morishige, D. P. Fenning, J. Hofstetter, M. Ann Jensen, S. Ramanathan, C. Wang, B. Lai, T. Buonassisi, "Elucidating and Engineering Recombination-Active, Metal-Rich Precipitates in *n*-type Multicrystalline Silicon," 40th IEEE Photovoltaics Specialist Conference, Denver, CO June 2014.
26. M. Ann Jensen, J. Hofstetter, D. P. Fenning, A. E. Morishige, G. Coletti, B. Lai, T. Buonassisi, "The Distribution of Chromium in Multicrystalline Silicon," 40th IEEE Photovoltaics Specialist Conference, Denver, CO, June 2014.
25. A. E. Morishige, J. Hofstetter, M. Ann Jensen, D. P. Fenning, S. Ramanathan, C. Wang, B. Lai, T. Buonassisi, "Engineering Metal-Rich Precipitates and Increasing Minority Carrier Lifetime in *n*-type Multicrystalline Silicon for Solar Cells," Quantum Energy and Sustainable Solar Technologies Site Visit, Tempe, AZ, May 2014.
24. J. Lindroos, D. P. Fenning, D. J. Backlund, E. Verlage, A. Gorgulla, S. K. Estreicher, H. Savin, T. Buonassisi, "Fast-Diffusing Interstitial Nickel in Silicon," 15th Gettering and Defect Engineering in Semiconductor Technology (GADEST 2013), Oxford, UK, September 2013.
23. D. P. Fenning, M. I. Bertoni, T. Buonassisi, "Hard X-ray Investigations of Trace Metal Impurities in Silicon Solar Cells," SUNCAT/Stanford Summer School: Heterogeneous Catalysis for Energy Transformations, Stanford, CA, August 2013.
22. M. I. Bertoni, D. P. Fenning, S. Gangam, B. Lai, J. Maser, T. Buonassisi, C. Honsberg, "*In-situ* Stage Development for High-Temperature X-ray Nanocharacterization of Defects in Solar Cells," 39th IEEE Photovoltaics Specialist Conference, Tampa, FL, June 2013.
21. A. E. Morishige, D. P. Fenning, J. Hofstetter, D. M. Powell, T. Buonassisi, "Simulated Co-optimization of Crystalline Silicon Solar Cell Efficiency and Throughput Using Continuously Ramping Phosphorus Diffusion Profiles," Lab for Manufacturing & Productivity: Manufacturing Summit/ASPE 2013 Spring Topical Meeting, Cambridge, MA, April 2013.
20. J. Hofstetter, D. P. Fenning, T. Buonassisi, "Correlation of Interstitial Iron Concentration and Recombination Strength of Dislocations in Multicrystalline Silicon," SiliconPV, Hamelin, Germany, March 2013.
19. J. Hofstetter, D. P. Fenning, A. E. Morishige, T. Buonassisi, "Toward Narrowing the Standard Deviation of Multicrystalline Silicon Solar Cell Effi-

- ciencies Through Customized Processing,” MRS Fall Meeting, Boston, MA, November 2012.
18. A. E. Morishige, D. P. Fenning, J. Hofstetter, T. Buonassisi, “Co-optimizing Crystalline Silicon Solar Cell Throughput and Efficiency Using Continuously Ramping Phosphorus Diffusion Profiles,” MRS Fall Meeting, Boston, MA November 2012.
 17. J. Hofstetter, D. P. Fenning, A. E. Morishige, T. Buonassisi, “Customized P diffusion gettering tailored to as-grown silicon material quality” 6th International Workshop on Crystalline Silicon Solar Cells, Aix-les-bains, France, October 2012.
 16. J. Hofstetter, D. P. Fenning, H. Choi, M. I. Bertoni, T. Buonassisi, “Metal-Dislocation Interaction in Multicrystalline Silicon,” 22nd NREL Workshop on Crystalline Silicon Solar Cells & Modules, Vail, CO, July 2012.
 15. A. E. Morishige, D. P. Fenning, J. Hofstetter, D. M. Powell, T. Buonassisi, “Simulated Co-Optimization of Crystalline Silicon Solar Cell Throughput and Efficiency Using Continuously Ramping Phosphorus Diffusion Profiles,” 38th IEEE Photovoltaics Specialist Conference, Austin, TX, June 2012.
 14. J. Schön, A. Haarahiltunen, D. Fenning, T. Buonassisi, W. Warta, M. C. Schubert, “Modeling the Size Distribution of Iron Precipitates in Multicrystalline Silicon,” 38th IEEE Photovoltaics Specialist Conference, Austin, TX, June 2012.
 13. D. P. Fenning, “Optimizing Phosphorus Diffusion for Silicon Solar Cells,” Quantum Energy and Sustainable Solar Technologies First Annual Site Vist, Tempe, AZ, May 2012.
 12. D. P. Fenning, M. I. Bertoni, T. Buonassisi. “Advancements in Synchrotron-Based Characteriation of Metals in Silicon,” 5th International Workshop on crystalline Silicon Solar Cells, Boston, MA, November 2011.
 11. J. Hofstetter, J. F. Lelièvre, D. P. Fenning, Tonio Buonassisi, and C. del Cañizo. “Toward the tailoring of P diffusion gettering to as-grown silicon material properties,” 5th International Workshop on crystalline Silicon Solar Cells, Boston, MA, November 2011.
 10. A. E. Morishige, D. P. Fenning, J. Hofstetter, T. Buonassisi. “Co-optimizing the phosphorus diffusion time-temperature profile for gettering and throughput,” 5th International Workshop on crystalline Silicon Solar Cells, Boston, MA, November 2011.
 9. D. P. Fenning, J. Hofstetter, T. Buonassisi, “Optimizing Industrial Phosphorus Diffusion for Silicon Solar Cells”, Gettering and Defect Engineering in Semiconductor Technology XIV, Loipersdorf, Austria, September 2011.

8. J. Hofstetter, J. F. Lelièvre, D. P. Fenning, M.I. Bertoni, A. E. Morishige, Tonio Buonassisi, and C. del Cañizo. "Towards the tailoring of P diffusion gettering to as-grown silicon material properties," 21st NREL Workshop on Crystalline Silicon Solar Cells & Modules: Materials and Processes, Breckenridge, CO , July 2011.
7. D. M. Powell, D. P. Fenning, T. Buonassisi, B. S. Conrad, J. Hofstetter, J. F. Lelièvre, Carlos del Cañizo. "Deployment of Impurity-to-Efficiency (I2E) Simulation Tool," 37th Photovoltaics Specialist Conference, Seattle, WA (2011).
6. D. P. Fenning, M. Bertoni, T. Buonassisi. "Predictive Modeling of the Optimal Phosphorus Diffusion Profile in Silicon Solar Cells," 24th European Photovoltaic Solar Energy Conference. Hamburg, Germany (2009).
5. J. Hofstetter, D. P. Fenning, J.F. Lelièvre, M. Bertoni, T. Buonassisi, C. del Canizo. "Simulating the Evolution of the Iron Content and Distribution during Solar Cell Processing," 24th European Photovoltaic Solar Energy Conference. Hamburg, Germany (2009).
4. S. Bernardis, B. Newman, M. Di Sabatino, D. P. Fenning, S.C. Fakra, R.B. Larsen, S. Gaal, M. Tangstad, and T. Buonassisi. "Iron Impurities in Si-bearing Compounds for Metallurgical Grade Silicon Production," Fall Meeting Materials Research Society, Boston, MA (2009).
3. D. P. Fenning, S. Hudelson, J. Sullivan, S. Bernardis, M. I. Bertoni, B. Newman, T. Buonassisi. "Synchrotron-Based Investigation of Metal Impurity Diffusion in Silicon Solar Cell Materials," Optics and Photonics for Advanced Energy Technology Conference, Cambridge, MA (2009).
2. D. G. Strickland, D. P. Fenning, S. Litster, and J.G. Santiago, "In Situ Polymerized Wicks for Passive Water Management in PEM Fuel Cell Systems, Proceedings of Energy Sustainability 2009, American Society of Mechanical Engineering Conference, San Francisco, July 19-23, 2009.
1. D. G. Strickland, D. P. Fenning, S. E. Litster, and J. G. Santiago. "In-situ polymerized wicks for water management in large-scale PEM fuel cell systems." Gordon Research Conference - Fuel Cells, Jul 20-25, 2008.