Exponent®
Engineering & Scientific Consulting

Isaac Mastalski, Ph.D., CFEI

Senior Associate | Thermal Sciences
Warrenville
+1-630-658-7533 | imastalski@exponent.com

Professional Profile

Dr. Mastalski applies chemical engineering fundamentals to provide technical consulting to clients and to investigate performance and failures in a variety of industries and applications. His core areas of expertise include fire and explosion investigation, alternative energy and sustainability, pyrolysis, chemical process safety, and performance-related contractual disputes. His main goal is to help clients successfully understand and address risks associated with accidents, failures, disputes, losses, and injuries, and he works with clients in diverse spaces, including energy producers, chemical processing facilities, the insurance industry, and the legal system.

Prior to joining Exponent, as a doctoral student in chemical engineering at the University of Minnesota, Dr. Mastalski performed research on pyrolytic methods for recycling plastics and developed a new type of reactor system capable of operating in the absence of heat and mass transfer limitations. He also studied catalyst design and the influence of operating parameters on a new reaction method to produce acrylic acid sustainably from renewably-sourced lactic acid. Dr. Mastalski earned a B.S. degree in chemical engineering from the University of Pittsburgh and completed research projects there on a variety of other topics, including natural gas-enabled large scale solar deployment, electrochemical processes to deposit defect-free thin films, and chemical looping procedures to produce carbon-negative syngas.

Dr. Mastalski is active in several professional societies, including AIChE, NAFI, NFPA, ACS, AAAS, and Tau Beta Pi Engineering Honor Society. He has also completed a number of additional projects related to sustainability, renewable energy implementation, science outreach, and community engagement and resiliency with a particular focus on climate change.

A selection of Dr. Mastalski's technical consulting project experiences can be found below.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, University of Minnesota, Twin Cities, 2023

B.S., Chemical Engineering, University of Pittsburgh, 2018

UMN Institute on the Environment Boreas Leader

UMN Center for Urban and Regional Affairs Resilient Communities Project Fellow

Tau Beta Pi Fellowship

Licenses and Certifications

Certified Fire and Explosion Investigator (CFEI)

Prior Experience

Graduate Student Researcher, Department of Chemical Engineering and Materials Science, University of Minnesota, 2018-2023

Summer Research Intern, Detector Systems Branch, NASA Goddard Space Flight Center, 2017

Professional Affiliations

National Association of Fire Investigators (NAFI)

National Fire Protection Agency (NFPA)

American Institute of Chemical Engineers (AIChE) – Chicago Local Section

American Institute of Chemical Engineers (AIChE)

American Association for the Advancement of Science (AAAS)

American Chemical Society (ACS)

Order of the Engineer

Tau Beta Pi Engineering Honors Society

Leadership

Session Co-Chair, Feedstocks from Recycled Materials. AIChE 2025 Spring Meeting and 21st Global Congress on Process Safety, Dallas, TX, April 9, 2025

Publications

Papers

Mastalski I, Morrison DR. When one door opens – case study of a fluidized bed dryer smoke explosion, 2025 Mary Kay O'Connor Safety & Risk Conference Proceedings.

Morrison DR, Cox BL, Mastalski I. Explosion of a cooling tower dosing system. Process Safety Progress 2025; 1□7.

Reding N, Mastalski I, Morrison DR. Oleum release – when the hose breaks. AIChE 2025 Spring Meeting & 21st Global Congress on Process Safety, Dallas, TX, April 8, 2025.

Brauer S, Mastalski I, Murphy M, Hoekstra B, Monson L, Dauenhauer P, Nicholas C. Dual-regime reaction kinetics of the autocatalytic hydrolyses of aqueous alkyl lactates. Industrial & Engineering Chemistry Research 2024; 63(50):21750-21759.

Ogle R, Dee S, Mastalski I. Process safety in bioenergy with carbon capture and storage systems (BECCS). Process Safety Progress. 2024; 1-8.

Morrison DR, Cox BL, Mastalski I. Explosion of a cooling tower dosing system. 10th CCPS Latin

American Conference on Process Safety, Barranquilla, Colombia, September 18, 2024.

Ogle R, Dee S, Mastalski I. Process Safety in bioenergy with carbon capture and storage systems (BECCS). AIChE 2024 Spring Meeting & 20th Global Congress on Process Safety, New Orleans, LA, March 26, 2024.

Sidhu N, Mastalski I, Zolghadr A, Patel B, Uppili S, Go T, Maduskar S, Wang Z, Neurock M, Dauenhauer P. On the intrinsic reaction kinetics of polypropylene pyrolysis. Matter 2023; 6(10):3413-3433.

Mastalski I. On the intrinsic kinetics of polyethylene pyrolysis. PhD Thesis 2023.

Mastalski I, Sidhu N, Zolghadr A, Maduskar S, Patel B, Uppili S, Go T, Wang Z, Neurock M, Dauenhauer PJ. Intrinsic millisecond kinetics of polyethylene pyrolysis via pulse-heated analysis of solid reactions. Chemistry of Materials 2023; 35(9):3628–3639.

Mastalski I, Sidhu N, Dauenhauer P. Data for 'On the Intrinsic Reaction Kinetics of Polypropylene Pyrolysis. Data Repository for the University of Minnesota 2023.

Mastalski I, Zolghadr A, Sidhu N, Facas G, Maduskar S, Uppili S, Go T, Neurock M, Dauenhauer PJ. On the method of pulse-heated analysis of solid reactions (PHASR) for polyolefin pyrolysis. ChemSusChem 2020; 14(19):4214-4227.

Mastalski I, Sidhu N, Zolghadr A, Dauenhauer P. High speed photography for manuscript 'on the method of pulse-heated analysis of solid reactions (PHASR) for polyolefin pyrolysis. Data Repository for the University of Minnesota 2020.

Mastalski I, More A, Veser G. Chemical looping for syngas production. Ingenium: Undergraduate Research at the Swanson School of Engineering 2017; 3:56-60.

Presentations

Mastalski I. When one door opens – case study of a fluidized bed dryer smoke explosion. Oral presentation, 2025 Mary Kay O'Connor Process Safety Conference, Houston, TX, 2025.

Mastalski I. Pyrolysis to promote plastic circularity. Oral presentation, UMN 2023 Sustainability Symposium, Minneapolis, MN, 2023.

Mastalski I. Intrinsic kinetics of polyethylene pyrolysis via pulse-heated analysis of solid reactions (PHASR): Enabling a plastic circular economy. Oral presentation, ACS Spring 2023, Indianapolis, IN, 2023.

Mastalski I. Pathway to a plastic circular economy: intrinsic kinetic insights of polyethylene pyrolysis via pulse-heated analysis of solid reactions (PHASR). Oral presentation, AIChE Fall 2022, Phoenix, AZ, 2022.

Mastalski I, Sidhu N, Dauenhauer P. Pulse-heated analysis of solid reactions (PHASR) to promote a plastic circular economy: intrinsic kinetics of polyethylene pyrolysis. Poster presentation, AIChE Fall 2022, Phoenix, AZ, 2022.

Mastalski I. Promoting a plastic circular economy via pulse-heated analysis of solid reactions (PHASR): Intrinsic kinetic insights from polyethylene pyrolysis. Oral presentation, ACS Fall 2022, Chicago, IL, 2022.

Mastalski I, Sidhu N, Dauenhauer P. Promoting a plastic circular economy via polyethylene pyrolysis and catalysts: Intrinsic kinetic insights from pulse heated analysis of solid reactions (PHASR). Poster presentation, ACS Summer School on Green Chemistry and Sustainable Energy Poster Session, Golden, CO, 2022

Mastalski I. Pulse-heated analysis of solid reactions (PHASR) to study intrinsic kinetics of polyethylene pyrolysis. Oral presentation, PYRO 2022 – International Conference on Applied and Analytical Pyrolysis, Ghent, Belgium, 2022.

Mastalski I. Promoting a plastic circular economy through pyrolysis. Oral presentation, UMN Sustainability and Energy Expo 2022, Online, 2022.

Mastalski I, Sidhu N, Dauenhauer P. Promoting a plastic circular economy via polyethylene pyrolysis and catalysts: Intrinsic kinetic insights from pulse heated analysis of solid reactions (PHASR). Oral presentation, ACS Spring 2022, San Diego, CA, 2022.

Mastalski I, Sidhu N, Dauenhauer P. Promoting a plastic circular economy via polyethylene pyrolysis and catalysts: Intrinsic kinetic insights from pulse heated analysis of solid reactions (PHASR). Poster presentation, ACS Spring 2022, San Diego, CA, 2022.

Mastalski I, Zolghadr A, Sidhu N, Neurock M, Dauenhauer PJ. Polyethylene pyrolysis by pulse-heated analysis of solid reactions (PHASR): Pathway to a circular plastic economy. Oral presentation, ACS Spring 2021, Online, 2021.

Mastalski I, Zolghadr A, Sidhu N, Dauenhauer P. Pulse-heated analysis of solid reactions (PHASR) for polyethylene pyrolysis: intrinsic kinetics and reaction visualization. Poster presentation, 2021 RSC Poster Twitter Conference, Online, 2021.

Mastalski I, Dastalfo T, Ferreira C, Kelly K, Veser G. natural gas enabled solar electricity production. Poster presentation, Pitt Omega Chi Epsilon Chemical Engineering Research Day Poster Session, Pittsburgh, PA, 2018.

Mastalski I. Developing X-Ray detectors for ATHENA X-IFU through morphologically-controlled electroplating. Poster presentation, NASA GSFC Intern Poster Session, Greenbelt, MD, 2017.

Mastalski I. Chemical looping for syngas production. Poster presentation, Pitt Omega Chi Epsilon Chemical Engineering Research Day Poster Session, Pittsburgh, PA, 2017.

Mastalski I. Chemical looping for syngas production. Oral presentation, Pitt Mascaro Center for Sustainable Innovation Summer Research Conference, Pittsburgh, PA, 2016.

Project Experience

The following is a sampling of Dr. Mastalski's project experience that demonstrates the breadth of his expertise in chemical engineering.

Fire and Explosion Investigation

Dr. Mastalski is a Certified Fire and Explosion Investigator (CFEI) and conducts origin and cause investigations as outlined in the National Fire Protection Association (NFPA) Guide for Fire and Explosion Investigations (NFPA 921). He has investigated fires and explosions in diverse settings, including industrial, commercial, and residential facilities. He has experience with fires and explosions related to gas leaks (e.g., natural gas, propane, hexanes) and combustible materials (e.g., corn germ, soy flakes, milk powder), as well as thermal failures of various products and systems (e.g., aerosol sprays, lithium ion battery-containing products, consumer electronics). Example project work includes:

- *Corn germ dryer fire.* Investigated a fire in a fluidized bed dryer for corn germ. Scope included lab testing to replicate incident conditions and calculations to relate lab testing to incident conditions.

- *Soy cooker smoldering events*. Investigated a series of smoldering events in a heated soybean screw conveyor. Scope included determination of origin and cause, as well as recommendations of best operating practices for the facility.
- *Propane tank flash fire*. Investigated a flash fire related to a 1 pound propane tank. Scope included engineering analysis of the incident, calculations and modeling of the incident conditions, and evaluation of various hypotheses for the cause of the incident.
- *Various residential, commercial, and industrial building fires*. Investigated fires at various locations, including residences, retail and commercial buildings, and warehousing facilities. Scopes typically included determination of origin and cause, as well as evaluation of inventory and materials in the area of origin.

Energy and Sustainability Consulting

Dr. Mastalski leverages his research background in plastics and plastic recycling, biopolymers, and renewable fuels to help clients with projects related to energy, green technologies, and sustainable processes. Examples of his projects in this space include:

- *Nanoparticle synthesis safety evaluation*. Performed a safety analysis of novel nanoparticles in accordance with NFPA standards for combustible materials. Scope included dust release calculations for a variety of scenarios, associated hazard analyses, and recommendations of protective controls to be implemented.
- *Biomass power plant arbitration*. Analyzed performance of a biomass-fueled power plant. Scope included extensive review of facility documentation and assessment of the validity of operational performance and feedstock specification claims.
- *VOC emissions control upgrade*. Analyzed a proposed upgrade to a thermal oxidizer system for control of volatile organic compounds. Scope included documentation review, calculations of flammability limits for complicated gas mixtures, and comparison with NFPA design standards.
- R*efinery wastewater treatment evaluation*. Evaluated compliance status of on-site wastewater treatment facilities at refineries nationwide. Scope included review of documentation and extensive site inspections, in collaboration with members of Exponent's Environmental & Earth Sciences Practice.

Contractual Disputes and Arbitration Projects

Dr. Mastalski applies chemical engineering principles to help clients navigate contractual disputes and arbitrations related to engineering interpretations of contractor scopes of work, generally accepted good engineering practices, facility performance, and post-failure recovery. Examples of this work include:

- *Power plant performance dispute*. Investigated allegations of poor power plant performance. Scope included review of facility documentation and operating practices, as well as performance comparisons to similarly-designed facilities.
- *Oil refinery EPC contract dispute*. Investigated allegations of deficiencies in EPC contracting and subcontracting work related to a mobile oil refinery design. Scope included review of engineering documentation, performance evaluation, and technical analysis of contracts with regard to engineering scope and expectations.

Additional Project Work

Dr. Mastalski has also worked on a variety of other projects, including:

- *Wastewater treatment overflow event*. Investigated severe flooding and resulting damage at a wastewater treatment facility. Scope included scene inspection, analysis of construction drawings and PLC programming, and determination of causal factors leading to the incident.
- *CPSC customer comment analyses*. Analyzed customer comments related to consumer products such as pressure cookers and electric tea kettles. Scopes typically included data extraction from customer comments and analysis of underlying trends, which helped inform subsequent lab testing to recreate reported incidents.
- *Water main break*. Investigated a large water loss event caused by a 36” water main break. Scope included review of process data, excavation of exemplar sections of the water main, and determination of causal factors leading to the incident.

Peer Reviews

Thermal Science and Engineering Progress