Heather P. H. Liddell

Assistant Professor, Purdue University
Mechanical Engineering & Sustainability Engineering

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EDUCATION

University of Rochester	Ph.D., Materials Science	2014
University of Rochester	M.S., Mechanical Engineering	2010
University of Rochester	B.S., Mechanical Engineering	2008 (*magna cum laude*)

SPECIALTIES

My research group applies interdisciplinary engineering approaches to address multiscale research challenges across two primary research thrusts: **manufacturing sustainability** (including life cycle assessment for production systems and supply chains) and **mechanics of multi-material systems** (including adhesion testing and fracture mechanics, particularly of coatings and multilayers). In addition to my core technical competencies, my approach maximizes research impact and reach by leveraging a decade of science-policy experience in Washington. Current research interests include:

- energy and emissions accounting in manufacturing systems and product supply chains
- environmentally extended input-output (EEIO) modeling with energy systems integration
- life cycle assessment (LCA) and techno-economic analysis (TEA) for early-stage technologies
- eco-informed product design
- fracture mechanics at solid-solid interfaces
- adhesion of paints, coatings, multilayers, and composites
- applied failure analysis for interlayer delamination and other interfacial problems

PROFESSIONAL EXPERIENCE

2023 – present **Purdue University**, West Lafayette, IN
Assistant Professor of Mechanical Engineering (ME) and Sustainability Engineering & Environmental Engineering (SEE); Faculty Affiliate, Purdue University Institute for a Sustainable Future (ISF)

2020 – 2023; 2014 – 2017 **Energetics**, a contractor to the U.S. Department of Energy (DOE), Washington, DC
Senior Scientist and Program Manager for Analysis & Modeling. Promoted from prior roles including: Associate Scientist, Staff Scientist, Senior Scientist, and Senior Subject Matter Expert

2017 – 2020 **U.S. Naval Research Laboratory,** U.S. Department of Defense (DOD), Washington, DC
American Society for Engineering Education (ASEE) NRL Postdoctoral Research Fellow

2013 – 2014 **National Highway Traffic Safety Administration**, U.S. Dept. of Transportation (DOT), Washington, DC
Safety Standards Engineer – Vehicle Dynamics Division – Rulemaking

2010 – 2013 **Laboratory for Laser Energetics**, University of Rochester, Rochester, NY
Frank J. Horton Graduate Research Fellow

2008 – 2010 **University of Rochester Mechanical Engineering Department**, Rochester, NY
Graduate Research Assistant and Graduate Teaching Assistant; Dean's Graduate Fellow

SELECTED AWARDS & RECOGNITIONS

Major National and International Awards

- American Center for Life Cycle Assessment (ACLCA) **Michael Levy Rising Star Award** (1 given per year), 2025
- DOE **EnergyTech University Prize** Faculty Explorer Award (10 winners nationally), 2024
- DOE **Secretary's Appreciation Award** (one of DOE's highest civil service honors, awarded in-person by the Secretary of Energy; received for contributions to the 2015 Quadrennial Technology Review), 2015
- DOT **Secretary's Honor Award** (one of DOT's highest civil service honors, awarded in-person by the Secretary of Transportation; received for STEM engagement with at-risk youth), 2014

Other Significant Honors

- Purdue **Outstanding Engineering Instructor** recognition (for top-quartile instructor evaluation ratings), 2025
- NSF **Young Investigator Travel Grants,** REMADE Circular Economy Tech Summit & Conference, 2024, 2025

- **Keynote Speaker**, Sustainable Metals Manufacturing Workshop, Pacific Northwest National Laboratory, 2023
- Energetics **Shooting Star Award** (peer-nominated award for innovation and excellence across the company), 2022
- Energetics **Above and Beyond Awards** (with spot bonuses for outstanding job performance), 2015, 2016, 2021, 2022
- University of Rochester **Outstanding Graduate Teaching Assistant** (~12 awardees university-wide), 2009
- University of Rochester **Helmut Weymann Prize** (1 given per year, for excellence in engineering experimentation by an undergraduate student), 2008
- B.S. degree granted with ***Highest Distinction in Mechanical Engineering*** (highest departmental honors), 2008
- Elected to **Tau Beta Pi**, 2007

Research Fellowships & Scholarships

- American Society for Engineering Education Postdoctoral Fellowship, U.S. Naval Research Laboratory, 2017-2020
- Frank J. Horton Graduate Research Fellowship, University of Rochester Laboratory for Laser Energetics, 2010-2013
- Pandeli Durbetaki Graduate Fellowship, University of Rochester, 2009-2010
- Dean's Graduate Fellowship, University of Rochester, 2009-2010
- Rush Rhees Scholarship, University of Rochester, 2004-2008

Selected Student Awards (of Purdue Mentees)

- **Best Poster Awards**: ACLCA Student Poster Competition (selected from a field of ~25 entries per year): 1st Place – Catherinne Mejia, 2024. 2nd Place – Elizabeth Kelley, 2024. 1st Place – Heyichen Xu, 2025.
- **Competitive Graduate Fellowships:** Purdue Presidential Excellence Award – Jenny Kwak, 2025. NSF National Research Traineeship – William Lewis, 2025; Jenny Kwak, 2026. Purdue Ross Fellowship – Jenny Kwak, 2025. Purdue SEE Discovery Fellowship – Tripta Bhattacharjee, 2023; William Lewis, 2025.
- **Undergraduate Research Awards:** Bottomley Research Scholarship in ME – Andrew Morrissey, 2024
- **Student Travel Grants:** Purdue Institute for a Sustainable Future Student Travel Grant – Tripta Bhattacharjee, 2025.

FUNDING

Scientific Grants

- ***Integrated Passive and Active Underwater Wave Control for Comprehensive Noise Abatement in Offshore Wind Installation***. DOE Energy Efficiency & Renewable Energy ($5,128,956). Co-PI. Liddell share 25%. In negotiations.
- ***Input-Output Analysis of Mass Flows in Manufacturing Production Networks.*** DOE Industrial Technologies Office, as sub to National Renewable Energy Laboratory ($186,091). Single PI. Liddell share 100%. 03/2024 – 12/2025.
- ***Optimized Radio Frequency (RF) Processing for Safer & More Sustainable Drying of Dairy Forage.*** Purdue University Ag-Eng Seed Grant ($50,000). Co-PI. Liddell share 50%. 01/2024-12/2024.

Prizes & Microgrants

- ***Teaching the Valley of Death: Learning Resources for Techno-Economics of Emerging Technologies.*** DOE Office of Technology Transitions. Single PI prize ($4,000). 01/2024.
- ***NSF Young Investigator Travel Grant*** for the REMADE Circular Economy Tech Summit & Conference: two awards ($2,500 each). 04/2024 and 04/2025.
- ***Honorarium:*** DOE Office of Technology Transitions ($850). 06/2024.
- ***Honorarium:*** DOE Advanced Materials & Manufacturing Technologies Office ($1,000). 05/2024.

LEADERSHIP & SERVICE

Affiliations

School of Mechanical Engineering (ME): 75% appointment. **School of Sustainability Engineering & Environmental Engineering (SEE):** 25% appointment. **Institute for a Sustainable Future**: faculty affiliate. **Purdue Institute for Polymers Innovation (PIPI):** faculty affiliate. **Manufacturing & Materials Research Laboratories (MMRL):** core faculty.

Student Advising

Graduate Advising: Major professor and committee chair for 6 current graduate students (1 M.S., 5 Ph.D.) and 3 alumni (3 M.S.). Advisory committee member for 9 additional graduate students (9 Ph.D., 1 M.S.) and 1 alum (Ph.D.). **Undergraduate Research & Advising:** Served as instructor of record for 7 credit-bearing research projects for 6 undergraduate students (2023-present). Faculty advisor for 5 additional undergraduate students (2024-present). **Student Organization Advising:** Faculty advisor for Purdue Solar Racing (2025-present) and Purdue Green Leaps (2023-present) student clubs.

Professional Society Membership & Leadership

Leadership Roles: The Adhesion Society: Sustainability Chair; 2024-present. American Center for Life Cycle Assessment (ACLCA): Education Committee; 2023-present. ASME: Secretary of University of Rochester Student Section; 2007-2008. Tau Beta Pi: Peer tutor for engineering courses; 2007-2008.

Society Memberships: ASME; 2006-present. Tau Beta Pi; 2007-present. The Adhesion Society; 2019-2020 and 2023-present. American Center for Life Cycle Assessment; 2022-present. Optica; 2010-2023. Women in Science and Engineering (WISE) at the U.S. Naval Research Laboratory; 2017-2020.

Conference Leadership

Conference Planning Committees: Served (or currently serving) on conference planning committees for the ACLCA Conference (2023, 2024, 2025); the Adhesion Society Annual Meeting (2025); the Global Product Sustainability Symposium (GPSS) (2026); and the Society of Engineering Science (SES) Technical Meeting (2026). **Conference Session Organizer or Chair Roles:** Organized and chaired the sustainability track (4 sessions) at the Adhesion Society Annual Meeting; 2025. Co-organized the Industrial Decarbonization session at the Global Product Sustainability Symposium, 2024. Co-organizing the Industry track for the Society of Engineering Science (SES) Technical Meeting; 2026. **Short Courses at Conferences:** Taught a short course, "Industrial Carbon Accounting," at ACLCA's LCA Institute; 2024, 2025. **Special Events:** Organized and co-facilitated the conference-wide ACLCA Challenge Session: "A Sustainability Premortem" (~250 participants), 2024. Organized and co-chaired the conference-wide American Council for an Energy-Efficient Economy (ACEEE) Action Session: "Strategies for Decarbonizing Industry: An Interactive Discussion & Debate" (~200 participants), 2023.

Participation in National and International Research Consortia

LCA for Emerging Technologies Research Network: Active researcher (meets biweekly; research output includes 5 conference presentations, 3 in-person workshops, and 1 submitted journal manuscript; 2022-present. **Macroeconomics for Net-Zero Consortium:** Active researcher (meets quarterly; in-person workshop planning underway); 2026-present. **Planetary Limits Academic Network:** Active researcher (meets monthly; collaborative book in-progress for *Cambridge University Press);* 2021-present. **IEA Technical Collaboration Program on Advanced Materials for Transportation (IEA TCP-AMT):** U.S. delegate from DOE; 2022-2023. **USDRIVE Government-Industry Partnership: Materials Technical Team (MTT):** Technical representative for DOE; 2022-2023.

Review Activity for Journals

Reviewer for the following journals (2015-present): Resources, Conservation, and Recycling; Environmental Science & Technology; Journal of Industrial Ecology; Sustainable Development; Applied Optics; Optics Letters

Review Activity for Grant Agencies

Panel reviewer for the following agencies and offices (2020-present): DOE Advanced Research Projects Agency – Energy (**ARPA-e** – 1 panel), DOE Office of Technology Transitions (**OTT** – 1 panel), DOE Advanced Materials & Manufacturing Technologies Office (**AMMTO** – 1 panel), DOE Vehicle Technologies Office (**VTO** – 3 panels).

Purdue Committees Served

For **Purdue Mechanical Engineering:** Manufacturing & Design Area Committee; 2023-present. Solid Mechanics Area Committee; 2023-present. ME Faculty Review Committees for the College of Engineering Outstanding Postdoc Award (2025) and the ME Postdoctoral Fellowship (2025). For **Purdue Sustainability Engineering & Environmental Engineering:** SEE Graduate Committee; 2023-present. SEE Laboratory Safety Committee (faculty representative); 2024-present. SEE Ph.D. Qualifying Exam - Examining Committee Member; 2025. For **Purdue College of Engineering:** College of Engineering Graduate Fellowship Review Committee; 2025.

K-12 Outreach

Competition Judge for the **Rube Goldberg 2025 Machine Contest**, West Lafayette, IN; 2025. Competition Official (science judge) in the DOE **National Science Bowl**, Washington, DC; 2023. Science Advisor for **Open Montessori** (an educational nonprofit focused on making Montessori materials broadly available through 3D printing), Lancaster, PA; 2020-2023. Member of Brent Elementary School's **"Science Brain Trust"** (a parent-led volunteer group to support elementary science faculty in DC Public Schools), Washington, DC; 2021-2023. STEM mentor and job skills coach in the **Living Classrooms Fresh Start Program** (a program that served out-of-school, at-risk teenage youth), Washington, DC; 2014-2015. Participated in youth outreach and kit assembly for OSA's (now Optica's) ***Optics Suitcase*** hands-on learning kit for middle schoolers; 2010-2013.

TEACHING

Credit-bearing courses at Purdue:

Fall 2023	ME 46300 Engineering Design	Enrollment: 28	Mean Instructor Rating: 4.63 / 5.00
Spring 2024	EEE 56000 Industrial Carbon Accounting	Enrollment: 33	Mean Instructor Rating: 4.69 / 5.00
Fall 2024	ME 46300 Engineering Design	Enrollment: 21	Mean Instructor Rating: 4.62 / 5.00
Spring 2025	EEE 59500 Carbon Acct. & Sustainability	Enrollment: 22	Mean Instructor Rating: 4.77 / 5.00*
Fall 2025	ME 44400 CAD & Prototyping – Lab	Enrollment: 84	Mean Instructor Rating: 4.30 / 5.00
Fall 2025	ME 44400 CAD & Prototyping – Lecture	Enrollment: 79	Mean Instructor Rating: 4.17 / 5.00
Fall 2025	EEE 690 Graduate Seminar	Enrollment: 35	Mean Instructor Rating: 4.71 / 5.00

***** Outstanding Engineering Instructor recognition for this semester (for teaching effectiveness ratings in the top quartile)

Short courses at Purdue and elsewhere:

Summer 2024	ME 297 Designing a Product with a 3D Printer	Purdue Summer College for High School Students
Fall 2024	Introduction to Carbon Accounting	Short course at the *2024 LCA Institute* (ACLCA)
Spring 2025	Introduction to Carbon Accounting	Short course at the *2025 LCA Institute* (ACLCA)

Teaching assistantships:
Six semesters as an undergraduate and graduate teaching assistant at the University of Rochester (2007-2009), earning an "Outstanding Teaching Assistant" recognition (2009) and participating as a trainer in a university-wide training workshop (2009). Courses taught: Thermodynamics (3 semesters), Solids & Materials Laboratory (2 semesters), Introduction to Materials Science (1 semester).

STUDENT ADVISING & MENTORSHIP

Graduate Students Supervised at Purdue (as Chair or Co-Chair)

Graduation Year	***Student Name***	***Degree***
2025	Elizabeth Kelley	M.S., Environmental & Ecological Engineering
2025	Sanatkumar Rajagopalan	M.S., Mechanical Engineering
2025	Catherinne Mejia Melara	M.S., Environmental & Ecological Engineering
2026 (Expected)	Andrew Morrissey	M.S., Mechanical Engineering
2028 (Expected)	Tripta Bhattacharjee	Ph.D., Environmental & Ecological Engineering
2028 (Expected)	Heyichen Xu	Ph.D., Environmental & Ecological Engineering
2029 (Expected)	Zubair Mumin Wahed	Ph.D., Mechanical Engineering
2029 (Expected)	Gyuna ("Jenny") Kwak	Ph.D., Environmental & Ecological Engineering
2030 (Expected)	William Lewis	Ph.D., Environmental & Ecological Engineering

Graduate Students Mentored at Purdue (as Advisory Committee Member)

Graduation Year	***Student Name***	***Degree***
2025	Venkat Roy	Ph.D., Environmental & Ecological Engineering
2026 (Expected)	Xiaohan Wu	Ph.D., Environmental & Ecological Engineering
2026 (Expected)	Mukhamad ("Mo") Suhermanto	Ph.D., Environmental & Ecological Engineering
2026 (Expected)	Seungho Lee	M.S., Industrial Engineering
2026 (Expected)	Seyi Ogunmodede	Ph.D., Computer & Information Technology
2027 (Expected)	Christopher Copeland	Ph.D., Environmental & Ecological Engineering
2027 (Expected)	Yue Yao	Ph.D., Environmental & Ecological Engineering
2027 (Expected)	Albin John	Ph.D., Environmental & Ecological Engineering
2027 (Expected)	Andrew Witty	Ph.D., Mechanical Engineering
2028 (Expected)	Aishwary Shrivastava	Ph.D., Mechanical Engineering
2030 (Expected)	Yimin Zeng	Ph.D., Mechanical Engineering

Undergraduate Student Researchers Supervised (from Purdue)

Graduation Year	***Student Name***	***Degree***
2024	Donghyun ("Han") Lee	B.S., Mechanical Engineering
2024	John Dec	B.S., Mechanical Engineering
2025	Joel Kerr	B.S., Mechanical Engineering
2025	Andrew Morrissey	B.S., Mechanical Engineering
2027 (Expected)	Yuvraj Jhanwar	B.S., Mechanical Engineering
2027 (Expected)	Olivia Helmuth	B.S., Environmental & Ecological Engineering

Undergraduate Student Researchers Supervised (other universities)

Graduation Year	***Student Name***	***Degree***
2025	Myla Chappell	B.S., Mechanical Engineering, Old Dominion University
2024	Kayla Huang	B.S., Materials Science & Engineering, UIUC

See *Leadership and Service* for additional student mentoring roles, including student organization advising and K12 outreach.

PUBLICATIONS AND PRESENTATIONS

Note on author's name change: Work dated before June 2013 was published under my maiden name, **Heather P. Howard.**

► Mechanics and/or Materials Focus ► Energy & Sustainability Focus

Peer-Reviewed Journal Articles

1. ► R. Woods-Robinson, M. A. Carbajales-Dale, A. Cheng, G. Cooney, A. Kirchofer, **H. P. H. Liddell,** S. Moni, L. Petersen, I. D. Posen, S. Sleep, E. Wachs, S. Zargar, and J. A. Bergersen, "Controversy and consensus: common ground and best practices for life cycle assessment of emerging technologies," under review at the Journal of Industrial Ecology (2026).

2. ► **H. P. H. Liddell,** B. M. Ray, and J. W. Cresko, "A retrospective analysis of circular economy and industrial decarbonization metrics in the United States, 1998-2022," Journal of Advanced Manufacturing and Processing 7 (2025) e70013.
3. ► T. Bhattacharjee, J. Mulrow, and **H. P. H. Liddell**, "Re-Investment Rebound Dynamic in the Cement Industry," Procedia CIRP 135 (2025) 76-82.
4. ►► H. Chen, **H. P. H. Liddell**, A. A. Ogale, Z. C. Miao, M. W. Ijeoma, and M. Carbajales-Dale, "A critical review and meta-analysis of energy demand, carbon footprint, and other environmental impacts from carbon fiber manufacturing," Resources, Conservation, and Recycling 219 (2025) 108302.
5. ► **H. P. H. Liddell**, L. M. Erickson, J. P. Tagert, A. Arcari, G. M. Smith, and J. Martin, "Mode mixity and fracture in pull-off adhesion tests," Engineering Fracture Mechanics 281, 109120 (2023).
6. ► **H. P. H. Liddell** and M. H. Merrill, "In situ visualization of particle motions during wipe sampling of explosives and other trace particulate materials," ACS Applied Materials & Interfaces 11, 23780-23788 (2019).
7. ► L. E. DeGreeff, **H. P. H. Liddell**, W. R. Pogue III, M. H. Merrill, and K. J. Johnson, "Effect of re-use of surface sampling traps on surface structure and collection efficiency for trace explosive residues," Forensic Science International 297, 254-264 (2019).
8. ► **H. P. H. Liddell**, J. C. Lambropoulos, and S. D. Jacobs, "Thermomechanical model to assess stresses developed during elevated-temperature cleaning of coated optics," Applied Optics 53, 5865-5878 (2014).
9. ► **H. P. H. Liddell**, K. Mehrotra, J. C. Lambropoulos, and S. D. Jacobs, "Fracture mechanics of delamination defects in multilayer dielectric coatings," Applied Optics 52, 7689–7698 (2013).
10. ► **H. P. Howard**, A. F. Aiello, J. G. Dressler, N. R. Edwards, T. J. Kessler, A. A. Kozlov, I. R. T. Manwaring, K. L. Marshall, J. B. Oliver, S. Papernov, A. L. Rigatti, A. N. Roux, A. W. Schmid, N. P. Slaney, C. C. Smith, B. N. Taylor, and S. D. Jacobs, "Improving the performance of high-laser-damage-threshold, multilayer dielectric pulse-compression gratings through low-temperature chemical cleaning," Applied Optics 52, 1682–1692 (2013). [as H. P. Howard]
11. ► K. Mehrotra, **H. P. Howard**, S. D. Jacobs, and J. C. Lambropoulos, "Nanoindentation of high-aspect-ratio pillar structures on optical multilayer dielectric diffraction gratings," AIP Advances 1, 042179 (2011). [as H. P. Howard]
12. ► **H. P. Howard**, J. Cheng, P. T. Vianco, and J. C. M. Li, "Interface flow mechanism for tin whisker growth," Acta Materialia 59, 1957–1953 (2011). [as H. P. Howard]

Peer-Reviewed Conference Papers

13. ►► A. Morrissey, S. Stencel, S. Ogunmodede, S. A. K. Karanam, C. Laux, N. Hartman, and **H. P.H. Liddell**, "From CAM to carbon: Operation-level energy monitoring for automated product-level carbon & energy footprinting," submitted for consideration in the Proceedings of the ASME 2026 21st International Manufacturing Science and Engineering Conference (MSEC 2026), State College, PA, June 14-18, 2026.
14. ►► C. Laux, S. Ogunmodede, S. Karanam, S. Prabhune, S. Stencel, B. Haley, **H. P. H. Liddell,** and N. Hartman, "Real-Time Sustainable Impact: Integrating Value Stream and Life Cycle Assessment in a Model Factory," Proceedings of the 6th International Conference on Quality Innovation & Sustainability, Urbino, Italy, May 21-23, 2025.
15. ► **H. P. H. Liddell**, B. Kelley, L. Wachs, A. Carpenter, and J. Cresko, "A physically extended EEIO framework for decarbonization and circularity assessment in United States manufacturing supply chains," Proceedings of the REMADE Circular Economy Tech Summit & Conference, Washington, DC, April 10-11, 2025.
16. ► T. Bhattacharjee, J. Mulrow, **H. P. H. Liddell**, "Re-investment rebound dynamic in the cement industry," Procedia CIRP 135 (2025) 76-82.
17. ► **H. P. H. Liddell,** G. M. Smith, and L. Erickson, "Extraction of mode mixity and other fracture data from crack paths in pull-off adhesion tests," Proceedings of the 43rd Annual Meeting of the Adhesion Society, Charleston, SC, February 23-26, 2020.
18. ► **H. P. H. Liddell** and M. H. Merrill, "Fracture mechanics of delamination in ballistic glass laminates," Proceedings of the 43rd Annual Meeting of the Adhesion Society, Charleston, SC, February 23-26, 2020.
19. ►**H. P. H. Liddell** and M. H. Merrill, "Enhancement of intimate surface contact for dry particle adhesion through mechanical property tailoring of a collection wipe," Proceedings of the 42nd Annual Meeting of the Adhesion Society, Hilton Head, SC, February 17-20, 2019.

20. ► S. B. Brueske, **H. P. H. Liddell,** J. W. Cresko, and A. C. Carpenter, "Manufacturing energy bandwidth studies," Proceedings of the 39th Industrial Energy Technology Conference, New Orleans LA, June 20-22, 2017.

21. ► W. R. Morrow III, S. Das, J. W. Cresko, and **H. P. H. Liddell**, "Net energy consequences of carbon fiber reinforced polymer composites in U.S. light-duty vehicle fleet lightweighting," Proceedings of the 2016 Composites & Advanced Materials Expo (CAMX), Anaheim CA, September 27-29, 2016.

22. ► **H. P. H. Liddell,** S. B. Brueske, A. C. Carpenter, and J. W. Cresko, "Manufacturing energy intensity and opportunity analysis for fiber-reinforced polymer composites and other lightweight materials," Proceedings of the 31st Technical Conference of the American Society for Composites, Williamsburg VA, September 19-22, 2016.

23. ► D. A. Sunter, W. R. Morrow III, J. W. Cresko, and **H. P. H. Liddell**, "The manufacturing energy intensity of carbon fiber reinforced polymer composites and its effect on life cycle energy use for vehicle door lightweighting," Proceedings of the 20th International Conference on Composite Materials, Copenhagen, Denmark, July 19–24, 2015.

24. ► J. C. Lambropoulos, K. Mehrotra, **H. P. Howard**, and S. D. Jacobs, "Glass ductility and fracture at the 50- to 100-nm scale," Proceedings of the OSA Imaging and Applied Optics Congress: Optical Fabrication and Testing, Monterey CA, June 24–27, 2012. [as H. P. Howard]

25. ► **H. P. Howard**, J. C. Lambropoulos, and S. D. Jacobs, "Dependence of thermal stresses on substrate thickness during wet processing of large coated optics," Proceedings of the OSA Imaging and Applied Optics Congress: Optical Fabrication and Testing, Monterey CA, June 24–27, 2012. [as H. P. Howard]

26. ► K. Mehrotra, **H. P. Howard,** S. D. Jacobs, and J. C. Lambropoulos, "Mechanical characterization of 'blister' defects on optical oxide multilayers using nanoindentation," Proceedings of the 2012 Materials Research Society (MRS) Spring Meeting, San Francisco CA, April 9–13, 2012. [as H. P. Howard]

27. ► K. Mehrotra, **H. P. Howard**, S. D. Jacobs, and J. C. Lambropoulos, "Nanoindentation probing of high-aspect-ratio pillar structures on optical multilayer dielectric diffraction gratings," Proceedings of the 2012 Materials Research Society (MRS) Spring Meeting, San Francisco CA, April 9–13, 2012. [as H. P. Howard]

Book Chapters

28. ► S. Gause, **H. P. H. Liddell**, C. Dollinger, J. Steen, and J. Cresko, "Environmentally extended input-output (EEIO) modeling for industrial decarbonization opportunity analysis: a circular economy case study," chapter in: N. Nasr (Ed.), *Technology Innovation for the Circular Economy: Recycling, Remanufacturing, Design, System Analysis and Logistics* (John Wiley & Sons, 2024), pp. 739-753.

29. ► J. W. Cresko, D. K. Shenoy, **H. P. H. Liddell**, and R. N. Sabouni, "Innovating Clean Energy Technologies in Advanced Manufacturing," chapter in *The Quadrennial Technology Review 2015* (U.S. Department of Energy, 2015), pp. 182–225.

Articles in Technical & Trade Magazines

30. ► **H. P. H. Liddell**, A. C. Carpenter, and J. W. Cresko, "Life Cycle Thinking for Sustainability-Informed Decisionmaking," Chemical Engineering Progress, June 2022. Invited by editor.

31. ►► S. Sikirica, S. Whalen, P. Kurup, H. Schwartz, and **H. P. H. Liddell**, "Low-Energy, High-Throughput Extrusion of High-Strength Aluminum Alloy 7075," Industrial Heating Magazine, April 2021. Invited by editor.

32. ►► S. Sikirica, B. Cottom, and **H. P. H. Liddell**, "Challenges and Solutions for Yttrium Aluminum Garnet as a Next-Generation Thermal Barrier Coating," Industrial Heating Magazine, March 2021. Invited by editor.

U.S. Government Reports

33. ►J. Cresko, C. Dollinger, B. Ray, …, **H. P. H. Liddell**, *et al.*, "Transformative Pathways for U.S. Industry: Unlocking American Innovation," DOE Technical Report No. DOE/EE-2963 (U.S. Department of Energy, 2025).

34. ►► **H. P. H. Liddell**, I. Atakpa, S. Gage, K. Huang, S. Morgan, D. Sellers, S. Brueske, A. Carpenter, J. Cresko, "Sustainable Materials Selection in Manufactured Products: A Framework for Design-Integrated Life Cycle Thinking with Case Studies," DOE Technical Report No. DOE/EE-2766 (U.S. Department of Energy, 2023).

35. ► J. Cresko, E. Rightor, A. Carpenter, K. Peretti, N. Elliott, S. Nimbalkar, W. R. Morrow III, A. Hasanbeigi, B. Hedman, S. Supekar, C. McMillan, … , **H. Liddell**, et al., U.S. Department of Energy's *Industrial Decarbonization Roadmap*, DOE Technical Report No. DOE/EE-2635 (U.S. Department of Energy, 2022).

36. ► **H. P. H. Liddell**, C. Dollinger, A. Fisher, S. Brueske, A. C. Carpenter, and J. W. Cresko, "Bandwidth Study on Energy Use and Potential Energy Saving Opportunities in U.S. Carbon Fiber Reinforced Polymer Manufacturing," DOE Technical Report No. DOE/EE-1662 (U.S. Department of Energy, 2017).

37. ► **H. P. H. Liddell**, C. Dollinger, A. Fisher, S. Brueske, A. C. Carpenter, and J. W. Cresko, "Bandwidth Study on Energy Use and Potential Energy Saving Opportunities in U.S. Glass Fiber Reinforced Polymer Manufacturing," DOE Technical Report No. DOE/EE-1666 (U.S. Department of Energy, 2017).

38. ► M. Justiniano, B. Levie, K. Jamison, **H. P. H. Liddell**, B. Chadwell, S. Brueske, A. Carpenter, and J. W. Cresko, "Bandwidth Study on Energy Use and Potential Energy Saving Opportunities in U.S. Glass Manufacturing," DOE Technical Report No. DOE/EE-1572 (U.S. Department of Energy, 2017).

39. ► D. Glassbrenner, A. Morgan, R. Kreeb, A. Svenson, **H. P. H. Liddell**, and F. Barickman, "A target population for automatic emergency braking in heavy vehicles," NHTSA Technical Report No. DOT-HS-812-390 (U.S. Department of Transportation, 2017).

40. ► S. B. Baldwin, G. Bindewald, A. Brown., …, **H. P. H. Liddell**, et al., *The Quadrennial Technology Review 2015: An Assessment of Energy Technologies and Research Opportunities* (U.S. Department of Energy, 2015).

41. ► **H. P. H. Liddell**, K. Mehrotra, J. C. Lambropoulos, and S. D. Jacobs, "Fracture mechanics of delamination defects in multilayer dielectric coatings," *LLE Review Quarterly Report* 135, 187–199, Laboratory for Laser Energetics, Rochester, NY, LLE Document No. DOE/NA/28302-1131 (U.S. Department of Energy, 2013).

42. ► **H. P. Howard**, A. F. Aiello, J. G. Dressler, N. R. Edwards, T. J. Kessler, A. A. Kozlov, I. R. T. Manwaring, K. L. Marshall, J. B. Oliver, A. L. Rigatti, A. N. Roux, A. W. Schmid, N. P. Slaney, C. C. Smith, B. N. Taylor, and S. D. Jacobs, "Laser damage threshold enhancement in multilayer dielectric diffraction gratings through targeted chemical cleaning," *LLE Review Quarterly Report* 131, 149–158, Laboratory for Laser Energetics, Rochester, NY, LLE Document No. DOE/NA/28302-1064 (U.S. Department of Energy, 2012). [as H. P. Howard]

Invited Talks & Seminars

43. ► **H. P. H. Liddell**, E. Kelley, and L. Wachs, "Data development for a physically extended EEIO model to support industrial decarbonization," invited speaker for the DOE Industrial Efficiency & Decarbonization Office Strategic Analysis research seminar series, virtual, November 7, 2024.

44. ► **H. P. H. Liddell**, "Industrial Decarbonization Pathways for the United States," invited speaker at the 2024 Global Product Systems Sustainability (GPSS) Workshop, University of Rhode Island, Kingston, RI, October 2-5, 2024.

45. ► D. R. Cooper, **H. P. H. Liddell**, R. Geyer, and D. C. A. Pigosso, "Industrial Decarbonization and Demand," invited session co-chair at the 2024 Global Product Systems Sustainability (GPSS) Workshop, University of Rhode Island, Kingston, RI, October 2-5, 2024.

46. ► **H. P. H. Liddell,** P. Rao, and J. Cresko, "Challenge Session: Global Harmonization of LCA," invited co-organizer and facilitator of plenary Challenge Session at the 2024 American Center for Life Cycle Assessment (ACLCA) Conference, Snowbird, UT, September 24-26, 2024.

47. ► **H. P. H. Liddell,** "Introduction to Carbon Accounting," invited instructor for the *LCA Institute* at the 2024 American Center for Life Cycle Assessment (ACLCA) Conference, Snowbird, UT, September 24-26, 2024.

48. ► J. F. Hajjar, J. Jung, **H. P. H. Liddell,** S. Ukkusuri, M. Velay-Lizancos, and A. Varma, "Panel Discussion: Designing for Climate Change & Sustainability," invited panelist for the *Purdue Engineering Distinguished Lecture Series,* post-lecture panel discussion featuring Prof. Jerome F. Hajjar. West Lafayette, IN, September 12, 2024.

49. ►► G. Wan, N. Deneke, **H. P. H. Liddell**, M. Seitz, J. Wilker, and L. Lopez, "Panel Discussion: Sustainability and Adhesion," invited panelist at the 47th Annual Meeting of the Adhesion Society, Savannah, GA, February 11-14, 2024.

50. ►► **H. P. H. Liddell**, "Materials Development & Lightweighting for Electric Vehicle Decarbonization: An Environmental Life Cycle Perspective with an Outlook to 2050," invited speaker for a Mechanical Engineering Research Seminar, IUPUI, Indianapolis, IN, November 9, 2023.

51. ►► **H. P. H. Liddell**, "Should We Lightweight Electric Vehicles? An Environmental Life Cycle Perspective with an Outlook to 2050," invited speaker for an Environmental & Ecological Engineering Research Seminar, Purdue University, West Lafayette, IN, October 3, 2023.

52. ► **H. P. H. Liddell**, "Lightweighting in Electric Vehicles: A Prospective Life Cycle Opportunity Analysis," invited presentation to the Environmental & Ecological Engineering External Advisory Committee, Purdue University, West Lafayette, IN, September 22, 2023.

53. ► J. Cresko, **H. P. H. Liddell**, A. Carpenter, C. Dollinger, T. Wenning, P. Stephens, D. Cooper, and A. Peterman, "Strategies for Decarbonizing Industry: An Interactive Discussion & Debate," invited co-organizer of conference-wide Action Session at the ACEEE Industry Summer Study, Detroit, MI, July 10-13, 2023.

54. ▶ **H. P. H. Liddell**, “Sustainable Materials for Transportation Sector Decarbonization: A Life Cycle Perspective with an Outlook to 2050,” invited Keynote Address for the Sustainable Metals Manufacturing Workshop, Pacific Northwest National Laboratory, Richland, WA, March 29-30, 2023.

55. ▶ **H. P. H. Liddell**, S. Gage, A. Carpenter, and J. Cresko, “A Design-Integrated Framework for Evaluating the Sustainability Impacts of Materials Substitutions and Recycling Decisions,” invited speaker at the 10th International Congress on Sustainability Science & Engineering, virtual, September 13-15, 2021.

56. ▶ **H. Liddell**, C. Rusnak, N. Fleet, and S. Barber, 2018 Naval Research Laboratory Women in Science and Engineering (NRL WISE) Career Panel of Women Scientists, invited panelist, U.S. Naval Research Laboratory, Washington D.C., July 17, 2018.

57. ▶ **H. P. H. Liddell**, “Failure analysis and fracture mechanics model for delamination defects in multilayer optical coatings,” invited speaker for a Multifunctional Materials Branch Seminar, U.S. Naval Research Laboratory, Washington D.C., October 11, 2016.

58. ▶ J. C. Lambropoulos, K. Mehrotra, **H. P. Howard**, and S. D. Jacobs, “Glass ductility and fracture at the 50- to 100-nm scale,” co-author of an invited presentation at the OSA Imaging and Applied Optics Congress: Optical Fabrication and Testing, Monterey CA, June 24–27, 2012. [as H. P. Howard] ★

59. ▶ **H. P. Howard**, “Evaluating thermal stresses in large coated optics: substrate thickness effects,” invited speaker for a Mechanical Engineering Dept. Seminar, University of Rochester, Rochester NY, April 20, 2012. [as H. P. Howard]

60. ▶ **H. P. Howard**, “An improved cleaning method to enhance the damage threshold of MLD gratings,” invited speaker at the International Committee on Ultra-high Intensity Lasers (ICUIL) Conference, Mamaia, Romania, September 16–21, 2012. [as H. P. Howard]

Contributed Conference Presentations

★ Starred contributions indicate that an accompanying proceedings paper was (or will be) published. Unstarred contributions were presentation-only.

61. ▶ G. Kwak and **H. P. H. Liddell,** "Life cycle greenhouse gas impacts of battery electric vehicle lightweighting under forward-looking grid and material scenarios," to be presented at the International Sustainable Systems Symposium 2026, Rochester, NY, June 16-18, 2026

62. ▶ A. Morrissey, S. Stencel, S. Ogunmodede, S. A. K. Karanam, C. Laux, N. Hartman, and **H. P.H. Liddell,** “From CAM to carbon: Operation-level energy monitoring for automated product-level carbon & energy footprinting,” to be presented at the ASME 2026 21st International Manufacturing Science and Engineering Conference (MSEC 2026), State College, PA, June 14-18, 2026. ★

63. ▶ T. Bhattacharjee, E. Wachs, A. Carpenter, J. Cresko, and **H. P. H. Liddell**, "Extending the EEIO-IDA Tool with Physical Flow Modules: A Steel Industry Case Study," presented at the 2nd Annual Conference of the National Sustainability Society, South Bend, IN, Oct 20-22, 2025.

64. ▶ **H. P. H. Liddell,** T. Bhattacharjee, B. Kelley, L. Wachs, A. Carpenter, and J. Cresko, "Building a data foundation for a physically extended EEIO framework for the United States," presented at the 2025 American Center for Life Cycle Assessment (ACLCA) Conference, Atlanta, GA, Sept. 15-18, 2025.

65. ▶ **H. P. H. Liddell,** P. Rao, and J. Cresko, "Lessons from a Sustainability Premortem: Insights from ACLCA’s 2024 Challenge Session Workshop," presented at the 2025 American Center for Life Cycle Assessment (ACLCA) Conference, Atlanta, GA, Sept. 15-18, 2025.

66. ▶ H. Xu, K. Rosentrater, and **H. P. H. Liddell**, "How old is too old? Quantifying the problem of temporal representativeness in LCI data," presented at the 2025 American Center for Life Cycle Assessment (ACLCA) Conference, Atlanta, GA, Sept. 15-18, 2025. Poster. *(Honors: first place in student poster competition).*

67. ▶ R. Woods-Robinson, L. Wachs, **H. P. H. Liddell,** W. Essouid, M. Kumar, D. Posen, J. Bergerson, "Enhancing Assessment Quality in LCA for Emerging Technologies," presented as a Special Session at the International Sustainable Systems Symposium 2025, Minneapolis, MN, June 16-18, 2025.

68. ▶ C. Laux, **H.P.H. Liddell,** S. Ogunmodede, S. Karanam, S. Prabhune, S. Stencel, B. Haley, and N. Hartman, "Real-Time Sustainable Impact: Integrating Value Stream and Life Cycle Assessment in a Model Factory," presented at the 6th International Conference on Quality Innovation & Sustainability, Urbino, Italy, May 21-23, 2025. ★

69. ▶ **H. P. H. Liddell**, B. Kelley, L. Wachs, A. Carpenter, and J. Cresko, “A physically extended EEIO framework for decarbonization and circularity assessment in United States manufacturing supply chains,” presented at the REMADE Circular Economy Tech Summit & Conference, Washington, DC, April 10-11, 2025. ★

70. ▶ T. Bhattacharjee, J. Mulrow, and **H. P. H. Liddell**, "Re-Investment Rebound Dynamic in the Cement Industry," presented at the 32nd CIRP Conference on Life Cycle Engineering (LCE 2025), Manchester, UK, April 7-9, 2025. ★

71. ▶ E. G. Kelley, E. Wachs, and **H. P. H. Liddell**, "Data development for a physically extended EEIO model to assess the life cycle emissions intensity of U.S. manufactured goods on a mass basis," presented at the 2024 American Center for Life Cycle Assessment (ACLCA) Conference, Snowbird, UT, September 24-26, 2024. Poster. *(Honors: second place in student poster competition).*

72. ▶ C. A. Mejia Melara, D. L. W. Smith, and **H. P. H. Liddell**, "Life-Cycle Impact Comparison of Two Industrial Drying Methods for Alfalfa Dairy Forage: Radiofrequency and Convective Drying," presented at the 2024 American Center for Life Cycle Assessment (ACLCA) Conference, Snowbird, UT, September 24-26, 2024. Poster. *(Honors: first place in student poster competition).*

73. ▶ H. Chen, **H. P. H. Liddell**, and M. Carbajales-Dale, "Sustainability in Carbon Fiber Manufacturing: Insights from Life Cycle Assessment," presented at the 2024 American Center for Life Cycle Assessment (ACLCA) Conference, Snowbird, UT, September 24-26, 2024.

74. ▶ S. Ogunmodede, C. Laux, C. Elizabeth, S. Futerer, and **H. P. H. Liddell**, "Integrating Lean and Sustainability into a Curricular Framework," presented at the 7th International Conference on Operational Excellence (OPEX) in Higher Education, Galway, Ireland, September 2-3, 2024. Poster.

75. ▶ J. Bergersen, M. Carbajales-Dale, G. Cooney, J. Cresko, A. Kirchofer, M. Kumar, **H. P. H. Liddell**, S. Moni, L. Peterson, Posen, D. I., Sleep, S., E. Wachs, R. Woods-Robinson, "LCA of emerging technologies: we can't agree, so let's stop trying," Special Session at the International Symposium on Sustainable Systems and Technology (ISSST), Baltimore, MD, June 18-20, 2024.

76. ▶ **H. P. H. Liddell**, B. Ray, and J. W. Cresko, "A retrospective time-series analysis of circular economy and industrial decarbonization metrics in the United States, 1998-2022," presented at the REMADE Circular Economy Tech Summit & Conference, Washington, DC, April 10-11, 2024. ★

77. ▶ **H. P. H. Liddell**, "Should we lightweight electric vehicles? A life cycle perspective with an outlook to 2050," presented at TMS 2024, Energy Technologies and CO_2 Management Symposium, Orlando, FL, March 3-7, 2024.

78. ▶ **H. P. H. Liddell**, "Crack path measurement for disambiguation of failure modes in pull-off adhesion tests," presented at the 47th Annual Meeting of the Adhesion Society, Savannah, GA, February 11-14, 2024.

79. ▶ D. A. Dillard, G. Dillingham, and **H. P. H. Liddell**, "Adhesive bondline thickness effects: reflecting on what we think we understand," presented at the 47th Annual Meeting of the Adhesion Society, Savannah, GA, February 11-14, 2024.

80. ▶ J. Cresko, A. Carpenter, P. Rao, S. Supekar, T. Uekert, D. Kamath, **H. P. H. Liddell**, P. Nagapurkar, and H. Fuchs, "Beyond industrial decarbonization: Pathways and challenges to sustainable manufacturing," Special Session at the American Society for Life Cycle Assessment (ACLCA) 2023 Conference, Burlington, VT, September 26-28, 2023.

81. ▶ K. Morrissey, S. Gause, C. Dollinger, **H. P. H. Liddell**, and J. Cresko, "Environmentally Extended Input-Output for Industrial Decarbonization Analysis (EEIO-IDA): A hands-on demo of a new Excel-based scenario modeling tool," Special Session at the American Society for Life Cycle Assessment (ACLCA) 2023 Conference, Burlington, VT, September 26-28, 2023.

82. ▶ K. Peretti, K. Morrissey, **H. P. H. Liddell**, M. Keane, A. Carpenter, M. Seitz, and J. Cresko, "LCA as a complementary tool for circular economy approaches: Applications and challenges," Special Session at the American Society for Life Cycle Assessment (ACLCA) 2023 Conference, Burlington, VT, September 26-28, 2023.

83. ▶ J. Steen, D. Thaller, **H. P. H. Liddell**, and J. Cresko, "A new DOE impact assessment tool: Techno-economic, Energy, and Carbon Heuristic Tool for Early-Stage Technologies (TECHTEST)," presented at the American Society for Life Cycle Assessment (ACLCA) 2023 Conference, Burlington, VT, September 26-28, 2023.

84. ▶ S. Gause, **H. P. H. Liddell**, C. Dollinger, J. Steen, and J. Cresko, "Hotspot detection for industrial decarbonization opportunities using environmentally extended input-output (EEIO) modeling," presented at the ACEEE Industry Summer Study, Detroit, MI, July 10-13, 2023.

85. ▶ **H. P. H. Liddell**, S. Gause, C. Dollinger, J. Steen, and J. Cresko, "Environmentally extended input-output (EEIO) modeling for industrial decarbonization opportunity analysis: a circular economy case study," presented at the REMADE Circular Economy Tech Summit & Conference, Washington, DC, March 20-21, 2023. ★

86. ▶ **H. P. H. Liddell**, J. Gibbs, and S. Ollila, "A fleet-based statistical assessment of the prospective opportunity for electric vehicle lightweighting to reduce greenhouse gas emissions in the United States," presented at the American Society for Life Cycle Assessment (ACLCA) 2022 Conference, virtual, November 7-12, 2022.

87. ► S. Gause, **H. P. H. Liddell**, C. Dollinger, E. Yüzügüllü, J. Steen, and J. Cresko, "Application of environmentally extended input/output (EEIO) techniques for industrial decarbonization opportunity analysis," presented at the American Society for Life Cycle Assessment (ACLCA) 2022 Conference, virtual, November 7-12, 2022.

88. ► S. Supekar, C. McMillan, **H. P. H. Liddell**, A. Carpenter, and S. Nimbalkar, "Developing shared foundational datasets for industrial modeling," presented as a Special Session at the American Society for Life Cycle Assessment (ACLCA) 2022 Conference, virtual, November 7-12, 2022.

89. ► J. Bergerson, D. Posen, M. Carbajales-Dale, S. Moni, A. Kirchofer, **H. P. H. Liddell**, et al., "Life Cycle Assessment of Emerging Technologies: Update on the SETAC/ACLCA Working Group Progress," 2022 International Symposium on Sustainable Systems and Technology (ISST), Pittsburgh, PA, June 21-23, 2022.

90. ► **H. P. H. Liddell**, I. Atakpa, S. Brueske, A. Carpenter, and J. Cresko, "Cradle-to-gate burden shifting in lightweighting: an analysis framework and automotive case study," presented at the American Society for Life Cycle Assessment (ACLCA) 2021 Conference, virtual, September 21–24, 2021.

91. ► **H. P. H. Liddell** and M. H. Merrill, "Fracture mechanics of delamination in ballistic glass laminates," presented at the 43rd Annual Meeting of the Adhesion Society, Charleston, SC, February 23-26, 2020. Poster. ★

92. ► **H. P. H. Liddell**, G. M. Smith, and L. Erickson, "Extraction of mode mixity and other fracture data from crack paths in pull-off adhesion tests," presented at the 43rd Annual Meeting of the Adhesion Society, Charleston, SC, February 23-26, 2020. ★

93. ► **H. P. H. Liddell** and M. H. Merrill, "Enhancement of intimate surface contact for dry particle adhesion through mechanical property tailoring of a collection wipe," presented at the 42nd Annual Meeting of the Adhesion Society, Hilton Head, SC, February 17-20, 2019. ★

94. ► **H. P. H. Liddell** and M. H. Merrill, "Adhesion of explosive particles to textile swab surfaces," presented at the 2018 American Chemical Society Colloid & Surface Science Symposium, State College, PA, June 10-13, 2018.

95. ► **H. P. H. Liddell** and M. H. Merrill, "Swab texture effects in swipe sampling for explosives detection," presented at the 2018 Explosives Detection (TED) Workshop, Ottawa, Canada, April 9-13, 2018.

96. ► S. B. Brueske, **H. P. H. Liddell**, J. W. Cresko, and A. C. Carpenter, "Manufacturing energy bandwidth studies," presented at the 39th Industrial Energy Technology Conference, New Orleans LA, June 20-22, 2017. ★

97. ► W. R. Morrow III, S. Das, J. W. Cresko, and **H. P. H. Liddell**, "Net energy consequences of carbon fiber reinforced polymer composites in U.S. light-duty vehicle fleet lightweighting," presented at the 2016 Composites & Advanced Materials Expo (CAMX), Anaheim CA, September 27-29, 2016. ★

98. ► **H. P. H. Liddell**, S. B. Brueske, A. C. Carpenter, and J. W. Cresko, "Manufacturing energy intensity and opportunity analysis for fiber-reinforced polymer composites and other lightweight materials," presented at the 31st Technical Conference of the American Society for Composites, Williamsburg VA, September 19-22, 2016. ★

99. ► D. A. Sunter, W. R. Morrow III, J. W. Cresko, and **H. P. H. Liddell**, "The manufacturing energy intensity of carbon fiber reinforced polymer composites and its effect on life cycle energy use for vehicle door lightweighting," presented at the 20th International Conference on Composite Materials, Copenhagen, Denmark, July 19–24, 2015. ★

100. ► **H. P. Howard**, J. C. Lambropoulos, and S. D. Jacobs, "Dependence of thermal stresses on substrate thickness during wet processing of large coated optics," presented at OSA Imaging and Applied Optics Congress: Optical Fabrication and Testing, Monterey CA, June 24–27, 2012. [Published as H. P. Howard] ★

101. ► K. Mehrotra, **H. P. Howard**, S. D. Jacobs, and J. C. Lambropoulos, "Mechanical characterization of 'blister' defects on optical oxide multilayers using nanoindentation," presented at the 2012 Materials Research Society (MRS) Spring Meeting, San Francisco CA, April 9–13, 2012. [Published as H. P. Howard] ★

102. ► K. Mehrotra, **H. P. Howard**, S. D. Jacobs, and J. C. Lambropoulos, "Nanoindentation probing of high-aspect-ratio pillar structures on optical multilayer dielectric diffraction gratings," presented at the 2012 Materials Research Society (MRS) Spring Meeting, San Francisco CA, April 9–13, 2012. [Published as H. P. Howard] ★

103. ► **H. P. Howard** and K. Mehrotra, "Investigation of the blister defect on MLD gratings using nanoindentation and microscopy," presented at Nanomaterials Symposium 2011: Frontiers in Materials Science for the 21st Century, University of Rochester. Poster. [Published as H. P. Howard]

104. ► **H. P. Howard** and J. C. M. Li, "Interface flow mechanism for tin whisker growth," presented at the 18th Annual MRS Symposium on Materials Research 2010, University of Rochester. Poster. *(Honors: "Best Poster" in student poster competition).* [Published as H. P. Howard]

105. ► J. Cheng, J. Subjeck, **H. P. Howard**, P. T. Vianco, and J. C. M. Li, "Accelerated growth of tin whiskers from evaporated film," presented at The Minerals, Metals and Materials Society (TMS) Annual Meeting, San Francisco CA, February 15–19, 2009. Poster. *(Honors: third place in student poster competition).* [Published as H. P. Howard]

Other Published Materials

106. ► S. Gause, **H. P. Liddell**, C. Dollinger, E. Yüzügüllü, J. Steen, K. Morrissey, and J. Cresko, Environmentally Extended Input-Output for Industrial Decarbonization Analysis (EEIO-IDA) Tool. Software tool, beta version 1.0 (2023). Available at: https://www.energy.gov/eere/iedo/articles/environmentally-extended-input-output-industrial-decarbonization-analysis-eeio

107. ► **H. P. Liddell**, K. Ajmo, J. Steen, and T. Evans, "Life Cycle Assessment and Techno-Economic Analysis Training." Short video series on the DOE YouTube channel; ten modules posted from 2021-2023. Available at: https://www.energy.gov/eere/amo/life-cycle-assessment-and-techno-economic-analysis-training

108. ► J. Steen, **H. P. Liddell**, D. Thaller, R. Brasier, S. Brueske, and J. Cresko, Techno-economic, Energy, and Carbon Heuristic Tool for Early-Stage Technologies (TECHTEST). Software tool, version 1.0 (2023). Available at: https://www.energy.gov/eere/amo/techno-economic-energy-carbon-heuristic-tool-early-stage-technologies-techtest-tool