

Dr. Joseph Lawrence is a Sr. Staff Consultant at ESI where he specializes in the engineering analysis of combustion, thermal, and fluid processes, specifically regarding the origin, cause, and propagation of fires and explosions. Dr. Lawrence has investigated fires in a wide range of applications including residential structures, internal combustion motor vehicles, hybrid motor vehicles, outdoor maintenance vehicles, watercraft, battery packs, and rail transport applications. These investigations included fire cause and origin determination, burn pattern interpretation, and evaluation of ignition mechanisms.

Dr. Lawrence has published scientific articles in the areas of detonation wave shaping, shock physics, hot spot initiation and sensitization, cocrystallization, explosive characterization, vibration-assisted printing, and additive manufacturing. Applications of his research include developing safer energetic materials, tailoring detonation wave shapes, the development and evaluation of novel energetic materials, optimization of additive manufacturing techniques, and additive manufacturing of rocket propellants. Dr. Lawrence also serves as a peer reviewer for the *Propellants, Explosives, and Pyrotechnics (PEP)* journal.

Dr. Lawrence has held a graduate research assistant position at Zucrow Laboratories at Purdue University. Dr. Lawrence has also held positions at DEVCOM Army Research Laboratory (Aberdeen Proving Ground), Kyocera SGS Precision Tools, and Swagelok.

Licenses & Certifications

- Fire Investigation 1A: Fire Origin and Cause Determination, accredited by the California State Fire Marshal
- SAE Course PD291808: High Voltage Vehicle Safety Systems

Publications

Detonation Performance and Material Characterization of CL-20 and MDNT Cocrystals Versus Physical Mixtures

J. R. Lawrence, S. G. Hamlin, D. N. Patel, M. Örnek, R. E. Ferguson, & S. F. Son. *Propellants, Explosives, and Pyrotechnics*, vol. 50, issue 5, 2025.

The Effects of Material Filled Voids on Detonation Waveshape in Rubberized RDX Explosives

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Education

Ph.D., Mechanical Engineering,
Purdue University

M.S., Mechanical Engineering,
Purdue University

B.S., Mechanical Engineering, Ohio
Northern University

J. R. Lawrence, A. D. Koebnitz, G. A. Montoya, P. Srinidhi, & S. F. Son. Propellants, Explosives, and Pyrotechnics, vol. 49, issue 12, 2024.

Switchable RDX-based Rubberized Explosive with Thermally-expandable Microspheres.

J. R. Lawrence, M. Örnek, R. E. Ferguson, D. N. Collard, & S. F. Son. Propellants, Explosives, and Pyrotechnics, vol. 49, issue 10-11, 2024.

The Effect of Volume Loading on the Extrusion of Bimodal Glass Bead Mixtures,

J. R. Lawrence, H. R. Lipic, T. D. Manship, & S. F. Son. npj Adv. Manuf. 1, 5, 2024.

Influence and Comparison of Cylindrical Engineered Defects on Detonation Waveshape in a Rubberized RDX Explosive

J. R. Lawrence, G. A. Montoya, A. D. Koebnitz, & S. F. Son, Propellants, Explosives, and Pyrotechnics. vol. 49, issue 6, 2024.

The Effect of Volume Loading on the Extrusion of a Bimodal Glass Bead Mixture

J. R. Lawrence, H. R. Lipic, T. D. Manship, & S. F. Son. JANNAF Meeting, May 22-26, 2023. Pittsburgh, PA.

Effects of Sub-mm Cylindrical Voids on Detonation Performance in PBX 9501

G. A. Montoya, W. W. Chapman, J. R. Lawrence, T. R. Salyer, & S. F. Son, Propellants, Explosives, and Pyrotechnics, vol. 48, issue 5, 2023.

Additive Manufacturing and Combustion of RDX-based Composite Solid Gun Propellants

A. Afriat., C. W. Wernex, J. R. Lawrence, A. C. Hoganson, S. R. Address, M. Örnek, J. F. Rhoads, & S. F. Son, JANNAF Journal of Propulsion and Energetics, Under Review, 2023.

The coupling of Vibrations and Pressure Strongly Affects the Flow Rate and Flow Obstruction Behavior of Additively Manufacturable Composite Gun Propellant Pastes: An Instrumented RAM Extrusion Study

A. Afriat, J. R. Lawrence, J. F. Rhoads, & S. F. Son, JANNAF Journal of Propulsion and Energetics, Under Review, 2023.

Evolution of Explosively Driven Flash Coatings

G. A. Montoya, J. Dean, J. R. Lawrence, T. R. Salyer, & S. F. Son, AIP Conference. Proceedings, vol. 2844, issue 1, 2023.

The Effect of Volume Loading and Monomodal Particle Size on the Extrusion of a Colloidal Suspension

B. J. Montaña, J. R. Lawrence, T. D. Manship, S. Isert, & S. F. Son. JANNAF Journal of Propulsion and Energetics. Under Review, Fall 2022.

Detonation Performance of CL-20 and MDNT Co-crystal Versus Physical Mixture

J. R. Lawrence, C. J. Blum-Sorensen, S. G. Hamlin, & S. F. Son 22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter, July 11-15, 2022. Anaheim, CA.

Effects of Sub-mm Cylindrical Voids on Detonation Performance in PBX 9501

G. A. Montoya, W. W. Chapman, J. R. Lawrence, T. R. Salyer, & S. F. Son. 22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter, July 11-15, 2022. Anaheim, CA.

The influence of microstructure and polymorphic conformer on the shock sensitivity of 1,3,5,7-tetranitro-1,3,5,7-tetrazoctane (HMX)

N. R. Cummock, J. R. Lawrence, C. J. Blum-Sorensen, V. S. Vuppuluri, & S. F. Son, Journal of Energetic Materials, 41:4, Pages 483-509, 2021.

The influence of microstructure and conformational polymorph on the drop-weight impact sensitivity of δ -phase HMX

N. R. Cummock, J. R. Lawrence, M. Örneke, & S. F. Son, Journal of Energetic Materials, 41:4, pages 483-509, 2021.

Professional Affiliations/Honors

University Awards

- Purdue University Ross Fellowship, 2020
- Ohio Northern University Mechanical Engineering Department Honors, 2020
- Ohio Northern University Engineering Innovation Award, 2016

Tau Beta Pi

- Engineering Honor Society, 2019

Advancing Army Modernization Priorities

- Undergraduate Program Outstanding Mentor, 2022 and 2023

NFPA 921 Task Group on Vehicle Fire Investigation

- Member, 2024

Society of Automotive Engineers International

- Member