

E. Zeynep Ayla, Ph.D., CFEI

Senior Staff Consultant

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Dr. Zeynep Ayla is a chemical engineer with expertise in the areas of catalysis, reaction engineering, and fire and explosion investigation. With an experimental background, she has strong skills in catalytic synthesis and characterization, kinetic analysis, batch and flow reactor design, gas chromatography, and UV-Vis, FTIR, and Raman spectroscopy. At ESi, she specializes in fire, explosion, and chemical release investigations, in addition to catalyst performance in industrial systems, dust hazard analysis, industrial chemical process arbitration and patent cases, and consumer product litigation including fuel dispensing systems.

Prior to joining ESi, Dr. Ayla was a graduate student researcher at the University of Illinois, Urbana-Champaign. Her doctoral dissertation centered around understanding structural, kinetic, and mechanistic differences in metal oxide catalysts with varying reaction rates. She developed skills in catalyst design and characterization, reaction engineering, reactor design, and heat and mass transfer. More specifically, she has designed and built a reactor system for gas-phase epoxidation with hydrogen peroxide, developed kinetic models to understand substrate activation to form active forms of oxygen for oxidation reactions, and optimized time-resolved in-situ spectroscopy to observe active intermediates formed on reactive surfaces.

Areas of Specialization

Analytical Chemistry
Chemical and Manufacturing Processes
Consumer Product Analysis
Dust and Process Hazard Analysis
Fire and Explosion
Industrial and Process Safety

Education

Ph.D., Chemical Engineering, University of Illinois at Urbana-Champaign, 2022
M.S., Chemical Engineering, University of Illinois at Urbana-Champaign, 2019
B.S., Chemical Engineering, minor in Sustainability, Arizona State University, 2017

Licenses/Certifications

Certified Fire and Explosion Investigator (CFEI)License No. 27866-16694

Professional Affiliations/Honors

American Institute of Chemical Engineers (AIChE)

July 2024

National Association of Fire Investigators (NAFI)

Society of Women Engineers (SWE)

Positions Held

Engineering Systems Inc., Seattle, Washington

Senior Staff Consultant, 2024 – Present

Exponent, Inc., Thermal Sciences, Natick, Massachusetts

Associate, 2022 – 2024

Dow Chemical Company, Reaction Engineering R&D, Lake Jackson, Texas

Graduate Student Intern, 2021

Continuing Education

Hazardous Waste Operations and Emergency Response (OSHA HAZWOPER) 40-Hr Certification

Publications

Kwon, O.; **Ayla, E.Z.**; Potts, D.S.; Flaherty, D.W.; “Influence of Ti-incorporated Zeolite Topology and Pore Condensation on Vapor Phase Propylene Epoxidation Kinetics with Gaseous H₂O₂” *Angewandte Chemie International Edition* **2024**.

Kwon, O.; **Ayla, E.Z.**; Potts, D.S.; Flaherty, D.W.; “Effects of Solvent-Pore Interaction on Rates and Barriers for Vapor Phase Alkene Epoxidation with Gaseous H₂O₂ in Ti-BEA Catalysts” *ACS Catalysis* **2023**, 13, 6430-6444.

Ayla, E.Z.; Patel, D.; Harris, A.; Flaherty, D.W.; “Identity of the Metal Oxide Support Controls Outer Sphere Interactions that Change Rates and Barriers for Alkene Epoxidations at Isolated Ti Atoms” *Journal of Catalysis* **2022**, 411, 167-176.

Bregante, D.T.; Chan, M.C.; Tan, J.Z.; **Ayla, E.Z.**; Nicholas, C.P.; Shukla, D.; Flaherty, D.W.; “The shape of water in zeolites and its impact on epoxidation catalysis” *Nature Catalysis*, **2021**, 4, 9, 797-808.

Yun, D.; **Ayla, E.Z.**; Bregante, D.T.; Flaherty, D.W.; “Reactive Species and Reaction Pathways for the Oxidative Cleavage of 4-Octene and Oleic Acid with H₂O₂ over Tungsten Oxide Catalysts” *ACS Catalysis* **2021** 11, 3137-3152.

Ayla, E.Z.; Potts, D.S.; Bregante, D.T.; Flaherty, D.W.; “Alkene Epoxidations with H₂O₂ over Groups 4-6 Metal-Substituted BEA Zeolites: Reactive Intermediates, Reaction Pathways, and Linear Free-Energy Relationships” *ACS Catalysis* **2020**, 11, 139-154.

- Bregante, D.T.; Potts, D.S.; Kwon, O.; **Ayla, E.Z.**; Tan, J.Z.; Flaherty, D.W.; “Effects of Hydrofluoric Acid Concentration on the Density of Silanol Groups and Water Adsorption in Hydrothermally Synthesized Transition Metal Substituted Silicalite-1” *Chemistry of Materials*, **2020**, 32, 17, 7425-7437.
- Bregante, D.T.; Tan, J.Z.; Schultz, R.L.; Potts, D.S.; **Ayla, E.Z.**; Torres, C.; Flaherty, D.W.; “Catalytic Consequences of Oxidant, Alkene, and Pore Structure on Alkene Epoxidations within Titanium Silicates” *ACS Catalysis*, **2020**, 10, 17, 10169-10184.
- Flores, A.; Choi, Hyun; Martinez, Rodrigo; Onyeabor, Moses; **Ayla, E.Z.**; Godar, Amanda; Machas, Michael; Nielsen, D.R.; Wang, X.; *Frontiers in Bioengineering and Biotechnology*, **2020**, 8, 329.
- Bregante, D.T.; Johnson, A.M.; Patel, A. Y.; **Ayla, E.Z.**; Cordon, M.J.; Bukowski, B.C.; Greely, J.; Gounder, R.; Flaherty, D.W.; “Cooperative Effects between Hydrophilic Pores and Solvents: Catalytic Consequences of Hydrogen-Bonding on Alkene Epoxidation in Zeolites” *Journal of the American Chemical Society*, **2019**, 141, 7302 – 7319.
- Flores, A.D.; **Ayla, E.Z.**; Wang, X.; Nielsen, D.R.; “Engineering a Synthetic, Catabolically Orthogonal Coculture System for Enhanced Conversion of Lignocellulose-Derived Sugars to Ethanol” *ACS Synthetic Biology*, **2019**, 8, 5, 1089 – 1099.

Presentations

- Ayla, E.Z.**; Patel, D.; Harris, A.; Flaherty, D.W.; “Identity of the Metal Oxide Support Controls Outer Sphere Interactions that Change Rates and Barriers for Alkene Epoxidations at Isolated Ti Atoms” 27th North American Catalysis Society Meeting **2022**; New York, NY - *Oral Presentation*
- Ayla, E.Z.**; Patel, D.; Harris, A.; Flaherty, D.W.; “Identity of the Metal Oxide Support Controls Outer Sphere Interactions that Change Rates and Barriers for Alkene Epoxidations at Isolated Ti Atoms” AIChE **2021**; Boston, MA – *Poster, Women in Chemical Engineering Travel Award*
- Ayla, E.Z.**; Potts, D.S.; Bregante, D.T.; Flaherty, D.W.; “Linear Free Energy Relationships for Alkene Oxidations with H₂O₂ over Groups 4 – 6 M-BEA” Catalysis Club of Chicago Symposium **2020**; Virtual – *Poster Presentation, Poster Prize Winner*
- Ayla, E.Z.**; Bregante, D.T.; Flaherty, D.W.; “Role of Electronic Properties of Active Metal in Alkene Oxidations with H₂O₂ over Groups 4 – 6 Substituted BEA Catalysts” International Congress of Catalysis **2020**; San Diego, CA – *Poster Presentation* (Canceled due to COVID-19)

- Ayla, E.Z.;** Bregante, D.T.; Flaherty, D.W.; “Reaction Pathways and Reactive Surface Intermediates Responsible for Alkene Oxidations with H_2O_2 over Groups 4-6 Metal-Substituted Zeolites” 26th North American Catalysis Society Meeting **2019**; Chicago, IL – *Oral Presentation*
- Ayla, E.Z.;** Bregante, D.T.; Flaherty, D.W.; “Reaction Pathways Responsible for Alkene Oxidations with H_2O_2 over Groups 4-6 M-BEA Catalysts” Catalysis Club of Chicago Symposium **2019**; Naperville, IL – *Poster Presentation*
- Ayla, Z.;** Bregante, D.T.; Flaherty, D.W.; “Green Epoxidations on Atomically Dispersed Groups 4-6 Metal Catalysts with H_2O_2 ” Catalysis Club of Chicago Symposium **2018**; Naperville, IL – *Poster Presentation*
- Ayla, Z.;** Flores, A.; Nielsen, D.; Wang, X.; “Engineering A Synthetic Co-Culture System for Enhanced Co-Utilization of Lignocellulose-Derived Sugar Mixtures” Honors Thesis Defense **2017**; Tempe, AZ – *Oral Presentation*