



**Exponent<sup>®</sup>**  
Engineering & Scientific Consulting

**Trevor Lardinois, Ph.D., P.E., CFEI**

Senior Engineer | Thermal Sciences

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## Professional Profile

Dr. Lardinois focuses on applying the fundamentals of chemical engineering, chemistry, and material science to investigations and analyses of safety incidents involving chemical processes, fires, explosions, and consumer products.

He has expertise involving formulations and characteristics of materials with propensities to self-heat and spontaneously combust, especially fiber materials, doped carbon, and adsorbent beds. Additionally, Dr. Lardinois has investigated hazardous waste treatment incidents concerning metal powders/fines and unknown chemical releases or chemistries. He also supports consumer product testing efforts for product recall investigations, corrective action plan development, incident recreation, and determination of fire risk. Dr. Lardinois has extensive experience with heterogeneous catalyst formulation, characterization, kinetics, and stability/deactivation for various applications, such as pollution control technologies for NO<sub>x</sub> abatement in diesel and stoichiometric engine exhaust and hydrocarbon upgrading.

Dr. Lardinois received his B.S. in Chemical Engineering from the University of Wisconsin – Madison, where he researched the upgrading of biomass derived feed stocks to value-added chemicals. After a summer sojourn to the Technical University of Vienna in Austria, Dr. Lardinois started his Ph.D. studies at Purdue University. His dissertation focused on the influence of zeolite material properties and external gas conditions on the thermodynamics and kinetics of metal structural interconversion for the abatement of NO<sub>x</sub> pollution from automotive engine exhaust. Throughout his Ph.D. studies, Dr. Lardinois worked with many advanced catalyst/material characterization instruments and frequently consulted with automotive companies.

## Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, Purdue University, 2021

B.S., Chemical and Biological Engineering, University of Wisconsin, Madison, 2016

Chemical Engineering Citation Award, Purdue University, 2023

Prof. K.C. Chao and Jiun Chao Graduate Education Endowment Grant, Purdue University, 2020

Outstanding Teaching Assistant Award (Heat and Mass Transfer), Purdue University, 2018

Ross Fellowship, Purdue University, 2016–2017

Melby Scholarship, University of Wisconsin – Madison, 2015

Gensler Scholarship, University of Wisconsin – Madison, 2015

Eugene and Patricia Kreger Herscher Scholarship, University of Wisconsin – Madison, 2014 & 2015

Engineering Great People Scholarship, University of Wisconsin – Madison, 2014

## Licenses and Certifications

Professional Engineer, Illinois, #062075487

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Certified Fire and Explosion Investigator (CFEI)

## Prior Experience

Quality and Assurance Intern, AbbVie, 2015

## Professional Affiliations

American Institute of Chemical Engineers (AIChE)

- Session Chair – Midwest Regional Conference 2022, Catalysis and Reaction Engineering
- Session Chair – Spring AIChE 2022, Fuels and Petrochemical Division, Catalysis Session
- Session Chair – Midwest Regional Conference 2023, Catalysis and Reaction Engineering

National Fire Protection Association (NFPA)

National Association of Fire Investigators (NAFI)

## Publications

Theis JR, Ura J, Getsoian A, Prikhodko VY, Thomas CR, Pihl JA, Lardinois TM, Gounder R, Wei X, Ji Y, Pace RB, Crocker M. Effect of framework Al pairing on NO storage properties of Pd-CHA passive NO<sub>x</sub> adsorbers. Applied Catalysis B: Environmental, March 2023; 322, 12074.

Lardinois TM, Mandal K, Yadav V, Wijerathne A, Bolton BK, Lippie H, Li CW, Paolucci C, Gounder R. Kinetic and Thermodynamic Factors Influencing Palladium Nanoparticle Redispersion into Mononuclear Pd(II) Cations in Zeolite Supports. Journal Physical Chemistry C 2022, 126, 19, 8337–8353.

Kim P, Van Der Mynsbrugge J, Aljama H, Lardinois TM, Gounder R, Head-Gordon M, Bell AT. Investigation of the Modes of NO Adsorption in Pd/H-CHA. Applied Catalysis B: Environmental, May 2022; 304, 120992.

Pace R, Lardinois TM, Ji Ya, Gounder R, Heintz O, Crocker M. Effects of treatment conditions on Pd speciation in CHA and Beta zeolites for passive NO<sub>x</sub> adsorption. ACS Omega, 2021; 6, 29471–29482

Crocker, M, Bell, AT, Van der Mynsbrugge, J, Kim, P, Gounder, R, Lardinois, T, Bates, J, Pace, R, Ji, Y, Lambert, C, Theis, JR, Getsoian, A, Ura, J, Lupescu, J, Prikhodko, V, Wei, X. Development of Passive HC/NO<sub>x</sub> Trap Catalysts for Low Temperature Gasoline Applications, Report Number: DOE-UKY-EE0008213, 2021.

Lardinois TM, Bates JS, Lippie HH, Russell CK, Miller JT, Meyer HM, Unocic KA, Prikhodko VY, Wei X,

Lambert CK, Getsoian A, Gounder R. Structural Interconversion Between Agglomerated Palladium Domains and Mononuclear Pd(II) Cations in Chabazite Zeolites. *Chemistry of Materials*, January 2021; 33(5):1698–1713.

Shih A, Khurana I, Li H, González JM, Kumar A, Paolucci C, Lardinois TM, Jones CB, Albarracin Caballero JD, Kamasamudram K, Yezerets A, Delgass WN, Miller JT, Luz Villa A, Schneider WF, Gounder R, Ribeiro FH. Spectroscopic and kinetic responses of Cu-SSZ-13 to SO<sub>2</sub> exposure and implications for NO<sub>x</sub> selective catalytic reduction. *Applied Catalysis A*, March 2019; 574(25):122–131.

## **Presentations**

Lardinois TM, Hietala DC, Cox BL, Dee SJ, Ogle RA, Walters MS. Learnings in Material Flash Point Characterization from the Lac-Mégantic Rail Disaster. AIChE Midwest Regional Conference (virtual), March 2022.

Lardinois TM, Lippie HH, Yadav V, Li CW, Gounder R. Effects of Pd particle size and water pressure on the structural transformation of Pd nanoparticles to mononuclear Pd(II) cations in CHA zeolites. Chicago Catalysis Club Conference (virtual), May 2021.

Lardinois TM, Bates JS, Lippie HH, Gounder R. Interconversion of agglomerated Pd domains and mononuclear Pd(II) cations in CHA zeolites. North East Corridor Zeolite Association Annual Meeting (virtual), December 2020.

Lardinois TM, Bates JS, Getsoian A, Miller JT, Gounder R. Interconversion of agglomerated Pd domains and mononuclear Pd(II) in CHA zeolites. American Institute of Chemical Engineers Annual Meeting (virtual), November 2020.

Lardinois TM, Bates JS, Getsoian A, Miller JT, Gounder R. Structural Interconversion Between Agglomerated Pd Domains and Isolated Pd<sup>2+</sup> Cations in Chabazite Zeolites. Cross-Cut Lean Exhaust Emissions Reduction Simulations (virtual), September 2020.

Lardinois TM, Bates JS, Getsoian A, Miller JT, Gounder R. Interconversion of agglomerated Pd domains ion-exchanged Pd<sup>2+</sup> in CHA zeolites.” Chicago Catalysis Club Conference (virtual), August 2020.

Lardinois TM, Gounder R. Structural interconversion between agglomerated Pd domains and isolated Pd cations in chabazite zeolites. Purdue Graduate Student Symposium (virtual), August 2020.

Lardinois TM, Bates JS, Unocic KA, Choi JS, Prikhodko VY, Getsoian A, Miller JT, Gounder R. Palladium Speciation in Beta and Chabazite Zeolites for Passive NO<sub>x</sub> Adsorption. North American Catalysis Society Meeting, Chicago, IL, June 2019.

Lardinois TM, Bates JS, Unocic KA, Prikhodko VY, Getsoian A, Theis J, Lambert CK, Miller JT, Gounder R. Palladium Speciation in Zeolites for Passive NO<sub>x</sub> Adsorption. Cross-Cut Lean Exhaust Emissions Reduction Simulations, Ann Arbor, MI, September 2018.

Lardinois TM, Motagamwala AH, Dumesic J. Conversion of Ligno-cellulosic Biomass to Sugars Using Gamma-Valerolactone. Chemical and Biological Undergraduate Research Poster Session, Madison, WI, December 2015.

## **Project Experience**

### **Fire Investigation and Sciences**

- Spontaneous combustion and basket testing (especially fiber and carbon materials)

- Self-heating of packed fiber and adsorbent beds
- Residential and commercial fire investigation
- Corn/grain processing facilities
- Leak testing of residential natural gas and propane systems and appliances
- Hospital fires involving oxygen enriched atmospheres and electrocautery

### **Hazardous Waste Chemistry**

- Chemical treatment of hazardous waste
- Representative sampling of hazardous waste
- Chemical releases of known or unknown incompatibilities
- Metal powder waste treatment
- Sulfur chemistry (H<sub>2</sub>S, SO<sub>2</sub>)

### **Product Safety and Failures**

- Aerosolized spray – slip and fall hazards, flammability testing following SOR/2001-269 Schedule 1 (Canada) and 16 CFR § 1500.45 (United States)
- AV carts - tipping (UL 1678)
- Blenders – motor locking, smoking
- Candles – flashing/flash over, container integrity, ASTM standards for fire safety, manufacturing, adhesion material compatibility
- Chairs – BIMFA testing
- Clothing storage tip-over – testing, ASTM F2057-23
- Electric Kettles – container integrity, burns
- Flame arresters – certification
- Heated massagers – skin burns, process parameters
- Laminators – safety features, smoking
- Shredders – smoking, locking motors
- Space Heaters – failures, melting
- Water heaters – control valves, thermal cutoffs

### **Engineering and Construction**

- EPC, turn-key, contracts

- Power plants with steam turbines and supercritical boilers
- Piping support following MSS SP-58, ASME B31.1, ASME B31.3

### **Emissions and Vehicles**

- Pollution abatement in mobile engine exhausts (especially SCR and NOx traps)
- 40 CFR Part 86
- Defeat devices

### **Catalysis and Chemical Conversion**

- Synthesis, characterization, and kinetics (especially zeolites)
- Deactivation and regeneration
- Technical requirements and compliance