

Exponent®
Engineering & Scientific Consulting

Kendyl Waddell, Ph.D.

Associate | Thermal Sciences
Natick
+1-508-903-4683 | kwaddell@exponent.com

Professional Profile

Kendyl Waddell, Ph.D., is trained in mechanical engineering in Exponent's Thermal Sciences practice with expertise in combustion, chemical kinetics, heat and mass transfer, material flammability, and fire suppression. He applies experimental and computational methods to analyze complex reacting-flow and thermal systems, including ignition, flame spread, radiative heat loss, soot formation, and extinction

Prior to joining Exponent, Dr. Waddell was a NASA Postdoctoral Program Fellow at NASA Glenn Research Center. During this work he used numerical modeling techniques to explain unusual chemical kinetic and thermal radiation behavior from ISS microgravity droplet combustion experiments across multiple combustion temperature regimes. He also conducted microgravity drop tower experiments to investigate the combustion performance of ammonia-methanol mixtures. Dr. Waddell studied fire safety in deep space exploration-relevant environments, including the performance of various inert gas fire suppressants and flame spread over high pyrolysis temperature materials. This work included experimental design and execution, data analysis, and computational modeling, and supported the development of future terrestrial and deep space experimental programs.

During doctoral studies at the University of Maryland, Dr. Waddell investigated ISS microgravity spherical diffusion flames across different temperature regimes and developed a new method for establishing cool diffusion flames in normal-gravity environments. This research included planning and executing resource-constrained experimental programs, analyzing temperature data using thin-filament pyrometry and thermocouples as well as radiometer and photomultiplier-tube data, and performing numerical simulations to investigate flame chemistry and extinction.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Maryland, College Park, 2023

B.S., Chemical Engineering, Howard University, 2019

NASA Postdoctoral Program Fellowship (2023-2026)

UMD Dean's Fellowship (2022)

UMD Clark Doctoral Fellowship (2019-2023)

UMD Flagship Fellowship (2019-2023)

GEM Fellowship (2019-2023)

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Prior Experience

Postdoctoral Researcher, NASA Glenn Research Center, Cleveland, OH (2023-2026)

Graduate Research Assistant, University of Maryland, College Park, MD (2019-2023)

Professional Affiliations

The Combustion Institute – Member

American Society of Gravitational and Space Research - Member

Publications

Waddell KA, Dietrich DL, Nayagam V. Pressure-driven transitions between hot, warm, and cool microgravity spherical diffusion flames. (submitted).

Waddell KA, Dietrich DL, Nayagam V. The effect of pressure on radiative losses in hot, warm, and cool microgravity spherical diffusion flames. Combustion and Flame 2026; 287:114884.

Waddell KA, Yablonsky G, Constales D, Sunderland PB, Axelbaum RL. The effects of elevated pressure on the kinetics and extinction of hot, warm, and cool gaseous ethylene spherical diffusion flames. Proceedings of the Combustion Institute 2024; 40:105400.

Waddell KA, Irace PH, Yablonsky G, Constales D, Sunderland PB, Axelbaum RL. The kinetics and warm flame chemistry associated with radiative extinction of spherical diffusion flames. Combustion Theory and Modelling 2024; 1–18.

Waddell KA, Lee HJ, Nayagam V, Axelbaum RL, Sunderland PB. Cool diffusion flames in a stably stratified stagnation flow. Combustion and Flame 2023; 254:112852.

Irace PH, Waddell KA, Constales D, Sunderland PB, Axelbaum RL. Critical temperature and reactant mass flux for radiative extinction of ethylene microgravity spherical diffusion flames at 1 bar. Proceedings of the Combustion Institute 2023; 39:1905–1913.

Irace PH, Waddell KA, Constales D, Kim M, Yablonsky G, Sunderland PB, Axelbaum RL. On the existence of steady-state gaseous microgravity spherical diffusion flames in the presence of radiation heat loss. Proceedings of the Combustion Institute 2023; 39:1721–1729.

Kim M, Waddell KA, Sunderland PB, Nayagam V, Stocker DP, Dietrich DL, Ju Y, Williams FA, Irace P, Axelbaum RL. Spherical gas-fueled cool diffusion flames. Proceedings of the Combustion Institute 2023; 39:1647–1656.

Frolov SM, Ivanov VS, Frolov FS, Vlasov PA, Axelbaum R, Irace PH, Yablonsky G, Waddell KA. Soot formation in spherical diffusion flames. Mathematics 2023; 11:261.

Irace PH, Lee HJ, Waddell KA, Tan L, Stocker DP, Sunderland PB, Axelbaum RL. Observations of long duration microgravity spherical diffusion flames aboard the International Space Station. Combustion and Flame 2021; 229:111373.

Presentations

Waddell KA, Krause TS, Colk Met, Nayagam V. Dietrich DL. Sunderland PB, on the stoichiometry of cool flames. American Society for Gravitational and Space Research Annual Conference, Phoenix, AZ, 2025.

Waddell KA, Dietrich DL, Nayagam V. Pressure effects in spherical microgravity hot, warm, and cool diffusion flame transitions. 14th U.S. National Combustion Meeting, Boston, Massachusetts, 2025.

Waddell KA, Dietrich DL, Nayagam V. A numerical investigation of the effects of pressure on spherical microgravity hot, warm, and cool diffusion flames. American Society for Gravitational and Space Research Annual Conference, San Juan, PR, 2024.

Waddell KA, Yablonsky G, Constales D, Sunderland PB, Axelbaum RL. The effects of elevated pressure on the kinetics and extinction of hot, warm, and cool gaseous ethylene spherical diffusion flames. International Symposium on Combustion, Milan, Italy, 2024.

Waddell KA, Dietrich DL, Nayagam V. The effects of pressure and optical thickness on radiative losses in spherical diffusion flames in microgravity. Spring Technical Meeting of the Central States Section of The Combustion Institute, Cleveland, OH, 2024.

Waddell KA, Yablonsky G, Constales D, Sunderland PB, Axelbaum RL. The kinetics and warm flame chemistry associated with radiative extinction of spherical diffusion flames. 13th U. S. National Combustion Meeting, 2023.

Waddell KA, Lee HJ, Sunderland PB, Nayagam V, Axelbaum RL. Cool diffusion flames above a heptane pool. 13th U. S. National Combustion Meeting, 2023.

Waddell KA, Lee HJ, Sunderland PB, Nayagam V, Axelbaum RL. Observations of cool pool diffusion flames. Spring Technical Meeting of the Eastern States Section of the Combustion Institute, 2022.

Waddell KA, Lee HJ, Sunderland PB, Nayagam V, Axelbaum RL. Observations of cool pool diffusion flames. Future Leaders in Mechanical an Aerospace Engineering, 2022.

Waddell KA, Sunderland PB, Medvedev SN, Frolov SM, Irace PH, Axelbaum RL. Flame and burner temperature measurements and predictions in spherical diffusion flames. American Society for Gravitational and Space Research Annual Meeting, 2021.

Waddell KA, Sunderland PB, Medvedev SN, Frolov SM, Irace PH, Axelbaum RL. Flame and burner temperature measurements and predictions in spherical diffusion flames. 12th U. S. National Combustion Meeting, the Combustion Institute, 2021.

Peer Reviews

Reviewer for Proceedings of the Combustion Institute, International Communications in Heat & Mass Transfer