

Christian M. Petrie

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Education

- PhD, Nuclear Engineering, The Ohio State University (2014)
- MS, Nuclear Engineering, The Ohio State University (2011)
- BS, Mechanical Engineering, The Ohio State University (2010)

Professional Summary

Dr. Christian Petrie leads the Advanced Fuel Fabrication and Instrumentation Group, primarily focusing on nuclear fuel development and accelerated fuel qualification using advanced manufacturing, accelerated irradiation testing, and sensor integration. Dr. Petrie is driving new innovations in nuclear science and technology through scientific output, industry engagement, and organizational and programmatic leadership. He is responsible for the conception and commissioning of several unique separate-effects irradiation vehicles in the High Flux Isotope Reactor that target important phenomena specific to advanced nuclear fuels, fuel cladding materials, and sensors. Dr. Petrie is a leading expert on fiber-optic sensors for nuclear applications. He has demonstrated sensors for measuring reactor conditions (e.g., spatially distributed temperature and strain, pressure, corrosion, gamma heating, and liquid level); embedded sensors in metal and ceramic materials using various additive manufacturing processes; and published many papers on the performance of fiber-optic sensors under extreme nuclear reactor–relevant environments. He holds numerous programmatic leadership roles within the US Department of Energy, Office of Nuclear Energy (DOE-NE), and has received many awards for his professional service.

Professional Experience

Oak Ridge National Laboratory

Group Leader, Senior R&D Staff	October 2020–present
R&D Staff	January 2018–September 2020
Weinberg Fellow, R&D Associate	July 2014–December 2017

The Ohio State University

Nuclear Energy University Program Research Fellow	September 2010–July 2014
Undergraduate Research Assistant	September 2009–September 2010

Research Interests and Accomplishments

- Managing a group of 15 R&D staff members focused on the design, analysis, and advanced manufacturing of nuclear fuels and evaluating fuel performance using embedded sensors and state-of-the-art measurement techniques before, during, and after irradiation (2020–present)
- >125 peer-reviewed publications with Google Scholar h-index=20; citations=1,377; i10-index=41 (as of 1/22/2024)
- 6 US nonprovisional patent applications (5 pending)
- Principal investigator (PI) or co-investigator on 10+ successful DOE-NE proposals (2016–2023)
- ORNL PI of the WIRE-21 experiment, the most highly instrumented irradiation experiment ever performed in the High Flux Isotope Reactor that is exposing fiber-optics, self-powered neutron detectors, thermocouples, passive temperature and neutron flux sensors, and wireless temperature and pressure sensors to extreme neutron fluence (2019–present)
- Conceived and commissioned the MiniFuel irradiation vehicle for performing separate-effects irradiation testing of advanced nuclear fuels, which has become a critical part of the industry’s accelerated fuel qualification approach (2016–present)

- ORNL lead for embedding sensors within a wide range of metal and ceramic materials using solid-state and powder bed additive manufacturing technologies to measure a wide range of parameters such as corrosion, pressure, and spatially distributed temperature and strain (2018–present)
- PI for a series of neutron irradiation experiments to evaluate the effects of extreme displacement damage on the dimensional stability and optical transmission of fiber-optic materials to inform sensor survivability and signal drift for nuclear reactor applications (2014–present)
- Designed and executed a unique experiment to expose advanced silicon carbide fiber-reinforced, silicon carbide matrix composite fuel cladding to simultaneous neutron irradiation and radial heat flux to provide an accelerated, cost-effective way to simulate representative stresses in light water reactors (2015–2019)

Awards and Honors

Senior Member, Institute of Electrical and Electronics Engineers	(2023)
Oppenheimer Science and Energy Leadership Program Fellow, National Laboratory Director’s Council	(2023)
Landis Young Member Engineering Achievement Award, American Nuclear Society	(2022)
Most publications, ORNL Nuclear Energy and Fuel Cycle Division	(2021, 2022)
Incentive Performance Award, ORNL	(2021)
Technology Commercialization Award, ORNL Technology Transfer	(2021)
National Academy of Engineering Frontiers of Engineering Symposium Nominee	(2019, 2020)
Significant Event Award, ORNL	(2019)
Supplementary Performance Award, ORNL	(2016, 2018)
Fuel Cycle R&D Excellence Award, US Department of Energy, Office of Nuclear Energy	(2016)
Alvin M. Weinberg Fellowship, ORNL	(2014–2016)
Most Outstanding Researcher, OSU Nuclear Engineering Program	(2013)
Most Outstanding Scholar, OSU Nuclear Engineering Program	(2012)
Nuclear Energy University Program Fellowship, US Department of Energy, Office of Nuclear Energy	(2010–2013)
Nuclear Energy University Program Scholarship, US Department of Energy, Office of Nuclear Energy	(2009–2010)
Nuclear Engineering Scholarship, US Nuclear Regulatory Commission	(2008–2010)
Engineering Dean’s Award, OSU	(2006–2010)
University Scholarship, OSU	(2006–2010)
Hendrix Engineering Scholarship, OSU	(2008–2009)
Walter H. Kidd Engineering Scholarship, OSU	(2006–2007)
Elks National Foundation Scholarship, Elks National Foundation	(2006–2007)

Programmatic Leadership Roles

- ORNL/DOE representative for the Halden Programme Group (2019–present)
- DOE-NE Advanced Fuels Campaign, Deputy Technical Lead for Irradiation Testing (2020–2022)
- DOE-NE Advanced Fuels Campaign, work package manager (WPM) for irradiation of accident tolerant fuels and accelerated fuel qualification (2017–2022)
- DOE-NE, Nuclear Science User Facilities Program, Irradiation Technical Lead (2017–2020)
- DOE-NE, Versatile Test Reactor Program, Principal Investigator for Molten Salt Corrosion Sensor Development (2018–2021)
- DOE-NE Microreactor Program, Instrumentation and Sensors WPM (2020–present)
- DOE-NE Transformational Challenge Reactor Program, Embedded Sensors Thrust Area Lead (2021–2022)
- DOE-NE Transformational Challenge Reactor Program, Fuels Thrust Area Lead (2021–2022)
- DOE-NE Advanced Materials and Manufacturing Technologies Program, Uncertainty Reduction in AM Qualification Certification WPM (2022–present)
- DOE-NE, Advanced Sensors and Instrumentation Program, Sensors for Advanced Reactors Technical Lead (2022–present)
- DOE-NE, Advanced Sensors and Instrumentation Program, Optical Fibers WPM (2022–present)

Symposium and Professional Society Leadership

- Senior Member of the Institute of Electrical and Electronics Engineers (2023–present)
- ORNL Scientific Secretariat for the Modeling, Experimentation, and Validation Summer School (2019)
- Member of The Minerals, Metals & Materials Society (2019–present)
- Member of the American Ceramic Society (2016–present)
- Member of the American Nuclear Society (2008–present)
- Member of the Alpha Nu Sigma Honorary (2011–2013)

Bibliography

Please see the following links for an ORNL profile, Google scholar page, and Scopus profile:

- ORNL profile: <https://www.ornl.gov/staff-profile/christian-m-petrie>
- Google Scholar: <https://scholar.google.com/citations?user=vj9sIucAAAAJ&hl=en>
- Scopus: <https://www.scopus.com/authid/detail.uri?authorId=54394003900>

Journal Publications:

1. J. Zhao, T. Hinds, W. Dong, Y. Li, Z. Splain, N. Bajaj, A.C. To, **C.M. Petrie**, and K.P. Chen, “Embedded Fiber Bragg Grating (FBG) Sensors Enabled by Ultrasonic Additive Manufacturing for High-Frequency Vibration Measurements,” *IEEE Sensors*, accepted.
2. J.P. Gorton, J.L. McDuffee, **C.M. Petrie**, and A.T. Nelson, “Heat Transfer Optimization of UO₂-Mo Fuel Using Genetic Algorithms,” *Nuclear Engineering and Design*, Vol. 418 (2024) 112861.
3. T. Koyanagi, X. Hu, **C.M. Petrie**, G. Singh, C. Ang, C.P. Deck, W.J. Kim, D. Kim, C. Sauder, J. Braun, and Y. Katoh, “Hermeticity of SiC/SiC composite and monolithic SiC tubes irradiated under radial high-heat flux,” *Journal of Nuclear Materials*, Vol. 588 (2024) 154784.
4. D. Schappel, K.D. Linton, G.W. Helmreich, T.J. Keever, and **C.M. Petrie**, “Failure Analysis of Nuclear Transient-Tested Uranium Nitride Tri-Structural Isotropic Fuel Particles in a 3D-Printed SiC Matrix,” *Journal of Nuclear Materials*, Vol. 586 (2023) 154691.
5. **C.M. Petrie** and D.C. Sweeney, “Enhanced backscatter and unsaturated blue wavelength shifts in F-doped fused silica optical fibers exposed to extreme neutron radiation damage,” *Journal of Non-Crystalline Solids*, Vol. 615 (2023) 122441.
6. J.P. Gorton, **C.M. Petrie**, and A.T. Nelson, “A review of neutronics and thermal hydraulics–based screening methods applied to accelerated nuclear fuel qualification,” *Progress in Nuclear Energy*, Vol. 162 (2023) 104737.
7. H.C. Hyer, D. Giuliano, and **C.M. Petrie**, “Toward Local Core Outlet Temperature Monitoring in Gas-Cooled Nuclear Reactors Using Distributed Fiber-Optic Temperature Sensors,” *Applied Thermal Engineering*, Vol. 230 Part B (2023) 120847.
8. B.W. Morgan, M.P. Van Zile, **C.M. Petrie**, P. Sabharwall, M. Burger, and I. Jovanovic, “Radiation-Induced Negative Optical Nonlinearities in Fused Silica, Sapphire, and Borosilicate Glass,” *Journal of Nuclear Materials*, Vol. 582 (2023) 154486.
9. **C.M. Petrie**, K.D. Linton, G. Vasudevamurthy, D. Schappel, R.L. Seibert, D. Carpenter, A.T. Nelson, and K.A. Terrani “Fission gas retention of densely packed uranium carbonitride tristructural-isotropic fuel particles in a 3D printed SiC matrix,” *Journal of Nuclear Materials*, Vol. 580 (2023) 154419.
10. B. Wilson, A. Conant, T.L. Ulrich, A. Kercher, L.R. Sadergaski, T. Gerczak, A.T. Nelson, **C.M. Petrie**, J. Harp, and A.E. Shields, “Nuclear Fuel Irradiation Testbed for Nuclear Security Applications,” *Frontiers in Nuclear Engineering*, Vol. 2 (2023) 1123134.
11. J.P. Gorton, R.C. Gallagher, Z.G. Wallen, A.G. Le Coq, G.W. Helmreich, **C.M. Petrie**, K.D. Linton, and T.J. Gerczak, “Simulation of a TRISO MiniFuel irradiation experiment with data-informed uncertainty quantification,” *Nuclear Engineering and Design*, Vol. 404 (2023) 112177.
12. H.C. Hyer, K. Carver, F.A. List, and **C.M. Petrie**, “Embedding Thermocouples in SS316 with Laser Powder Bed Fusion,” *Smart Materials and Structures*, Vol. 32 (2023) 02LT01.

13. P. Sabharwall, J.L. Hartvigsen, T.J. Morton, J. Yoo, S. Qin, M. Song, D.P. Guillen, T. Unruh, J.E. Hansel, J. Jackson, J. Gehin, H. Trellue, D. Mascarenas, R.S. Reid, and **C.M. Petrie**, “Nonnuclear Experimental Capabilities to Support Design, Development, and Demonstration of Microreactors,” *Nuclear Technology*, Vol. 209 (2023) S41–S59.
14. B.W. Morgan, M. Van Zile, P. Sabharwall, M. Burger, **C.M. Petrie**, and I. Jovanovic, “Optical absorption of fused silica and sapphire exposed to neutron and gamma radiation with simultaneous thermal annealing,” *Journal of Nuclear Materials*, Vol. 570 (2022) 153945.
15. D.C. Sweeney, A. Birri, and **C.M. Petrie**, “Hybrid Method for Monitoring Large Fabry-Pérot Cavity Displacements with Nanometer Precision,” *Optics Express*, Vol. 30 (2022) 29148.
16. J.D. Arregui Mena, T. Koyanagi, E. Cakmak, **C.M. Petrie**, W.J. Kim, D. Kim, C.P. Deck, C. Sauder, J. Braun, and Y. Katoh, “Qualitative and quantitative analysis of neutron irradiation effects in SiC/SiC composites using X-ray computed tomography,” *Composites Part B*, Vol. 238 (2022) 109896.
17. J.P. Gorton, D.C. Sweeney, **C.M. Petrie**, and J.L. McDuffee, “Simulation of natural circulation cartridge loop experiments and application to molten salt reactors,” *Nuclear Engineering and Design*, Vol. 392 (2022) 111767.
18. A. Cheniour, G. Pastore, J. Harp, **C. Petrie**, and N. Capps, “Application of BISON to UO₂ MiniFuel fission gas release analysis,” *Journal of Nuclear Materials*, Vol. 565 (2022) 153686.
19. H.C. Hyer and **C.M. Petrie**, “Effect of Slice Thickness on the Microstructural Development of Additively Manufactured SS316,” *Journal of Manufacturing Processes*, Vol. 76 (2022) 666-674.
20. J.T. Jones, D.C. Sweeney, A. Birri, **C.M. Petrie**, and T.E. Blue, “Calibration of Distributed Temperature Sensors Using Commercially Available SMF-28 Optical Fiber from 22°C to 1000°C,” *IEEE Sensors*, Vol. 22 (2022), 4144-4151.
21. H.C. Hyer, D.C. Sweeney, and **C.M. Petrie**, “Functional Fiber Optic Sensors Embedded in Stainless Steel Components using Ultrasonic Additive Manufacturing for Distributed Temperature and Strain Measurements,” *Additive Manufacturing*, Vol. 52 (2022), 102681.
22. D.C. Sweeney and **C.M. Petrie**, “Extending the Range of Distributed Fiber Optic Strain Measurements Using a Local Adaptive Reference Approach,” *Optics Letters*, Vol. 47 (2022), 269-272.
23. **C.M. Petrie**, A. Birri, and T.E. Blue, “Optical transmission and dimensional stability of single-crystal sapphire after high-dose neutron irradiation at various temperatures up to 688°C,” *Journal of Nuclear Materials*, Vol. 559 (2022), 153432.
24. J. McDuffee, R. Christensen, D. Eichel, M. Simpson, S. Phongikaroon, X. Sun, J. Baird, A. Burak, S. Chapel, J. Choi, J. Gorton, D.E. Hamilton, D. Killinger, S. Miller, J. Palmer, **C. Petrie**, D. Sweeney, A. Schrell, and J. Vollmer, “Design and Control of a Fueled Molten Salt Cartridge Experiment for the Versatile Test Reactor,” *Nuclear Science and Engineering*, Vol. 196 (2022) S234-S259.
25. D.C. Sweeney, D. Sweeney, and **C.M. Petrie**, “Graphical Optimization of Spectral Shift Reconstructions for Optical Backscatter Reflectometry,” *Sensors*, Vol. 21 (2021), 6154.
26. T. Koyanagi, H. Wang, J.D. Arregui Mena, **C.M. Petrie**, C.P. Deck, W.J. Kim, D. Kim, C. Sauder, J. Braun, and Y. Katoh, “Thermal diffusivity of SiC composite tubes: the effects of microstructure and irradiation,” *Journal of Nuclear Materials*, Vol. 557 (2021), 153217.
27. N. Capps, R. Sweet, J. Harp, and **C.M. Petrie**, “High Burnup Fuel Stress Analysis Prior to and During a LOCA Transient,” *Journal of Nuclear Materials*, Vol. 556 (2021), 153194.
28. D.C. Sweeney, A.M. Schrell, and **C.M. Petrie**, “Pressure-driven fiber optic sensor for online corrosion monitoring,” *IEEE Transactions on Instrumentation and Measurement*, Vol. 70 (2021) 9510310.
29. **C.M. Petrie**, A.M. Schrell, D.N. Leonard, Y. Yang, B.C. Jolly, and K.A. Terrani, “Embedded sensors in additively manufactured silicon carbide,” *Journal of Nuclear Materials*, Vol. 552 (2021) 153012.
30. K.A. Terrani, T. Lach, H. Wang, A. Le Coq, K. Linton, **C. Petrie**, T. Koyanagi, and T.S. Byun, “Irradiation stability and thermo-mechanical properties of 3D printed SiC,” *Journal of Nuclear Materials*, Vol. 551 (2021) 152980.

31. A. Birri, **C.M. Petrie**, and T.E. Blue, "Parametric Analysis of an Optical Fiber–Based Gamma Thermometer for University Research Reactors Using an Analytic Thermal Model," *Nuclear Technology*, Vol. 207 (2021), 1865-1872.
32. G.L. Beausoleil, **C.M. Petrie**, W.J. Williams, A. Jokisaari, L. Capriotti, S. Novascone, C. Adkins, and M.J. Kerr, "Integrating Advanced Modeling and Accelerated Testing for a Modernized Fuel Qualification Paradigm," *Nuclear Technology*, Vol. 207 (2021), 1491-1510.
33. M. Pagan, **C. Petrie**, D. Leonard, N. Sridharan, D. Coffey, S. Zinkle, and S.S. Babu, "Interdiffusion of Elements during Ultrasonic Additive Manufacturing," *Metallurgical and Materials Transactions A*, Vol. 52 (2021) 1142-1157.
34. D.C. Sweeney, A.M. Schrell, and **C.M. Petrie**, "An Adaptive Reference Scheme to Extend the Functional Range of Optical Backscatter Reflectometry in Extreme Environments," *IEEE Sensors*, Vol. 21 (2021) 498-509.
35. J.M. Harp, R.N. Morris, **C.M. Petrie**, J.R. Burns, and K.A. Terrani, "Postirradiation Examination from Separate Effects Irradiation Testing of Uranium Nitride Kernels and Coated Particles," *Journal of Nuclear Materials*, Vol. 544 (2021) 152696.
36. **C.M. Petrie**, D.C. Sweeney, R.H. Howard, D.K. Felde, and J.L. McDuffee, "Single-phase, natural circulation annular flow measurements for cartridge loop irradiation experiments," *Nuclear Engineering and Design*, Vol. 370 (2020) 110900.
37. **C.M. Petrie** and N. Sridharan, "In situ measurement of phase transformations and residual stress evolution during welding using spatially-distributed fiber optic strain sensors," *Measurement Science and Technology*, Vol. 31 (2020) 125602.
38. D.C. Sweeney, A.M. Schrell, Y. Liu, and **C.M. Petrie**, "Metal-embedded fiber optic sensor packaging and signal demodulation scheme towards high-frequency dynamic measurements in harsh environments," *Sensors and Actuators A: Physical*, Vol. 312 (2020) 112075.
39. A. Birri, **C.M. Petrie**, and T.E. Blue, "Analytic Thermal Model of an Optical Fiber Based Gamma Thermometer and its Application in a University Research Reactor," *IEEE Sensors*, Vol. 20 (2020) 7060.
40. **C.M. Petrie**, A. Birri, and T.E. Blue, "High-Dose Temperature-Dependent Neutron Irradiation Effects on the Optical Transmission and Dimensional Stability of Amorphous Fused Silica," *Journal of Non-Crystalline Solids*, Vol. 525 (2019) 119668.
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42. **C.M. Petrie**, N. Sridharan, A. Hehr, M. Norfolk, and J. Sheridan, "High-temperature strain monitoring of stainless steel using fiber optics embedded in ultrasonically consolidated nickel layers," *Smart Materials and Structures*, Vol. 28 (2019) 085041.
43. G. Singh, T. Koyanagi, **C.M. Petrie**, C. Deck, K.A. Terrani, J. Arregui-Mena, and Y. Katoh, "Elastic Moduli Reduction in SiC-SiC Tubular Specimen after High Heat Flux Neutron Irradiation Measured by Resonant Ultrasound Spectroscopy," *Journal of Nuclear Materials*, Vol. 523 (2019) 391-401.
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45. K. Field, J.L. McDuffee, J. Geringer, **C.M. Petrie**, and Y. Katoh, "Evaluation of the Continuous Dilatometer Method of Silicon Carbide Thermometry for Passive Irradiation Temperature Determination," *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*, Vol. 445 (2019) 46-56.
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48. P. Mulligan, **C.M. Petrie**, J. McDuffee, H. Sakasegawa, Y. Katoh, and H. Tanigawa, "An F82H Steel Pressurized Tube Creep Capsule for Irradiation in HFIR," *Nuclear Materials and Energy*, Vol. 15, (2018) 254-260.
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53. **C.M. Petrie** and T.E. Blue, "In-situ reactor radiation-induced attenuation in sapphire optical fibers heated up to 1000°C," *Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms* Vol. 342 (2015) 91-97.
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55. **C.M. Petrie**, B. Wilson, and T.E. Blue, "In-situ Gamma Radiation-Induced Attenuation in Sapphire Optical Fibers Heated to 1000°C," *Journal of the American Ceramic Society* Vol. 97 (2014) 3150-3156.
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Manuscripts Submitted for Publication:

1. H.C. Hyer and **C.M. Petrie**, "Capturing Divergent Strain Behavior using Bi-Metallic Coated Fiber-Optic Sensors Embedded in Stainless Steel," *Nature Communications*, submitted.

Conference Proceedings:

1. D.C. Sweeney and **C.M. Petrie**, "Methods for Continuously Resolving Spectral Shifts in Distributed Optical Fiber Sensors Irradiated to Extreme Neutron Fluence," *Nuclear Plant Instrumentation, Control & Human-Machine Interface Technologies* (2023) 1431-1440.
2. N.D.B. Ezell, B. Wilson, P. Ramuhalli, W. Williams, and **C.M. Petrie**, "Non-Nuclear Advanced Controls Testbed," *Nuclear Plant Instrumentation, Control & Human-Machine Interface Technologies* (2023) 686-693.

3. P.L. Mulligan, D.C. Sweeney, K.M. Godsey, N.D.B. Ezell, and **C.M. Petrie**, “In-Rod Sensor System Overview, Benefits and Recent Irradiation Test Results,” *Nuclear Plant Instrumentation, Control & Human-Machine Interface Technologies* (2023) 1420–1430.
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5. J. Carvajal, S. Stafford, J. Arndt, P. Sirianni, **C.M. Petrie**, N.D.B. Ezell, D.C. Sweeney, P.L. Mulligan, and A.S. Chapel, “In-Rod Sensor System Overview, Benefits and Recent Irradiation Test Results,” *Nuclear Plant Instrumentation, Control & Human-Machine Interface Technologies* (2023) 8–20.
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11. J.P. Gorton, D. Schappel, J.L. McDuffee, **C.M. Petrie**, A.T. Nelson, “Thermal Optimization of UO₂-Mo Fuel Using Sensitivity Analysis and Genetic Algorithms,” *Proceedings of TopFuel 2022* (2022) 73–78.
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13. J. Zhao, Y. Li, K. Zhao, Q. Wang, P. Swinehart, C. Jewart, **C.M. Petrie**, and K.P. Chen, “High-Speed Interrogation of Embedded Fiber Bragg Grating (FBG) Sensors Fabricated by Ultrasonic Additive Manufacturing,” *27th International Conference on Optical Fiber Sensors* (2022) W4.40.
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55. **C.M. Petrie**, A.G. Le Coq, R.C. Gallagher, K. Linton, and C.P. Deck, "Design and Thermal Analysis for Irradiation of Silicon Carbide Joint Specimens in the High Flux Isotope Reactor," ORNL/TM-2018/940, Oak Ridge National Laboratory, Oak Ridge, TN (2018).
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59. **C.M. Petrie**, R.H. Howard, K.R. Smith, and C.R. Daily, "Analysis and Experimental Qualification of an Irradiation Capsule Design for Testing Pressurized Water Reactor Fuel Cladding in the High Flux Isotope Reactor," ORNL/TM-2017/67 (2017).
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62. N.D. Bull Ezell, P. Mulligan, L. Qualls, **C. Petrie**, K. Smith, N. Taylor, and M. Adkisson, "High Temperature Fission Chamber: Ohio State University Site Test Plan," ORNL/TM-2017/448 (2017).
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64. R. Howard, R. Gallagher, **C. Petrie**, and K. Smith, "Design Scoping Analysis to Support the Irradiation of Ex-Service CANDU Non-Optimized Garter Springs in HFIR," ORNL/SPR-2017/434 (2017).
65. **C.M. Petrie** and K. Terrani, "Thermal Analysis of a Flexible Rabbit Design for Irradiating PWR Cladding," ORNL/SR-2016/197 (2016).
66. J. Geringer, Y. Katoh, R. Howard, N. Cetiner, **C. Petrie**, K. Smith, and J. McDuffee, "Neutron Irradiation Program Vehicle Design Report," ORNL/TM-2016/123 (2016).
67. **C. Petrie**, J. McDuffee, Y. Katoh, and K. Terrani, "Delivery of completed irradiation vehicles and the quality assurance document to the High Flux Isotope Reactor for irradiation," ORNL/LTR-2015/569 (2015).

Invited Talks:

1. **C.M. Petrie**, "Irradiation Experiment Design and Analysis," The Ohio State University, Mechanical and Aerospace Engineering Seminar, Columbus, OH, November 2, 2016.
2. **C.M. Petrie**, "Fiber-optic sensors for nuclear applications: Fundamental radiation effects and recent advances in sensor development," Boise State University, Micron School of Materials Science and Engineering Seminar, Boise, ID, March 31, 2021.
3. **C.M. Petrie**, "Integration of Nuclear Fuel and Embedded Sensors Within Additively Manufactured SiC Components," MS&T22: Materials Science & Technology, Pittsburgh, PA, October 9 – 13, 2022.

Thesis Committees:

1. T.M. Naughton, “Development of a Capacitive Sensor for In-Pile Materials Monitoring,” The University of Tennessee, Knoxville, Master of Science Degree, Nuclear Engineering Seminar, 2020. Committee: J. Coble (adviser), R. Wood, X. Li, and **C. Petrie**.
2. S. Wang, “Integration and performance of distributed optical fibre sensors in thermoplastics and thermoplastic composites,” Norwegian University of Science and Technology, Trondheim, Norway, PhD Mechanical Engineering, 2023. Assessment committee: B. Haugen (administrator), **C.M. Petrie (1st opponent)**, and X. Liu (2nd opponent).

Book Chapters:

1. N. Sridharan and **C.M. Petrie**, “Ultrasonic additive manufacturing” in ASM Handbook Volume 24: Additive Manufacturing Processes (2020), ASM International, Materials Park, OH.

Patent Applications:

1. D.C. Sweeney, A. Birri, and **C.M. Petrie**, “System and Method for Monitoring Fabry-Perot Cavity Displacements,” US Non-Provisional Patent Application No. 18/219,746, filed July 10, 2023, published January 11, 2024.
2. D.C. Sweeney, **C.M. Petrie**, K.R. Smith, and N.D. Ezell, “Mineral insulated cable adaptor to interface with printed circuit boards,” US Provisional Patent Application No. 63/404,676, filed September 8, 2022.
3. **C.M. Petrie**, P. Chesser, B. Betzler, R. Dehoff, K. Field, and K. Terrani, “3D-Printed Features on Nuclear Fuel Cladding for Optimized Heat Transfer,” US Non-Provisional Patent No. US 2022/0359094 A1, Application No. 17/728,3827, filed April 25, 2022, published November 10, 2022.
4. T.E. Blue, A. Birri, and **C.M. Petrie**, “Optical fiber-based gamma calorimeter (OFBGC),” US Non-Provisional Patent No. US 2021/0372957 A1, Application No. 17/213,432, filed March 26, 2021, published December 2, 2021.
5. D.C. Sweeney, **C.M. Petrie**, and A.M. Schrell, “Post-Processing Method to Extend the Functional Range of Optical Backscatter Reflectometry in Extreme Environments,” US Non-Provisional Patent No. US 2021/0348971 A1, Application No. 17/306,113, filed May 3, 2021, published November 11, 2021.
6. **C.M. Petrie**, B.C. Jolly, M.P. Trammell, and K.A. Terrani, “Embedding Sensors in 3D-Printed Silicon Carbide,” US Non-Provisional Patent No. US 2021/0230076 A1, Application No. 17/142,315, filed January 6, 2021, published July 29, 2021.
7. **C.M. Petrie**, D.C. Sweeney, and Y. Liu, “Metal-embedded optical fibers for monitoring pressure or corrosion at high temperatures,” US Non-Provisional Patent No. US 2021/0033479 A1, Application No. 16/865,475, filed May 4, 2020, published February 4, 2021, granted August 18, 2022.
8. **C.M. Petrie** and J.L. McDuffee, “Combined Liquid Level, Distributed Temperature Sensor, and Gamma Thermometer for In-Pile Sensing Applications,” US Provisional Patent Application No. 62/674,649, filed May 22, 2018.

Other Publications:

1. S. Cetiner, **C. Petrie**, V. Varma, N. See, E. Fountain, “Innovations in Instrumentation and Controls from the Transformational Challenge Reactor Program,” Nuclear News, August 2021.
2. **C. Petrie**, J. Harp, A. Nelson, “Accelerated Nuclear Fuel Testing in HFIR using the Miniature Fuel Samples,” Nuclear News, September 2019.
3. J. Ellis, “Chris Petrie: Instrumenting a change for nuclear energy,” Oak Ridge National Laboratory: News, May 30, 2019, <https://www.ornl.gov/news/chris-petrie-instrumenting-change-nuclear-energy>.
4. K. Linton, P. Edmondson, **C. Petrie**, C. Bryan, K. Terrani, “ORNL: Providing access to nuclear infrastructure, expertise,” Nuclear News, February 2018.