ZACHARY CHARLES HOLMAN

Professor and Vice Dean

Arizona State University
Tempe, AZ 85287-5706

(480) 965-9959
zachary.holman@asu.edu

APPOINTMENTS

08/2023–	**Vice Dean for Research and Innovation** Ira A. Fulton Schools of Engineering, Arizona State University (Tempe, Arizona)
08/2023–	**Professor** School of Electrical, Computer, and Energy Engineering, Arizona State University (Tempe, Arizona)
08/2019–07/2023	**Associate Professor** School of Electrical, Computer, and Energy Engineering, Arizona State University (Tempe, Arizona)
08/2019–06/2023	**Director of Faculty Entrepreneurship** Ira A. Fulton Schools of Engineering, Arizona State University (Tempe, Arizona)
06/2021–	**Cofounder** Beyond Silicon, Inc. (Chandler, Arizona)
03/2020–	**Cofounder** Sunflex Solar LLC (Phoenix, Arizona)
07/2016–	**Cofounder and Chief Technology Officer** Swift Coat, Inc. (Phoenix, Arizona)
03/2013–07/2019	**Assistant Professor** School of Electrical, Computer, and Energy Engineering, Arizona State University (Tempe, Arizona)
07/2014–08/2014	**Visiting Professor** Photovoltaics and Thin-Film Electronics Laboratory, Institute of Microengineering, Ecole Polytechnique Fédérale de Lausanne (Neuchâtel, Switzerland)
10/2010–03/2013	**Postdoctoral Researcher** Photovoltaics and Thin-Film Electronics Laboratory, Institute of Microengineering, Ecole Polytechnique Fédérale de Lausanne (Neuchâtel, Switzerland)

EDUCATION

10/2010	**Doctor of Philosophy** Mechanical Engineering; Nanoparticle Science and Engineering (minor), University of Minnesota (Minneapolis, Minnesota) Dissertation: *Germanium nanocrystal solar cells*; Advisor: Prof. Uwe Kortshagen
05/2005	**Bachelor of Arts** Physics, Reed College (Portland, Oregon) Thesis: *Electron transport in amorphous silicon*; Advisor: Prof. John Essick

RESEARCH INTERESTS

Broad research interests span the fields of solar cells, coatings, nanotechnology, semiconductors, plasmas, and aerosols. Specific interests include silicon-based tandem solar cells, contacts to solar cells, light management

in solar cells, novel uses of nanoparticles in devices, semiconductor nanoparticles, optical and electronic properties of nanoscale materials, plasma synthesis of powders, and deposition of powders and thin films.

AWARDS & HONORS

2023	ASU Fulton Schools of Engineering Top 5% Teaching Award
2022	Hopkins Professorship
2021	American-Made Perovskite Startup Prize Winner
2020	American-Made Solar Prize Winner
2019	IEEE Stuart R. Wenham Young Professional Award
2019	NSF CAREER Award
2018	Gordon and Betty Moore Foundation Inventor Fellowship
2018	Fulton Entrepreneurial Professorship
2017	ASU Fulton Schools of Engineering Top 5% Teaching Award
2016	Trustees of ASU Professorship
2016	Joseph C. Palais Distinguished Faculty Scholar Award
2016	Fulton Outstanding Assistant Professor Award
2015	ASU Fulton Schools of Engineering Top 5% Teaching Award
2014	ASU Senior Sustainability Scientist
2013	3rd International Conference on Crystalline Silicon Photovoltaics top 5% of papers
2010	NSF EAPSI Fellowship at the Tokyo Institute of Technology
2010	University of Minnesota Doctoral Dissertation Fellowship
2008	Particle Society of Minnesota Scholarship
2007	18th International Symposium on Plasma Chemistry Best Paper Award
2005	NSF IGERT Fellowship at the University of Minnesota

AWARDS WON BY STUDENTS AND POSTDOCS

2023	Bernard Henry AIMCAL-SVC Scholarship (Zach Leuty)
2023	xTechPrime Finalist with cash prize (Jason Yu, Wahab Alasfour, Zach Leuty, David Quispe)
2022	ARCS (Achievement Awards for College Scientists) Award (David Quispe)
2022	Hool Coury Law Tech Venture Challenge Winner (Wahab Alasfour, Zach Leuty, David Quispe)
2021	ASU Presidential Graduate Assistantship (Vidya Krishnan)
2021	NSF Graduate Research Fellowship (David Quispe)
2021	American-Made Perovskite Startup Prize Winner (Jason Yu, Wahab Alasfour, Zach Leuty, David Quispe)
2020	American-Made Solar Prize Winner (Kate Fisher, Jason Yu, Barry Hartweg)
2020	ASU Dean's Fellowship (Mason Mahaffey)
2020	NSF Graduate Research Fellowship (Justin Huxel)
2020	QESST Best Paper Award (Zachary Leuty)
2019	SiliconPV Best Poster Award (William Weigand and Jason Yu)
2018	ASU Dean's Fellowship (Barry Hartweg)

2018	Palais' Outstanding Doctoral Student Award (Jason Yu)
2018	Venture Madness Hardware Tech Winner (Peter Firth)
2017	European PV Solar Energy Conference and Exhibition Student Award (Jason Yu)
2017	IEEE Photovoltaic Specialists Conference Most Outstanding Technical Contribution (Jason Yu)
2017	MRS Graduate Student Silver Award (Jason Yu)
2017	Rice Business Plan Competition Department of Energy Cleantech University Prize (Peter Firth and Jonathan Bryan)
2017	ASU Innovation Open SRP Innovation Award (Peter Firth)
2017	SiliconPV Award (Jason Yu)
2017	SiliconPV Award (Mathieu Boccard)
2017	ASU Graduate and Professional Student Association Research Award (Jason Yu)
2017	ThinkSwiss Research Scholarship (Nathan Rodkey)
2017	ARCS (Achievement Awards for College Scientists) Award (Peter Firth)
2017	Zero Mass Water Materials Award (Peter Firth)
2017	DOE Science Undergraduate Laboratory Internship at NREL (Nathan Rodkey)
2017	Rhodes Scholarship (Ngoni Mugwisi)
2016	Palais Senior Design Prize (Heliovation senior design team)
2016	Arizona Student Energy Conference Distinguished Poster Award (Jason Yu)
2016	IEEE Photovoltaic Specialists Conference Best Paper Award (Mathieu Boccard)
2016	IEEE Photovoltaic Specialists Conference Best Poster Award (Mathieu Boccard)
2016	ASU Dean's Fellowship (Will Weigand)
2016	ASU Dean's Fellowship (Jonathan Bryan)
2016	ASU New Venture Challenge Winner (Peter Firth)
2016	ARCS (Achievement Awards for College Scientists) Award (Peter Firth)
2016	Micron Technology Team Prize (Hall Effect senior design team)
2015	IEEE Photovoltaic Specialists Conference Best Poster Award (Jason Yu)
2015	Harold and Lucille Dunn Memorial Engineering Scholarship (Jason Yu)
2015	Barrett Electronic Materials Fellowship (Peter Firth)
2015	ASU Dean's Fellowship (Peter Firth)
2015	Arizona Student Energy Conference Distinguished Poster Award (Priyaranga Koswatta)
2015	NSF Graduate Research Fellowship (Joe Carpenter)
2014	NSF Integrative Graduate Education and Research Traineeship (Michael Bernstein)
2014	NSF Integrative Graduate Education and Research Traineeship (Joe Carpenter)
2014	University Graduate Fellowship (Salman Manzoor)

PROFESSIONAL ACTIVITIES & OUTREACH

- Co-lead of the ASU Energy Forward Strategy and Planning Committee (2024–)
- Member of the Arizona Technology Council's Aerospace, Aviation, Space and Defense Committee (2024–)
- Editor of the IEEE Journal of Photovoltaics (2022–)
- Member of the Program Committee for the International Photovoltaic Science and Engineering Conference (2024)
- Member of the Industry Liaison Committee for the World Conference on Photovoltaic Energy Conversion (2022)

- Member of the Program Committee for the IEEE Photovoltaic Specialists Conference (2020)
- Member of the Organizing Committee for the International Workshop on Silicon Heterojunction Solar Cells (2019, 2020)
- Symposium Organizer for the E-MRS Spring Meeting (2017)
- Symposium Organizer for the IEEE Photovoltaic Specialists Conference (2016, 2017, 2018, 2021)
- Symposium Organizer or Lead Symposium Organizer for the MRS Spring Meeting (2015, 2016, 2018)
- Session Chair for IEEE Photovoltaic Specialists Conference, MRS Spring Meeting, SiliconPV (2013–)
- Member of the Fulton Schools of Engineering Dean's Research Committee (2017–2019)
- Member of the Fulton Schools of Engineering Master Mentors (2019–2021)
- Co-leader of Thrust 2 of the Quantum Energy and Sustainable Solar Technology ERC (2015–2020)
- Member of the ASU Goldwater Materials Science Facility Steering Committee (2014–2016)
- Member of the ASU Leadership Academy Materials Team (2015–2016)
- Member of the ASU University Undergraduates Standards Committee (2015–2017)
- Member of the ASU Instrument Design and Fabrication Board (2016–2019; 2020–2022)
- Member and Chair of the ASU Advanced Electronics and Photonics Core Facility Board (2020–2024)
- Member of the ASU Solar Fabrication Core Facility Board (2021–)
- Member of the ASU Eyring Materials Center Board (2017–2021)
- Member or Chair of an ASU ECEE Faculty Search Committee (2015, 2018, 2020, 2021, 2022, 2025)
- Member of the ASU ECEE Website Design Committee (2015, 2019)
- Member of the ASU Faculty Working Group for the MS degree in Innovation and Venture Development
- Designer and instructor of a new course entitled *EEE 598: Manuscript Writing for Engineers*
- Reviewer for funding bodies, including NSF and DOE, and journals, including *Nature Energy, Journal of Applied Physics, ACS Nano, Solar Energy Materials and Solar Cells, Thin Solid Films, Nanotechnology, IEEE Journal of Photovoltaics*
- Volunteer Scientist for ASU's Night of The Open Door, ASU's Summer Transportation Institute, Cesar Chavez High School, Minnesota FIRST LEGO League, and the Science Museum of Minnesota

FUNDING

01/2025–12/2029	DOC National Advanced Packaging Manufacturing Program, "Substrate-based heterogeneous integration enabling leadership demonstration for the USA (SHIELD USA)," (Co-PI)
10/2024–09/2025	DOE NETL, "Center for clean energy materials," (PI)
11/2023–10/2028	NSTXL Microelectronics Commons, "Southwest Advanced Prototyping (SWAP) Hub," (Co-PI)
10/2023–05/2027	DOE SETO, "TEAMUP: Tandems for efficient and advanced modules using ultrastable perovskites," (Co-PI)
07/2023–04/2024	DOE BES SBIR, "Development of new metallization pastes for front-side tunnel oxide passivated contact crystalline silicon solar cells," (Co-PI)
07/2023–06/2025	TSMC, confidential project, (PI)
04/2023–03/2024	Applied Materials, confidential project, (PI)
10/2022–10/2023	DOE SETO, "PV Foundry: Increasing manufacturing innovation and capabilities in the US," (PI)

09/2022–08/2024	US Department of State, “GIST Innovates the Balkans,” (Co-PI)
11/2021–10/2026	USAID, “Center of Excellence for Energy,” (Co-PI)
11/2021–10/2022	AZ New Economy Initiative, “Suns-ERE: A characterization tool to accelerate the learning cycle of thin-film photovoltaics,” (PI)
10/2021–09/2024	EDA Build to Scale, “Arizona semiconductor industry startup entrepreneurial development project,” (Co-PI)
10/2021–11/2025	DOE SETO, “Manufacturing 27%-efficient perovskite/silicon tandem photovoltaic cells using slot die coating at >5000 wafers per hour,” (Co-PI)
04/2021–03/2024	DOE SETO, “The role of hydrogen in the performance and long-term stability of high-efficiency silicon cells and modules,” (Co-PI)
01/2021–12/2022	Sunflex Solar, “Scaling Sunfoil solar modules,” (PI)
08/2020–08/2020	Corporate gift (PI)
04/2020–03/2023	DOE SETO, “Sonic Wafering™ of III-V substrates for high efficiency cells: A path to <$0.50/W,” (Co-PI)
10/2019–09/2020	US Government, “Flexible and advanced solar panel technologies,” (PI)
08/2019–07/2021	NSF, “Center to center (C2C) international collaboration on advanced photovoltaics: Electrode manufacturing and indoor power applications,” (Co-PI)
08/2019–07/2022	DOE SETO, “Scalable manufacturing of efficient perovskite/silicon tandem modules,” (Co-PI)
03/2019–02/2024	NSF CAREER, “CAREER: Transparent, passivating, and carrier-selective heterojunction contacts for silicon and cadmium telluride solar cells,” (PI)
01/2019–12/2021	DOE SETO, “Diagnosing and overcoming recombination and resistive losses in non-silicon solar cells using a silicon-inspired characterization platform,” (PI)
01/2019–12/2021	DOE SETO, “Bringing high-efficiency silicon solar cells with heterojunction contacts to market with a new, versatile deposition technique,” (PI)
01/2019–06/2020	DOE SETO, “Wide-bandgap polycrystalline III-Vs as transparent, carrier-selective heterojunction contacts for silicon photovoltaics,” (Co-PI)
01/2019–12/2020	NREL, “ASU-NREL joint silicon solar cell research: passivated contacts, metallization, and bulk defects,” (PI)
01/2019–12/2021	ARPA-E DAYS, “Solid state thermal battery,” (Co-PI)
01/2019–12/2019	FSE/CLAS/AMI Seed, “MRSEC planning and preliminary data collection,” (Co-PI)
10/2018–09/2020	Fulton Entrepreneurial Professors Program, “Aerosol impaction-driven assembly of functional nanomaterial coatings,” (PI)
10/2018–09/2021	Moore Foundation Inventor Fellowship, “Aerosol impaction-driven assembly of functional nanomaterial coatings,” (PI)
10/2018–09/2019	FSE/CLAS/AMI Seed, “Diamond and III-nitride integration for ultra-gap devices,” (PI)
06/2018–05/2019	NSF SBIR, “Non-thermal plasma source for functional metal-oxide nanoparticle coatings,” (Co-PI)
02/2018–09/2018	NREL, “PERC and SHJ silicon solar modules with high infrared reflectance,” (Co-PI)

01/2018–01/2021	ARENA, “Hydrogenated and hybrid heterojunction p-type silicon PV cells R&D project,” (Co-PI)
10/2017–09/2020	DOE PVRD-II, “Perovskite-on-silicon tandem solar cells,” (Co-PI)
10/2017–05/2020	DOE DuraMAT, “Silicon IBC modules with copper foil electrodes: Failure mechanisms of electrically conductive adhesive bonds between cells and foil,” (PI)
10/2017–09/2018	BAPVC, “Low capex solar manufacturing enabled by perovskite semiconductors,” (Co-PI)
08/2017–01/2019	ACAP, “P-type hybrid heterojunction solar cells,” (Co-PI)
05/2017–04/2019	NSF EAGER, “Collaborative research: 30%-efficient, stable perovskite/silicon monolithic tandem solar cells,” (PI)
02/2017–04/2017	NSF SBIR, “The aerosol-spray deposition of photoluminescent quantum-dot coatings on substrates,” (Co-PI)
01/2017–12/2019	ARPA-E SHIELD, “Single-pane windows with insulating sprayed particulate coatings,” (PI)
12/2016–11/2017	NSF SBIR, “Low damage sputter magnetron for silicon heterojunction PV production,” (Co-PI)
11/2016–10/2018	DOE NextGen-III, “Developing efficient silicon cells for perovskite/silicon tandem devices,” (Co-PI)
09/2016–08/2017	American Jobs Project, “Arizona’s advanced energy landscape,” (PI)
08/2016–07/2019	DOE PVRD, “Monolithic silicon module manufacturing at < 0.40 $/W,” (PI)
08/2016–07/2018	DOE PVRD, “15%-efficiency (Mg,Zn)CdTe solar cells with 1.7 eV bandgap for tandem applications,” (PI)
08/2016–07/2017	SolarReserve, “Hybrid heliostat development,” (PI)
07/2016–01/2017	FSE Technology Innovation Laboratory, “Advanced manufacturing of nanoparticle-based coatings,” (PI)
06/2016–05/2017	DOE PVRD SIPS, “A new class of tandems: Optically coupled III-V/silicon module with outdoor efficiency exceeding 30%,” (PI)
05/2016–11/2016	FSE Technology Innovation Laboratory, “Hybrid heliostat for combined photovoltaic and solar thermal power plants,” (PI)
04/2016–03/2019	NSF REU Site, “Solar energy research for the Terawatt Challenge,” (PI)
01/2016–12/2018	DOE SuNLaMP, “Overcoming bottlenecks to low-cost, high-efficiency Si PV and industrially relevant, ion implanted interdigitated back passivated contact cell development,” (Co-PI)
09/2015–08/2018	NSF Energy for Sustainability, “Collaborative research: 30%-efficient III-V/silicon tandem solar cells,” (PI)
08/2015–07/2020	NSF ERC, “Nano-Enabled Water Treatment: NEWT,” (Co-PI)
06/2015–05/2020	USAID, “U.S.-Pakistan Centers for Advanced Studies in Energy,” (Co-PI)
05/2015–04/2016	ARPA-E I-Corps Supplement, “PVMirror: Cost competitive solar with storage,” (PI)
02/2015–01/2017	RCSA Scialog, “Scalable tandem architecture for solar water splitting,” (PI)
06/2014–05/2017	ARPA-E FOCUS, “PVMirror: A solar concentrator mirror incorporating PV cells,” (PI)

09/2013–08/2016	DOE FPACE-II, "Thin silicon solar cells: A path to 35% Shockley-Queisser limits," (Co-PI)
08/2011–07/2021	NSF/DOE ERC, "Quantum Energy and Sustainable Solar Technologies: QESST," (Co-PI)
06/2010–08/2010	NSF EAPSI, "Novel solar cells using silicon nanocrystals synthesized in an atmospheric-pressure plasma," (PI)

STUDENTS, POSTDOCS, AND STAFF ADVISED

- Ph.D.:
  - Ashling Leilaeioun (2013–2018)
  - Jason Yu (2014–2018)
  - Joe Carpenter (2014–2020)
  - Jonathan Bryan (2016–2021)
  - Barry Hartweg (2018–2023)
  - Zachary Leuty (2019–2024)
  - David Quispe (2019–2024)
  - Alan Wu (2019–2021)
  - Vidya Krishnan (2021–)
  - Jason Ro (2022–)
  - Jianwei Shi (2013–2018)
  - Salman Manzoor (2014–2019)
  - Peter Firth (2015–)
  - William Weigand (2016–2023)
  - Warda Mushtaq (2018–2024)
  - Abdulwahab Alasfour (2019–)
  - Mark Li (2019–2024)
  - Mason Mahaffey (2020–)
  - Maria Garcia (2021–)
- M.S.:
  - Salman Manzoor (2013–2014)
  - Priyaranga Koswatta (2013–2016)
  - Michael Bernstein (2014–2016)
  - Trent Hoffman (2016–2017)
  - Sagnik Dasgupta (2019–2020)
  - Prateek Garg (2013–2015)
  - Peter Firth (2014–2015)
  - Alec Jackson (2014–2016)
  - Sujyot Mony (2018–2019; MORE)
- Undergraduate:
  - Claire Block (2017–2018)
  - Christopher Chen (2017–2019)
  - Angelica Guzman (2018–2019; FURI)
  - Sanketh Kamath (2013–2015; FURI)
  - Ngoni Mugwisi (2016–2017; Barrett)
  - Marcial Rodarte (2016–2017)
  - Kari Sanford (2015–2017; FURI, Barrett)
  - Daniel Sinclair (2017–2018; FURI)
  - Brian Wu (2018–2019; FURI)
  - Joe Carpenter (2013–2014; FURI)
  - Angelo Delluomo (2015–2016; FURI)
  - Justin Huxel (2017–2019; FURI)
  - Mark Kapron (2017–2018; FURI)
  - Corbin Ott (2017–2018; FURI)
  - Nathan Rodkey (2015–2018; FURI, Barr.)
  - Nicholas Scheenstra (2015–2016; FURI)
  - Marshall Styers (2015–2016)
  - John Hsu (2021–2021; SURI)
- Postdoc:
  - Mathieu Boccard (2014–2016)
  - Martyn Fisher (2016–2018)
  - Shalinee Kavadiya (2018–2020)
  - Salman Manzoor (2019–2020)
  - Thomas Fiducia (2021–2023)
  - Drew Swanson (2016–2017)
  - Arthur Onno (2017–2020)
  - Shannon Poges (2018–2020)
  - Joe Carpenter (2020–2020)
- Staff:
  - Kathryn Fisher (2014–)
  - Albert Victoria (2019–2024)
  - Juan Venegas (2021–2022)
  - Nathan Rodkey (2018–2019)
  - Mark George (2020–)
  - John Hsu (2021–)
- Research faculty:
  - Jason Yu (2018–)
  - Arthur Onno (2020–2022)
- REU visitor:
  - Emily Dafflon (2013)
  - Juan Asencio (2018)
  - Culver McWhirter (2016)
  - Jones Ou (2016)
  - Jakob Häusele (2017)
  - Stefan Mercado (2017)
  - Ethan Bendau (2015)
  - William Firth (2015)
  - Amine El Mahati (2016)
  - Matthew Warner (2016)
  - Noemi Mundhaas (2017)
  - Syeda Mohsin (2017)

	Tien Ngo (2017)	Yuji Okamoto (2017)
	David Quispe (2017)	Mateo Estrada (2018)
	Jewel Haik (2018)	Richelle Javier (2018)
	Xingyi Wang (2019)	Alexa Cetta (2019)
	Jorge Almeida (2019)	Maria Garcia (2019)
• PCASE visitor:	Saleem Ahmed (2016)	Asad Ali (2016)
	Asghar Ali (2016)	Waqar Ali (2016)
	Farah Qazi (2016)	Ijaz Husnain (2016)
	Mahmood Jamil (2016)	Mehwish Javed (2016)
	Syeda Qudsia (2016)	Warda Mushtaq (2016)
	Maham Akhlaq (2017)	Kamran Alam (2017)
	Maoz (2017)	Asma Shamim (2017)
	Hira Rehman (2017)	Shah Naveed (2017)
	Maria Kanwal (2018)	Sundas Khan (2018)
	Fazal Subhan (2018)	Mudasar Rashid (2019)
	Qandeel Rehman (2019)	Kashan Ahmad (2019)
	Muneeza Ahmad (2019)	Saddam Hussain (2019)

COURSES TAUGHT

- EEE 352: Properties of Electronic Materials (F15, F16, F17, F18)
- EEE 436/591: Fundamentals of Solid State Devices (F13, F14, S16)
- EEE 465/591: Photovoltaic Energy Conversion (S15)
- EEE 498/591: Solar Energy (S14)
- EEE 536: Semiconductor Characterization (S17)
- EEE 565: Solar Cells (F22)
- EEE 598: Manuscript Writing for Engineers (F14, F15, F17, F18, F19, F20, F21, F22, F23)
- ASU 101: The ASU Experience (F14)
- IVD 561: Innovation Studio II: Problem Reframing (F21)
- IVD 562: Innovation Studio III: Explore, Fail, Solve (S21, S22)

PEER-REVIEWED PUBLICATIONS

(ASU students in red; ASU postdocs and staff in orange)

113. Z. Leuty, M. George, M. Garcia, Z. Yu, and Z. Holman, “High mobility soft sputtered ITO coatings by dual gas-flow sputtering,” (submitted).

112. Z. Leuty, W. Weigand, J. Ochoa, J. Carpenter, Z. Yu, M. Bertoni, and Z. Holman, “Ultra-high throughput inline deposition of silicon oxide for polycrystalline silicon passivating contacts,” (submitted).

111. D. Quispe, B. Eng, M. Kim, B. Coppa, M. Lee, and Z. Holman, “Evaluating the potential of polycrystalline $Al_{0.25}Ga_{0.75}P$ and $Al_{0.9}Ga_{0.1}As$ as hole contacts in silicon heterojunction solar cells,” *IEEE J. Photovoltaics* (in press).

110. D. Padmanaban, S. Sadhu, S. Dsouza, W. Mushtaq, Z Holman, V. Svrcek, and D. Mariotti, “One-step synthesis and deposition of metal oxides: NiO quantum dots as a transport layer for perovskite photovoltaics,” *Adv. Eng. Mat.* **26**, 2400826 (2024).

109. B. Hartweg, K. Fisher, J. Ro, and Z. Holman, “Qualification of laser-weld interconnection of aluminum foil to back-contact silicon solar cells,” *Sol. Energy Mater. Sol. Cells* **266**, 112647 (2024).

108. M. Mahaffey, A. Onno, C. Reich, A. Danielson, W. Sampath, and Z. Holman, "Measuring the absorber doping concentration of Si, CdSeTe, and perovskite solar cells using injection-dependent quasi-steady-state photoluminescence," *IEEE J. Photovoltaics* **13**, 800–807 (2023).

107. G. Yang, Z. Yu, M. Wang, Z. Shi, Z. Ni, H. Jiao, C. Fei, A. Wood, A. Alasfour, B. Chen, Z. Holman, and J. Huang, "Shunt mitigation toward efficient large-area perovskite-silicon tandem solar cells," *Cell Reports Phys. Sci.* **4**, 101628 (2023).

106. D. Quispe, B. Eng, M. Kim, A. Onno, B. Coppa, Z. Yu, M. Lee, and Z. Holman, "Optical constants of polycrystalline $Al_{0.25}Ga_{0.75}P$ and $Al_{0.9}Ga_{0.1}As$ determined by variable-angle spectroscopic ellipsometry," *J. Appl. Phys.* **134**, 073104 (2023).

105. J. Levi, S. Guo, S. Kavadiya, Y. Luo, C.-S. Lee, H. Jacobs, Z. Holman, M. Wong, S. Garcia-Segura, C. Zhou, b. Rittmann, and P. Westerhoff, "Comparing methods to deposit Pd-In catalysts on hydrogen-permeable hollow-fiber membranes for nitrate reduction," *Water Res.* **235**, 119877 (2023).

104. G. Yang, M. Wang, C. Fei, H. Gu, Z. Yu, A. Alasfour, Z. Holman, and J. Huang, "Recycling silicon bottom cells from end-of-life perovskite–silicon tandem solar cells," *ACS Energy Lett.* **8**, 1639–1644 (2023).

103. A. Bothwell, C. Reich, A. Danielson, A. Onno, Z. Holman, W. Sampath, and D. Kuciauskas, "Charge carrier lifetime determination in graded absorber solar cells using time-resolved photoluminescence simulations and measurements," *Solar RRL*, 2201029 (2023).

102. A. Danielson, C. Reich, R. Pandey, A. Munshi, A. Onno, W. Weigand, D. Kuciauskas, S. Li, A. Bothwell, J. Guo, M. Murugeson, J. McCloy, R. Klie, Z. Holman, and W. Sampath, "Electro-optical characterization of arsenic-doped CdSeTe and CdTe solar cell absorbers doped in-situ during close space sublimation," *Sol. Energy Mater. Sol. Cells* **251**, 112110 (2023).

101. B. Hartweg, K. Fisher, S. Niverty, N. Chawla, and Z. Holman, "Analysis of electrically conductive adhesives in shingled solar modules by X-ray imaging techniques," *Microelectron. Reliab.* **136**, 114627 (2022).

100. B. Chen, Z. Yu, A. Onno, Z. Yu, S. Chen, J. Wang, Z. Holman, and J. Huang, "Bifacial all-perovskite tandem solar cells," *Sci. Adv.* **8**, eadd0377 (2022).

99. G. Yang, Z. Ni, Z. Yu, Z. Yu, B. Larson, B. Chen, A. Alasfour, X. Xiao, J. Luther, Z. Holman, and J. Huang, "Defect engineering in wide bandgap perovskites for efficient perovskite-silicon tandem solar cells," *Nature Photonics* **16**, 588–594 (2022).

98. H. Bauser, M. Foley, M. Phelan, W. Weigand, D. Needell, Z. Holman, and H. Atwater, "Amorphous silicon carbide high contrast gratings as highly efficient spectrally selective visible reflectors," *Opt. Express* **30**, 26787–26793 (2022).

97. A. Onno, C. Reich, S. Li, A. Danielson, W. Weigand, A. Bothwell, S. Grover, J. Bailey, G. Xiong, D. Kuciauskas, W. Sampath, and Z. Holman, "Understanding what limits the voltage of polycrystalline CdSeTe solar cells," *Nature Energy*, **7**, 400–408 (2022).

96. K. Chen, B. Hartweg, M. Woodhouse, H. Guthrey, W. Nemeth, S. Theingi, M. Page, Z. Holman, P. Stradins, S. Agarwal, and D. Young, "Self-aligned selective area front contacts on poly-Si/SiOx passivating contact c-Si solar cells," *IEEE J. Photovoltaics* **12**, 678–689 (2022).

95. N. Liew, Z. Yu, Z. Holman, and H.-J. Lee, "Parametric study about performances of a solar photovoltaic/thermal hybrid using a spectral beam splitting technique," *J. Renew. Sustain. Energy* **14**, 013701 (2022).

94. J. Ding, C. Campbell, J. Becker, C.-Y. Tsai, S. Schaefer, T. McCarthy, M. Boccard, Z. Holman, and Y.-H. Zhang, "Monocrystalline 1.7-eV MgCdTe solar cells," *J. Appl. Phys.* **131**, 023107 (2022). [Editor's Pick].

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(ASU students in red; ASU postdocs and staff in orange)

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