



First-Principles Engineering Depth

CAPABILITY STATEMENT

Serving NNSA · DOE-NE · DOE-EM

National Laboratories & Prime Contractors

Joseph McKay, PhD, MBA

Principal Engineer & Founder

(801) 610-9399 · ardousengineering.com

contact@ardouseng.com

OVERVIEW

Ardous Engineering & Research LLC provides advanced materials R&D, physics-based thermal and radiative modeling, high-fidelity simulation, and DOE-aligned V&V to prime contractors on NNSA, DOE-NE, and DOE-EM programs. Founded by Dr. Joseph McKay, PhD, MBA. Every engagement is led directly by the Principal Engineer, no junior handoffs, no generalist layers.

CORE COMPETENCIES

Advanced Materials R&D

Original development and characterization of nanostructured materials for thermal emission control; direct application to nuclear fuel cladding, reactor components, and high-temperature systems.

Computational Simulation

Ansys Mechanical (FEA), Ansys Fluent (CFD), and custom MATLAB frameworks for thermal, fluid, vibrational, and structural analysis; executed on high-performance computing clusters.

Requirements & Test Planning

ConOps to technical requirements; design-of-experiments plans; V&V strategy development for DOE and NNSA task orders.

Thermal & Radiative Modeling

Near-field and far-field radiative heat transfer built from first principles using fluctuational electrodynamics; spectral radiative property characterization for nuclear-relevant materials.

V&V and Technical Documentation

Convergence testing, mesh sensitivity, uncertainty quantification, and benchmark comparisons structured to DOE Order 414.1D and ASME V&V standards; defensible on DOE program reviews.

Proposal Technical Support

Technical volume writing, past-performance narratives, and program-specific analysis for NNSA and DOE-NE solicitations.

KEY DIFFERENTIATORS

01

PhD-Level Technical Depth

Four peer-reviewed publications in Physical Review B, Journal of Applied Physics, and JQSRT, held by the Principal Engineer. No generalist engineering firm brings this level of peer-reviewed rigor to a DOE task order.

02

Original IP, In-House

USPTO patent application No. 63/921,537 — near-zero-emission-loss thermal infrared waveguide using SiC nanowires — filed 2025, held by the Principal Engineer. The inventor executes your work directly.

03

Direct Principal Execution

A PhD engineer performs every task on every engagement. No junior staff handoffs, no generalist layers. The person you evaluate is the person who delivers.

UEI

E21RBVZSHDM5

CAGE

173F4

SAM.GOV

Active · Small Business

NAICS

541713 · 541715 · 541330

KEY PERSONNEL

Joseph McKay, PhD, MBA · *Principal Engineer & Founder*

PhD Mechanical Engineering, University of Utah (4.0 GPA) · MBA, Western Governors University (4.0 GPA)

U.S. Citizen · 4 peer-reviewed publications · USPTO patent application No. 63/921,537

PAST PERFORMANCE & PUBLICATIONS

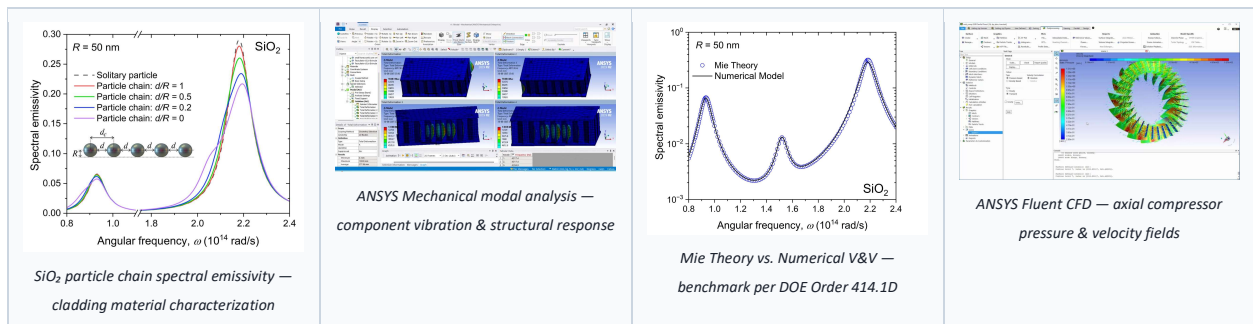
NSF Award 2130083 · University of Utah · 2021–2025

Principal Engineer Dr. McKay delivered thermal emission modeling and radiative heat transfer analysis as the lead technical contributor. Work included MATLAB simulation frameworks using fluctuational electrodynamics, V&V benchmarking against peer-reviewed datasets, uncertainty quantification, and on-time milestone reporting to the NSF program officer. Results were submitted through formal peer review and published in high-impact journals; demonstrating documentation rigor directly transferable to DOE Order 414.1D and ASME V&V program expectations.

Selected Patent and Peer-Reviewed Publications

1. **J. C. McKay**, B. Raeymaekers, and M. Francoeur, “Near-zero-emission-loss thermal infrared waveguide made of SiC nanowires,” **U.S. Patent Appl. No. 63/921,537**, filed 2025.
2. **J. C. McKay**, B. Raeymaekers, and M. Francoeur, “Near-zero-emission-loss thermal infrared waveguiding enabled by SiC nanowire chains,” *Journal of Quantitative Spectroscopy and Radiative Transfer* **355**, 109890 (2026).
3. **J. C. McKay**, B. Raeymaekers, and M. Francoeur, “Tunable thermal emission and waveguiding by SiC nanowires via collective localized surface phonons,” *Journal of Applied Physics* **139**, 074303 (2026).
4. **J. C. McKay**, B. Raeymaekers, and M. Francoeur, “Thermal emission from agglomerated polaritonic dielectric particles,” *Physical Review B* **111**, 115408 (2025).
5. L. P. Walter, **J. C. McKay**, B. Raeymaekers, and M. Francoeur, “Near-field thermal emission from metasurfaces constructed of SiC ellipsoidal particles,” *Journal of Applied Physics* **134**, 225102 (2023).

REPRESENTATIVE TECHNICAL WORK



PROGRAMS WE SUPPORT

- ▶ **Reactor Thermal Analysis** — DOE-NE advanced reactor programs
- ▶ **Fuel Cladding Radiative Properties** — SiC & advanced cladding materials
- ▶ **Waste Storage Thermal Modeling** — DOE-EM spent fuel & HLW
- ▶ **NNSA Component Studies** — Thermal & EM stockpile analysis
- ▶ **Advanced Manufacturing Thermal** — AM & high-temperature processing
- ▶ **Independent V&V Studies** — Simulation-heavy DOE task orders

READY TO ENGAGE

The deep technical specialist your team is missing.

Counts toward small business subcontracting plan goals.

CONTACT

Joseph McKay, PhD, MBA · *Principal Engineer*
 (801) 610-9399 · contact@ardouseng.com
ardousengineering.com · Taylorsville, UT 84123