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Kyle Uhlenhake, Ph.D.

Dr. Kyle Uhlenhake is a Senior Engineer at Colwell Consulting where he specializes in the engineering analysis of fluid and thermal processes, especially regarding the origin, cause, and propagation of fires and explosions. Dr. Uhlenhake has investigated fires and explosions in a diverse range of applications including residential and commercial structures, internal combustion motor vehicles, electric and hybrid motor vehicles, watercraft and marine applications, rail transport applications, heavy equipment applications, chemical mixing processes, and battery packs. Experience within these applications includes fire cause and origin determination, evaluation of ignition mechanisms, fire spread, and burn pattern interpretation.

Dr. Uhlenhake has published peer-reviewed, scientific articles in the areas of ignition mechanisms, combustion analysis, thermodynamic processes, laser diagnostics, and rocket propellants. Applications of his research include better understanding of novel ignition mechanisms and using experimental and computational methods to explain complex combustion processes.

Dr. Uhlenhake has held a graduate research assistant position at Zucrow Laboratories at Purdue University, as well as an undergraduate research assistant position at the Energetic Materials Combustion Laboratory at Iowa State University. Dr. Uhlenhake also has experience as a graduate teaching assistant and has taken coursework in engineering education. He has instructed a laboratory course on combustion of energetic materials, and has lectured engineering courses in combustion, internal combustion engines, and thermodynamics. Dr. Uhlenhake has also held positions at Rolls-Royce Corporation and Caterpillar Inc.

Education

Ph.D., Mechanical Engineering, Purdue University
M.S., Mechanical Engineering, Purdue University
B.S., Mechanical Engineering, Iowa State University

Licenses, Certificates, and Certifications

Fire Investigation 1A: Fire Origin and Cause Determination accredited by the California State Fire Marshal
High Voltage Vehicle Safety Systems Course, Society of Automotive Engineers International
Fundamentals of High Voltage xEV, Safety, and PPE Course, Society of Automotive Engineers International
Fundamentals of Engineering, National Council of Examiners for Engineering and Surveying

Professional Honors

Advancing Army Modernization Priorities Undergraduate Program Outstanding Mentor, 2022
Purdue Lozar Fellowship, 2018-2021
Iowa State Cardinal Key Honor Society, 2017-2018

Publications

D. Olsen, K.E. Uhlenhake, M. Gomez, M. Örnek, S. F. Son, and M. Zhou. “Computational Study of Laser-Induced Heating of PVDF/Al Composites.” *AIP Advances* 13 (11): 115210. 2023

V. Radhakrishna, K.E. Uhlenhake, S. F. Son, and C. S. Goldenstein. “Dual-Zone Temperature and Multi-Species Measurements in Solid-Propellant Flames via Broadband Mid-Infrared Laser Absorption Spectroscopy.” *In AIAA AVIATION 2023 Forum. American Institute of Aeronautics and Astronautics.* 2023

K.E. Uhlenhake, M. Gomez, D. N. Collard, M. Örnek, and S. F. Son. “Laser Ignition of Solid Propellants Using Energetic Al-PVDF Optical Sensitizers.” *Combustion and Flame* 254 (August): 112848. 2023

K. E. Uhlenhake, D. N. Collard, A. C. Hoganson, A. D. Brown, S. Fox, M. Örnek, J. F. Rhoads, S. F. Son, “Additively Manufactured Micro- and Nano- Al/PVDF Ignition Sensitivity and Burning Characterization” *Prop., Explos., Pyrotech.* 2023, 48, e202200204.

K. E. Uhlenhake, O. R. Yehia, A. Noel, B. C. Terry, M. Örnek, H. M. Belal, I. E. Gunduz, and S. F. Son, “On the Use of Fluorine-Containing Nano-Aluminum Composite Particles to Tailor Composite Solid Rocket Propellants,” *Propellants, Explosives, Pyrotechnics*, vol. 47, no. 10.1002, 2022.

K. E. Uhlenhake, A. Hoganson, D. N. Collard, and S. F. Son, “Additively Manufactured Micron and Nano Al/PVDF Combustion Characterization and Hotwire Sensitivity Testing,” 2022 *Spring Technical Meeting of The Combustion Institute*, May 15-17, 2022. Detroit, MI

K. E. Uhlenhake, D. Patel, D. Olsen, M. Örnek, M. Zhou, and S. F. Son, “Optical Ignition and Combustion Characterization of Novel Metal Fuel/Fluoropolymer Composites,” *45th International Pyrotechnics Seminar*, Jul. 10-15th, 2022. Colorado Springs, CO.

D. N. Collard, K. E. Uhlenhake, J. F. Rhoads, and S. F. Son, “Photoflash and laser ignition of Al/PVDF films and additively manufactured igniters for solid propellant,” *Combust. Flame*, vol. 244, p. 112252, 2022.

M. Örnek, K. E. Uhlenhake, Y. Zhou, B. Zhang, M. Kalaswad, D. N. Collard, H. Wang, Q. Wang, S.F. Son, “Preparation and characterization of multifunctional piezoenergetic polyvinylidene fluoride/aluminum nanocomposite films,” *J. Appl. Phys.*, vol. 131, no. 5, 2022



K. E. Uhlenhake, D. Olsen, M. Gomez-Gomez, M. Örnek, M. Zhou, and S. Son, “Photoflash and Laser Ignition of Full Density Nano-Aluminum PVDF Films,” *Combust. Flame*, vol. 233, no. 111570, 2021.

K. E. Uhlenhake, D. Olsen, M. G. Gomez, M. Örnek, M. Zhou, and S. F. Son, “Optical Ignition of Nano-Aluminum PVDF Films Using Photoflash and Laser Energy,” *12th U. S. National Combustion Meeting*. May 24-26, 2021. College Station, TX.

K. E. Uhlenhake, M. Örnek, and S. F. Son, “Flash Ignition of Nanoaluminum and Fluoropolymer Composites,” *21st Biennial Conference of the APS Topical Group on Shock Compression of Condensed matter*, June 16-21, 2019. Portland, OR.

Professional Organizations

Society of Automotive Engineers International

Peer Reviewer

- Journal of Propellants, Explosives, and Pyrotechnics
- Journal of Propulsion and Power Research

Patents

S. Son, K. Uhlenhake, D. Collard, M. Gomez, “Optical Sensitizer Device and Method for Low-Energy Laser Ignition of Propellants” U.S. Patent No. 11,873,788, US-20220349373-A1

B. Barker, E. Koenig, B. Varney, and K. Uhlenhake, “Airfoil with Dual-Wall Cooling and Angled Cooling Channels” U.S. Patent No. 11,459,901, US-11459901-B1

