

Nicholas E. Thornburg

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Summary

Fifth-year Ph.D. candidate researches new heterogeneous oxide catalyst synthesis and development for industrial applications and is actively engaged in pedagogy. Will begin a post-doctorate at the National Renewable Energy Laboratory in May 2017.

Education

- NORTHWESTERN UNIVERSITY, Ph.D. Chemical Engineering (GPA 3.87/4.00), March 2017 (expected)
- WASHINGTON UNIVERSITY IN SAINT LOUIS, B.S. Chemical Engineering, *summa cum laude* (GPA 3.94/4.00), Spanish minor, May 2012

Research & Professional Experience

National Renewable Energy Laboratory – *Postdoctoral Researcher*, beginning May 2017 Golden, CO

Chemical catalyst design and reaction engineering for oxidative lignin depolymerization to renewable chemicals and biofuels.

Notestein Research Group, Northwestern University – *Ph.D. Candidate*, January 2013–present Evanston, IL

Innovative design of atomically-precise supported transition metal oxide catalysts and novel active site titrations for selective oxidations (alkene epoxidation by H₂O₂; thioether oxidation and oxidative desulfurization by H₂O₂; selective ring-opening and isomerization of epoxides) to aid in the design of next-generation chemical systems.

3M: Corporate Research Materials Laboratory – *Intern*, June–September 2015 St. Paul, MN

Designed and optimized formulations of novel non-acrylate, low-VOC pressure-sensitive adhesives for automotive applications.

ARCADIS U.S., Inc. – *Intern*, May–August 2011 Highlands Ranch, CO

Developed *in situ* remediation solutions for contaminated soil and groundwater phases in industrial waste sites.

National Renewable Energy Laboratory – *Intern*, May–August 2010 Golden, CO

Bench- and pilot-scale thermochemical conversion of biomass to syngas via catalytic gasification for biofuels production.

Publications:

- **N. E. Thornburg**, A. B. Thompson, J. M. Notestein, “Periodic trends in highly dispersed Group IV and V supported metal oxide catalysts for alkene epoxidation with H₂O₂,” *ACS Catalysis* **5** (2015) 5077-5088 (DOI: 10.1021/acscatal.5b01105)
- **N. E. Thornburg**, S. L. Nauert, A. B. Thompson, J. M. Notestein, “Synthesis–structure–function relationships of silica-supported niobium(V) catalysts for alkene epoxidation with H₂O₂,” *ACS Catalysis* **6** (2016) 6124-6134 (DOI: 10.1021/acscatal.6b01796)
- **N. E. Thornburg**, Y. Liu, P. Li, O. K. Farha, J. T. Hupp, J. M. Notestein, “MOFs and their grafted analogues: regioselective epoxide ring-opening with Zr₆ nodes,” *Catalysis Science & Technology* **6** (2016) 6480-6484 (DOI: 10.1039/C6CY01093H)
- **N. E. Thornburg**, C. Raimondo, P. I. de Leon, D. Prieto-Centurion, N. J. Schoenfeldt, A. W. Korinda, L. V. Sorokina, T. R. Eaton, J. M. Notestein, “Research note: suggested experimental methods for liquid-phase epoxidation with H₂O₂,” *Journal of Catalysis*, submitted to research sponsor.
- S. Ahn, **N. E. Thornburg**, Z. Li, T. C. Wang, L. C. Gallington, K. W. Chapman, J. M. Notestein, J. T. Hupp, O. K. Farha, “Stable metal–organic framework-supported niobium catalysts,” *Inorganic Chemistry*, in press (DOI: 10.1021/acs.inorgchem.6b02103)
- P. I. de Leon, C. A. Contreras, **N. E. Thornburg**, A. B. Thompson, J. M. Notestein, “Catalyst structure and substituent effects on epoxidation of styrenics with immobilized Mn(tmtacn) complexes,” *Applied Catalysis A: General* **511** (2016) 78-86 (DOI: 10.1016/j.apcata.2015.12.002)
- S. Cheah, K. R. Gaston, Y. O. Parent, M. W. Jarvis, T. B. Vinzant, K. M. Smith, **N. E. Thornburg**, M. R. Nimlos, K. A. Magrini-Bair, “Nickel cerium olivine catalyst for catalytic gasification of biomass,” *Applied Catalysis B: Environmental* **134-135** (2013) 34-45 (DOI: 10.1016/j.apcatb.2012.12.022)
- **N. E. Thornburg**, J. M. Notestein, “Thioether versus alkene oxidation with H₂O₂ via phosphonate-modified niobium(V)-silica catalysts,” *ChemCatChem*, in preparation.
- **N. E. Thornburg**, J. M. Notestein, “Competitive kinetics of 1,2-epoxyoctane alcoholysis, isomerization, and acetalization *via* fluorinated arylborane catalysts,” in preparation.
- Z. Bo, **N. E. Thornburg**, S. L. Nauert, L. Pen, C. George, K. C. Schwartzenberg, L. D. Marks, P. C. Stair, R. P. Van Duyne, J. M. Notestein, “Highly dispersed, supported TaO_x catalysts via a ‘nanocavity’ route,” in preparation.

Technical Presentations:

- **N. E. Thornburg**, J. M. Notestein, "Understanding Group IV, V metal oxide catalysts for alkene and thioether oxidations with H₂O₂ through well-defined grafting and active-site titration," Department of Energy, Environmental and Chemical Engineering Seminar Series, Washington University in St. Louis, November 11, 2016 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Understanding Group IV, V metal oxide catalysts for alkene and thioether oxidations with H₂O₂ through well-defined grafting and active-site titration," W. L. Gore Fellow Award Seminar, November 4, 2016 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Understanding Group IV, V transition metal oxide catalysts for alkene epoxidation with H₂O₂ through well-defined grafting and active-site titration," Distinguished Graduate Researcher Award Seminar, Chemical & Biological Engineering Department Retreat, September 16, 2016 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Synthesis–structure–function relationships of highly dispersed Group IV, V supported metal oxide catalysts for alkene epoxidation with H₂O₂," Gordon Research Conference – Catalysis, June 14, 2017 (*Poster*)
- **N. E. Thornburg**, J. M. Notestein, "Synthesis–structure–function relations of silica-supported niobium(V) catalysts for alkene epoxidation with H₂O₂," Catalysis Club of Chicago 2016 Spring Symposium, May 17, 2016 (*Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Synthesis–structure–function relations of silica-supported niobium(V) catalysts for alkene epoxidation with H₂O₂," American Chemical Society Spring 2016 Meeting – *Session: Amorphous Catalytic Materials*, March 13, 2016 (*Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Understanding supported catalyst systems for selective epoxide activation," Dow Chemical site visit, February 24, 2016 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Synthesis–structure–function relationships of supported transition metal oxide catalysts for selective oxidation processes," W. L. Gore Fellow Award Finalist Site Visit, December 7, 2015 (*Invited Poster*)
- **N. E. Thornburg**, J. M. Notestein, "Understanding supported metal oxide catalysts through well-defined grafting and active site titration," W. L. Gore Research Fellow Semifinal, October 6, 2015 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Understanding Group IV, V metal oxide catalysts for alkene epoxidation with H₂O₂ through well-defined grafting and active site titration," 3M Green Chemistry Tech Forum, August 13, 2015 (*Invited Talk*)
- **N. E. Thornburg**, V. Ho, G. D. Joly, "Beyond acrylates: next-generation pressure-sensitive adhesives," 3M Intern Poster Session, July 21, 2015 (*Poster*)
- **N. E. Thornburg**, A. B. Thompson, J. M. Notestein, "Synthesis–structure–function relationships of highly dispersed Group IV, V supported metal oxide catalysts for alkene epoxidation with H₂O₂," 2015 North American Catalysis Society Meeting (NAM24), June 15, 2015 (*Poster*)
- **N. E. Thornburg**, R. E. Franks, J. M. Notestein, "Surface modification of silica-supported Ti(IV) and Nb(V) oxides for enhanced reactivity and stability in the epoxidation of alkenes with H₂O₂," American Chemical Society Spring 2015 Meeting – *Session: Surface Chemistry and Catalysis on Oxides*, March 24, 2015 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Understanding supported Lewis acid catalysts for selective ring-opening of epoxides," Dow Chemical site visit, March 16, 2015 (*Invited Talk*)
- **N. E. Thornburg**, J. M. Notestein, "Counting active and selective sites on niobia-silica catalysts for alkene epoxidation with H₂O₂," AIChE 2015 Midwest Regional Conference – *Session: Catalysis for Chemicals Synthesis*, March 13, 2015 (*Talk*)
- **N. E. Thornburg**, A. B. Thompson, J. M. Notestein, "Highly dispersed Group IV, V transition metal oxide catalysts from grafted metallocalixarenes for alkene epoxidation," American Institute of Chemical Engineers 2014 Annual Meeting – *Session: Atomically Dispersed Supported Metal Catalysts*, November 19, 2014 (*Talk*)
- **N. E. Thornburg**, A. B. Thompson, J. M. Notestein, "Alkene epoxidation with H₂O₂ over single-site Group IV, V transition metal oxide catalysts from grafted metallocalixarenes," Small Molecule Activation Conference – *Session: H₂O_x Activation*, July 17, 2014 (*Talk*)
- **N. E. Thornburg**, A. B. Thompson, J. M. Notestein, "Highly dispersed Group IV, V transition metal oxide catalysts for alkene epoxidation with H₂O₂," Catalysis Club of Chicago 2014 Spring Symposium, May 13, 2014 (*Poster*)

Non-Technical Presentations and Publicity:

- S. Witkowski, **N. E. Thornburg**, "Better living through 'green' chemistry," PhDrinking Podcast, October 30, 2016 (*Podcast*)
- M. Quintanilla, "Green chemistry: preventative healthcare for the environment," *Medill Reports Chicago*, Medill News Service, October 11, 2016 (*News article interview*)
- **N. E. Thornburg**, Q. M. Dudley, J. A. Schoborg, "How to be a successful ChBE teaching assistant," Seminar for first-year Ph.D. students in Chemical & Biological Engineering, November 19, 2015 (*Invited Talk*)
- **N. E. Thornburg**, "Effective oral and written scientific communication," STEM outreach event at Niles West High School, September 30, 2015 (*Invited Talk*)

- **N. E. Thornburg**, “Better living through ‘green’ chemistry,” Graduate Student Speaker Series: STEM outreach event at Glenbrook South High School, April 15, 2015 (*Talk*)
- **N. E. Thornburg**, “Better living through ‘green’ chemistry,” Seven Minutes of Science Symposium, *Ready, Set, Go!* Research Communication Program, September 11, 2014 (*Talk*)

Key Technical Competencies

- **Laboratory:** Heterogeneous catalyst synthesis with air-free techniques (Schlenk line, glove box). Kinetic testing and chemical reactor design. Materials characterization (UV-visible spectroscopy, X-ray absorption, ICP-OES, TGA, powder X-ray diffraction, NMR, MALDI-MS). Gas chromatograph (GC-MS, GC-FID) instrument manager. X-ray absorption spectroscopy (XANES/EXAFS) at Argonne National Laboratory’s synchrotron. Swagelok plumbing for transport of compressed liquids and gases. Polymer synthesis, film coating, co-extrusion, curing, ATR-FTIR, and overlap shear strength testing (3M). Trained for safe use of concentrated hydrofluoric acid (HF). Machine shop trained.
- **Safety:** Completed coursework in chemical process safety. Safe handling of volatile solid powders and compressed gas cylinders. Practices bonding and grounding of flammable fluid containers. Wrote Standard Operating Procedures for reactor units and safe use of concentrated HF. Competent in inherently safe design of chemical systems.
- **Simulation:** Kinetic data modeling (MATLAB). Proficiency with process control (OPTO) and simulation (HYSYS).
- **Management:** Certificate for Management for Scientists & Engineers course at Northwestern University Kellogg School of Management (Summer 2016). Received leadership coaching from Northwestern Center for Leadership.
- **Communication:** Full professional proficiency in Spanish. Elementary proficiency in French and German. Completed coursework in technical communication.

Teaching, Leadership & Community Outreach

- Co-teacher of junior-level Kinetics & Reactor Engineering course with Professor John M. Torkelson, Spring 2016
- Assistant Chair of graduate student-led Chemical & Biological Engineering Teaching Committee, 2014–2016
 - Founded quarterly informal teaching forums for ‘Socratic’ discussion of pedagogy among students and faculty
- Manuscript reviewer, *Industrial & Engineering Chemistry Research* (ACS Publications), July 2016–present
- Notestein Research Group liaison and team leader for activities at Argonne National Laboratory’s X-ray synchrotron, 2013–2016
- Notestein Research Group recruiting leader, 2013–2016
- Captain of Washington University Men’s Varsity Swim Team, 2011–2012
 - NCAA Academic All-American, 2009–2012
- Mentorship Opportunities for Research Engagement (MORE), August 2014–August 2016 – *more.northwestern.edu*
 - Program Coordinator of MORE @ Niles West High School STEM mentorship: 46 participating students
 - Northwestern facility instrument liaison & safety designate
- Research mentoring, 2013–2016
 - Eric Taw, Northwestern University, B.S. Chem. Eng. 2018 (now interning at Dow Chemical)
 - Vijay Shah, Niles West High School 2017 (now interning at LanzaTech)
 - Ryan Franks, Illinois Mathematics & Science Academy 2015 (now Northwestern sophomore)
 - Chi Hun Choi, Northwestern University, B.S. Chemistry 2015 (now Ph.D. student at POSTECH)
 - Andrew Boston, Northwestern University, B.S. Chem. Eng. 2014 (now Ph.D. student at CU Boulder)
- Received leadership coaching through Northwestern Center for Leadership, March–June 2015 – *lead.northwestern.edu*
- Graduate Student Speaker Series (GS3) presenter, September 2014–December 2016 – *ciera.northwestern.edu*
- Science Club mentor at Pederson–McCormick Boys & Girls Club of Chicago, August 2014–August 2015
- Lead event organizer for NU Chemical & Biological Engineering Department retreat, debate and social events
- Washington University in St. Louis Alumni Interviewer (APAP program), August 2014–present
- Volunteer judge at Illinois regional science fairs, 2013–2016, and at Minnesota Special Olympics, 2015

Awards, Honors & Memberships

- Distinguished Graduate Researcher Award, Chemical & Biological Engineering Department, 2016
- Northwestern University Terminal Year Fellowship, The Graduate School, 2016-2017
- W. L. Gore Research Fellowship Grand Prize Winner, 2015
- George Thodos Teaching Assistant Award, Chemical & Biological Engineering Department, 2015
- American Chemical Society Travel Award, Division of Catalysis Science and Technology, 2015–2016
- Northwestern University Travel Award, The Graduate School, 2014 and 2016
- Royal E. Cabell Northwestern University Research Fellow, 2012–2013
- NCAA Academic All-American, Men's Swimming, 2009–2012
- Tau Beta Pi Engineering Honor Society, 2010–2012
- Boeing Company Chemical Engineering Scholar, 2010–2012
- Washington University in St. Louis Dean's List, 2009–2012
- Professional memberships in American Institute of Chemical Engineers (2010–present), American Chemical Society (2011–present), North American Catalysis Society (2014–present) and Catalysis Club of Chicago (2013–present)