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Engineering & Scientific Consulting

Eri Amezcua, Ph.D.

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Professional Profile

Dr. Amezcua applies his expertise in mechanical engineering and petroleum engineering across a variety of topics, including fundamental combustion, propulsion, alternative and renewable fuels, reactive mixing for nuclear fusion and hypersonic jets, internal combustion engines, battery thermal runaway, oil and gas, CO2 sequestration, optical diagnostics, and laser diagnostics to provide consulting service and tackle a wide range of challenges in these fields. He investigates and analyzes safety incidents and technical issues related to reactive and mechanical processes, including fires and explosions, industrial equipment, oil and gas, battery runaways, toxic releases, propulsion systems, internal combustion engines, renewable fuels, and consumer products. Dr. Amezcua is also fluent in Spanish.

Dr. Amezcua earned two Bachelor of Science degrees, one in Mechanical Engineering and the other in Petroleum Engineering, from Texas Tech University. He then obtained his Master of Science degree in Mechanical Engineering from the University of Wisconsin-Madison, followed by a Ph.D. in Mechanical Engineering, also from the University of Wisconsin-Madison. Before joining Exponent, Dr. Amezcua was a postdoctoral researcher at the U.S. Army Research Laboratory, where he received the Distinguished Power and Propulsion Postdoctoral Fellowship. He also taught engineering courses at the University of Wisconsin–Madison.

During his doctoral and postdoctoral studies, Dr. Amezcua focused on optical and laser diagnostics to conduct fundamental research on reactive processes. These processes include the combustion of both renewable and petroleum-derived jet fuels, reactive mixing for nuclear fusion and hypersonic jets, reactive turbulent flows, and thermal runaway in batteries. His research enhances his expertise in a variety of areas, including explosions, fires, heat transfer, thermodynamics, turbulence, fluids, chemical processes, chemical kinetics, and transport phenomena. Additionally, during his doctoral studies, Dr. Amezcua obtained a patent for a new combustion strategy and founded a carbon capture start-up, which was awarded $250,000 in the Elon Musk XPrize carbon capture competition.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Wisconsin, Madison, 2023

M.S., Mechanical Engineering, University of Wisconsin, Madison, 2018

B.S., Mechanical Engineering, Texas Tech University, 2017

B.S., Petroleum Engineering, Texas Tech University, 2017

ARL Distinguished Power and Propulsion Post-Doctoral Fellow

ARL Journeyman Fellow Scholarship – University of Wisconsin – Madison

Ankie Foell Energy Analysis and Policy Scholarship – University of Wisconsin – Madison

Byron H. Greaves Memorial Scholarship – Texas Tech University

President's High Honor List – Texas Tech University

Dean's High Honor List – Texas Tech University

Academic Appointments

Lecturer, Mechanical Engineering, University of Wisconsin – Madison, 2025

Prior Experience

Distinguished Power and Propulsion Fellow, Center for UAV Propulsion, U.S. Army Research Laboratory, 2023-2025

Mechanical Engineering Lecturer, University of Wisconsin – Madison, 2024-2025

Post-doctoral Research Associate, Engine Research Center, University of Wisconsin, 2023-2025

Data Analyst, Wisconsin Department of Health Services, 2020-2025

Scientist, Earth Repair, 2021-2023

Research Journeyman Fellow, U.S. Army Research Laboratory, 2018-2023

Research Assistant, Engine Research Center, University of Wisconsin – Madison, 2017-2018

Professional Affiliations

The Combustion Institute, 2025

The American Society of Mechanical Engineers, 2025

Society of Automotive Engineers, 2025

Energy Analysis and Policy Program at the University of Wisconsin - Madison

Patents

US Patent 12,209,532 B2: Compression Ignition Engine with Igniter and Pilot Injector, January 2025

Publications

Amezcua E, Kim K, Kweon C-BM, Rothamer D. Investigation of the combustion process and modes of energy-assisted compression-ignition for low cetane number sustainable aviation fuels. Fuel 2025; 393:134605.

Amezcua E, Stafford J, Kim K, Kweon C-BM, Rothamer D. Impacts of injection pressure on split-injection energy-assisted compression-ignition combustion of low cetane number SAFs with a Gaussian-shaped ribbed piston bowl design. SAE Technical Paper 2025-01-8350, 2025.

Amezcua E, Kim K, Kweon C-BM, Rothamer D. Optical engine investigation of two-injection strategies for energy-assisted compression-ignition combustion of low cetane number sustainable aviation fuels. International Journal of Engine Research. 2024; 26(4):453–471.

Stafford J, Amezcua E, Miganakallu Narasimhamurthy N, Kim K, Kweon C-BM, Rothamer DA. Impact of a split-injection strategy on energy-assisted compression-ignition combustion with low cetane number sustainable aviation fuels. SAE Technical Paper 2024-01-2698, 2024.

Sapra H, Hessel RP, Miganakallu N, Amezcua E, Stafford J, Rothamer D, Kim K, Kweon C-BM, Kokjohn S. Computational fluid dynamics and machine learning-based piston-bowl optimization for energy-assisted compression ignition of low cetane number sustainable aviation fuel blends. Energy Conversion and Management 2024; 300:117929.

Witkowski D, Amezcua E, Rothamer DA. On the intrusiveness of phosphor thermometry for metal surface temperature measurements in reciprocating engines: an experimental and heat conduction modeling study. Measurements Science and Technology 2024; 35(11):115206.

Sapra H, Hessel RP, Miganakallu N, Amezcua E, Stafford J, Rothamer D, Kim K, Kweon C-BM, Kokjohn S. Hot surface pilot ignition: a pathway to fuel agnostic combustion strategy. Proceedings of the ASME 2023, Internal Combustion Engine Division Fall Technical Conference, 2023.

Witkowski D, Amezcua E, Rothamer DA. Quantitative assessment of phosphor thermometry intrusiveness for metal surface temperature measurements in reciprocating engines. 2023 13th U.S. National Combustion Meeting of The Central States Section of the Combustion Institute, 2023.

Amezcua E, Kim K, Kweon C-BM, Rothamer D. Investigation of the combustion process and modes of energy-assisted compression-ignition for low cetane number sustainable aviation fuels. 2023 13th U.S. National Combustion Meeting of The Central States Section of the Combustion Institute, 2023.

Reisetter M, Herzog J, Amezcua E, Kim K, Kweon C-BM, Rothamer D. Non-intrusive accelerometer-based sensing of start-of-combustion in compression-ignition engines. SAE Technical Paper 2023-01-0292, 2023.

Stafford J, Amezcua E, Miganakallu Narasimhamurthy N, Kim K, Kweon C-BM, Rothamer DA. Combined impacts of engine speed and fuel reactivity on energy-assisted compression-ignition operation with sustainable aviation fuels, SAE Technical Paper 2023-01-0263, 2023.

Sapra H, Hessel RP, Miganakallu N, Amezcua E, Stafford J, Rothamer D, Kim K, Kweon C-BM, Kokjohn S., Numerical Modeling and Analysis of Energy-Assisted Compression Ignition of Varying Cetane Number Jet Fuels for High-Altitude Operation. ASME. J. Eng. Gas Turbines Power. September 2023; 145(9): 091004.

Miganakallu N, Amezcua E, Stafford J, Kim K, Kweon C-BM, Rothamer D. Impact of ignition assistant on combustion of cetane 30 and 35 jet-fuel blends in a compression-ignition engine at moderate load and speed. ASME. J. Eng. Gas Turbines Power July 2023; 145(7):071013.

Sapra H, Hessel RP, Miganakallu N, Amezcua E, Rothamer D, Kim K, Kweon C-BM, Kokjohn S. Evaluating energy-assisted compression ignition for high-altitude operation using computational fluid dynamics. 2022 Spring Technical Meeting of The Central States Section of the Combustion Institute, 2022.

Amezcua E, Kim K, Kweon C-BM, Rothamer D. Ignition sensitivity analysis for energy-assisted compression-ignition operation on jet fuels with varying cetane number. SAE International Journal of Advances and Current Practices in Mobility 4 2022; 1651–1666.

Amezcua E, Maldonado B, Rothamer D, Stefanopoulo A, Kim K, Kweon C-BM. Accelerometer-based estimation of combustion features for engine feedback control of compression-ignition direct-injection engines. SAE Technical Paper 2020-01-1147, 2020.

Amezcua E, Rothamer D, Kim K, Kweon C-BM. Optical engine study of variable energy assisted compression ignition using a glow plug for unmanned aircraft propulsion systems. American Institute of Aeronautics and Astronautics, AIAA 2020-2281.

Presentations

Amezcua E, et al. Impacts of injection pressure on split-injection energy-assisted compression-ignition combustion of low cetane number SAFs with a Gaussian-shaped ribbed piston bowl design. SAE World Congress, 2025.

Amezcua E, et al. Influence of piston bowl design on energy-assisted compression-ignition with low cetane number sustainable aviation fuels. Multi-Agency Coordinating Committee for Combustion Research, 2024.

Amezcua E, et al. Impacts of injection pressure and timing on energy-assisted compression-ignition combustion with Gaussian-shaped ribbed piston bowl design. NDIA Michigan Ground Vehicle Systems Engineering and Technology Symposium, 2024.

Amezcua E, et al. Influence of piston bowl design on energy-assisted compression-ignition with low cetane number sustainable aviation fuels. SAE World Congress, 2024.

Amezcua E, et al. Investigation of the combustion process and modes of energy-assisted compression-ignition for low cetane number sustainable aviation fuels. 13th U.S. National Combustion Meeting of The Central States Section of the Combustion Institute, 2023.

Amezcua E, et al. Optical engine investigation of two-injection strategies for energy-assisted compression-ignition combustion of low cetane number sustainable aviation fuels. The ICEF ASME Forward Conference, 2023.

Amezcua E, et al. Investigation of the combustion process and modes of energy-assisted compression-ignition for low cetane number sustainable aviation fuels. Multi-Agency Coordinating Committee for Combustion Research, 2023.

Amezcua E, et al. Ignition Sensitivity analysis for energy-assisted compression-ignition operation on jet fuels with varying cetane number. SAE World Congress, 2022.

Amezcua E, et al. Accelerometer-based estimation of combustion features for engine feedback control of compression-ignition direct-injection engines. SAE World Congress, 2020.

Amezcua E, et al. Optical engine study of variable energy assisted compression ignition using a glow plug for unmanned aircraft propulsion systems. AIAA SciTech Forum, 2020.

Editorships & Editorial Review Boards

SAE (Society of Automotive Engineers), Session Chair, 2025

Peer Reviews

SAE (Society of Automotive Engineers) International

SAE (Society of Automotive Engineers) World Congress

IJER (International Journal of Engine Research)

ICEF ASME (Internal Combustion Engines Forward Conference - The American Society of Mechanical Engineers)