

George B. Ulrich



Program Manager - Radioisotope Power Systems Program
Group Leader – Alloy Behavior and Design Group
Materials Science & Technology Division
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6079
Phone: (865) 576-8497
Cell: (865) 567-8446
email: ulrichgb@ornl.gov

Professional Interest

Research, development, characterization, testing, and production of high temperature materials and components for compact power systems.

Experience

November 2014-present – Group Leader, Alloy Behavior and Design, Materials Science and Technology Division, Oak Ridge National Laboratory

- Group emphasis is on materials design and improved fundamental understanding based on advanced characterization (e.g. microstructural, mechanical, x-ray and neutron scattering), and modeling techniques utilizing computational thermodynamics and phase diagrams.
- Manage personnel providing expertise in computational modeling and design, synthesis and processing, mechanical and microstructural characterization, alloy design and selection for new structural and functional materials applications in extreme environments (cryogenic, high-temperature, radiation, high mechanical loading, oxidizing, and corrosive). Classes of materials include steels, stainless steels, iron and nickel base heat-resistant alloys and superalloys, lightweight metals, intermetallics, high entropy alloys, precipitation strengthened TRIP/TWIP alloys, refractory alloys, powder metals/oxide dispersion strengthened, and platinum group alloys. Laboratory facilities include melting, casting, heat treating, thermomagnetic and powder processing.

July 2013-present – Program Manager, Radioisotope Power Systems (RPS) Special Component Manufacturing and Testing Program, Materials Science and Technology Division, Oak Ridge National Laboratory - \$6M annual program

- Develop and manage technical direction and milestones, schedules, and budgets for fabrication, characterization, testing, and maintenance activities.
- Cultivate customer relationships with DOE NE-3 (Office of Nuclear Infrastructure), NASA, DOE-ORNL Site Office and security program customers as well as interact and collaborate with other national laboratories (LANL, INL, SNL) and contractors (University of Dayton Research Institute, Teledyne Energy Systems, Aerojet Rocketdyne, and others).

- Promote the ORNL role as the lead materials laboratory for the national RPS Program by continuing to develop, evaluate and produce high-temperature materials and fabricate these materials into heat source components for high-impact national/international missions.
- Perform succession planning/training for task managers, technicians, and craft persons to ensure program capability and continuity.

1996–June 2013 – Assistant Program Manager (2006 -2013) plus Task Manager for Clad Vent Set and Light Weight Radioisotope Heater Unit Manufacturing and Nuclear Launch Safety Tasks for RPS Materials, Production, and Technology Program, Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN - \$1.5M+ activities

- Prepared annual production plans including budget requests and milestones for task activities.
- Supervised personnel for hardware production and testing.
- Managed quality requirements for production, including maintenance and documentation of training and retraining of personnel, calibration of equipment, and records generation and storage.
- Prepared contributions to weekly, monthly and annual program reports.
- Managed purchase and receipt of materials, tooling, and equipment in accordance with quality and safety requirements.
- Created and maintained process procedures and equipment operating guidelines.
- Managed maintenance, upgrade, replacement, and safe operation of equipment as needed to ensure production capability.

1987–1996 – Engineer, Development/Clad Vent Set Manufacturing (CVS), Y-12 Plant, Oak Ridge, TN

- Clad Vent Set Manufacturing Experience: involved in all aspects of iridium alloy CVS manufacturing - including technology transfer from Mound Plant to Y-12 Plant as well as Y-12 Plant to Oak Ridge National Laboratory. Conducted studies and authored technical reports evaluating and characterizing various aspects of iridium alloy CVS manufacturing. Member of CVS and Blank and Foil Production Configuration Control Boards and Material Review Boards.
- Management Responsibilities: CVS Manufacturing Task (\$2.3M annually) Y-12 Plant Technical Leader for RPS Program. Principal Investigator for joint U.S./Russian project (\$1.1M) entitled “Advanced Recycling of Commingled Metals” for U.S. Department of Energy Initiatives for Proliferation Prevention Program. Identified, proposed, and managed implementation of \$920K weapon program cost savings. Division representative for weapon program. Production methods demonstration project leader. Co-op student supervisor.

1981-1990 – Production/Process Engineer, Y-12 Plant

- Product Metallurgist Duties: Ensured specification requirements were met for various materials including iridium, alloy and stainless steels, aluminum alloys, titanium alloys, iron, uranium alloys, tantalum, and other special materials.

- **Process Metallurgist Duties:** Ensured materials were properly processed through vacuum induction melting furnaces, 7500-, 1500-, 450-, or 35-ton hydraulic presses, 66"-wide 4-high rolling mill, foil rolling mill, hydroforms, rotary swaging machines and/or numerous heat treat facilities utilizing vacuum, inert, or air atmosphere, or salt baths. Responsible for developing, characterizing, and optimizing processes and material properties.
- **Liaison Metallurgist Duties:** Technical consultant - performed failure analyses and recommended alternative materials and processes. Extensive interaction with metal working, plating, machining, inspection/test, and assembly production personnel as well as vendor, design, development, and research personnel. Involved in \$7M forging procurement and \$1.5M equipment procurement. Temporary assignment with design group at Los Alamos National Laboratory, Los Alamos, New Mexico.

1977-1980 – Steel Metallurgist (Professional Practice Program), Republic Steel, Canton, Ohio

- **Lab Metallurgist: (Final Assignment)** Conducted feasibility analysis of replacing oil with an aqueous polymer quenchant for numerous alloy steels. Performed numerous metallurgical claim investigations.
- **Assistant Process Metallurgist: (Middle Assignments)** Performed studies in 8", 12" and 18" bar rolling mills, heat treat, and bar finish areas as well as cold strip and sheet mills.
- **Assistant Process and Product Metallurgist: (Early Assignments)** Performed studies in alloy and stainless steel electric melt shop and continuous casting facility with vacuum degassing unit and AOD vessel.

Education

B. S., Metallurgical Engineering (Professional Practice Program), University of Cincinnati, 1981

Activities/Honors

U. S. DOE Secretary of Energy Achievement Award for Mars Science Laboratory Multi-Mission Radioisotope Thermoelectric Generator

Registered Professional Engineer in the State of Tennessee (inactive status)

Member of ASM International

ORNL Significant Event Award for Clad Vent Set Manufacturing

Martin Marietta Award of Excellence for Technical Achievement

U.S. DOE Weapons Program Award of Excellence for Significant Program Cost Savings

U.S. DOE Weapons Program Award of Excellence for Project/Process Implementation

U.S. DOE Quality Improvement Award

Martin Marietta Energy Systems President's Award for Performance Improvement

Delta Tau Delta Fraternity Scholarship and Intramural Award

Mary Rowe Moore Admission with Distinction Award from the University of Cincinnati

Publications

1. Ulrich, G. B., Carmichael, C. A., Clark, A. M., Friske, B. R., Gallego, N. C., George, E. P., Kohlhorst, N. M., Miller, R. G., Muralidharan, G., Romanoski, G. R., and Veach, K. R., Jr., (June 2020), "Annual Technical Progress Report of Radioisotope Power Systems Special Component Manufacturing and Testing Program for October 1, 2018 through September 30, 2019," ORNL/TM-2020/1562, Oak Ridge National Laboratory, Oak Ridge, TN.
2. Ulrich, G. B., Carmichael, C. A., Friske, B. R., Gallego, N. C., Miller, R. G., Muralidharan, G., Muth, T. R., Pierce, D. T., and Romanoski, G. R., (May 2019), "Annual Technical Progress Report of Radioisotope Power Systems Special Component Manufacturing and Testing Program for October 1, 2017 through September 30, 2018," ORNL/TM-2019/1087, Oak Ridge National Laboratory, Oak Ridge, TN.
3. Romanoski, G., Lach, K., Monaghan, K., Clark, A., Gallego, N., and Ulrich, G., (February 2019), "An Investigation of the Rheological Behavior of Phenolic Resins Considered for Production of Carbon Bonded Carbon Fiber Insulation," Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Richland, WA.
4. Gallego, N., Romanoski, G., Clark, A., and Ulrich, G., (February 2019), "Evaluation of Alternative Fibers to Replace NARC-Rayon for the Production of CBCF," Nuclear and Emerging Technologies for Space, American Nuclear Society Topical Meeting, Richland, WA.
5. Robert Michael Wham, George Behrens Ulrich, Jacquelyn Candelaria Lopez-Barlow, Stephen Guy Johnson, Constant Rate Production: DOE Approach to Meeting NASA Needs for Radioisotope Power Systems for Nuclear-Enabled Launches, *American Journal of Aerospace Engineering*. Vol. 5, No. 2, 2018, pp. 63-70. doi: 10.11648/j.ajae.20180502.11
6. Johnson, S. G., Lopez-Barlow, J., Wham, R. M., Ulrich, G. B., (May 2018), "Integrated Program Plan for DOE Radioisotope Power Systems Constant Rate Production Program for October 2017 – September 2018," INL/LTD-18-45462, Idaho National Laboratory, Idaho Falls, ID.
7. Ulrich, G. B., Friske, B. R., Miller, R. G., Ohriner, E. K., Veach, K. R. Jr., Waked, R. R., (February 2018), "Annual Technical Progress Report of Radioisotope Power Systems Materials Production and Technology Program Tasks for October 1, 2013 through September 30, 2014," ORNL/TM-2017/746, Oak Ridge National Laboratory, Oak Ridge, TN.
8. Romanoski, G. R., Lach, K., Clark, A., Gallego, N., Adhikari, S., and Ulrich, G., (February 2018), "An Investigation of the Melt, Flow and Cure Behavior of Phenolic Resin During Processing of Carbon Bonded Carbon Fiber Insulation," ANS NETS 2018 - Nuclear and Emerging Technologies for Space, American Nuclear Society, Las Vegas, NV.
9. Barklay, C., Duckwitz, N., George, E., Hula, G., Johnson, S., Kramer, D., Lopez-Barlow, J., Miller, R., Mulford, R., Ulrich, G., Wingo, R., (January 2018), "Mars 2020 Iridium Safety Review Summary Report," INL-LTD-18-44322, Idaho National Laboratory, Idaho Falls, ID.
10. Schneibel, J. H., Miller, R. G., Carmichael, C. A., Fox, E. E., Ulrich, G. B., and George, E. P., (August 2017), "High Strain Rate Tensile Properties of Welded DOP-26," ORNL/TM-2017/276, Oak Ridge National Laboratory, Oak Ridge, TN.
11. Song, B., Nelson, K., Jin, H., Lipinski, R., Bignell, J., Ulrich, G., and George, E., (September 2015), "Dynamic High-Temperature Characterization of an Iridium Alloy in Tension," SAND2015-8380, Sandia National Laboratories, Albuquerque, NM and Livermore, CA.

12. Song, B., Nelson, K., Lipinski, R., Bignell, J., Ulrich, G., and George, E., (September 2015), "Dynamic High-Temperature Tensile Characterization of an Iridium Alloy with Kolsky Tension Bar Techniques," *Journal of Dynamic Behavior of Materials*, Volume 1, Issue 3, pp. 290-298.
13. Ulrich, G. B., Romanoski, G. R., Gallego, N. C., Contescu, C. I., Ohriner, E. K., Friske, B. R., Miller, R. G., Veach, and K. R., (2015), "Heat Source Component Manufacturing Qualifications for Radioisotope Power Systems at Oak Ridge National Laboratory," *Nuclear and Emerging Technologies for Space*, Albuquerque, NM.
14. Ulrich, G. B., (2014), "Annual Technical Progress Report of Radioisotope Power Systems Materials Production and Technology Program Tasks for October 1, 2012 through September 30, 2013," ORNL/TM-2014/542, Oak Ridge National Laboratory, Oak Ridge, TN.
15. Ulrich, G. B., Ohriner, E. K., Romanoski, G. R., Miller, R. G., Veach, K. R., Jr., Friske, B. R. and George, E. P., (2014), "Heat Source Component Production for Radioisotope Power Systems," *Proceedings of the Institute of Nuclear Materials Management 55th Annual Meeting*, Atlanta, GA.
16. Hemrick, J. G., Burns, Z. M., and Ulrich, G. B., (2014), "Thermomechanical Characterization and Analysis of Insulation Materials for Nuclear-Based Space Power Systems," *Proceedings of the Institute of Nuclear Materials Management 55th Annual Meeting*, Atlanta, GA.
17. Bo Song, Kevin Nelson, Ronald Lipinski, John Bignell, George Ulrich, and E. P. George, (2014), "Dynamic High-temperature Testing of an Iridium Alloy in Compression at High Strain Rates", *Strain*.
18. King, J. F. and Ulrich, G. B., (2013), "Annual Technical Progress Report of Radioisotope Power Systems Materials Production and Technology Program Tasks for October 1, 2011 through September 30, 2012," ORNL/TM-2013/176, Oak Ridge National Laboratory, Oak Ridge, TN.
19. Ohriner, E. K., Zhang, W., and Ulrich, G. B., (2012), "Analysis of Abrasive Blasting of DOP-26 Iridium Alloy," *International Journal of Refractory Metals and Hard Materials*, Vol. 35, pp. 122-126, Oak Ridge National Laboratory, Oak Ridge, TN.
20. Ohriner, E. K., Ulrich, G. B., Miller, R. G., and Zhang, W., (2011), Abstract for presentation, "Surface Processing of an Iridium Alloy for Control of Emissivity," *Symposium Refractory Metals Annual Meeting*, San Diego, CA.
21. Ulrich, G. B., and Longmire, H. F., (2010), "Metallurgical Evaluation of Grit Blasted Versus Non-Grit Blasted Iridium Alloy Clad Vent Set Cup Surfaces," ORNL/TM-2010/14, Oak Ridge National Laboratory, Oak Ridge, TN.
22. Ohriner, E. K., Zhang, W., and Ulrich, G. B., (2010), "Surface Processing of an Iridium Alloy," *TMS Annual Meeting*, Seattle, WA.
23. Ohriner, E. K., Sabau, A. S., Ulrich, G. B., and George, E. P., (June 2008), "Deformation Modeling of Iridium DOP-26 Alloy to Determine Potential for Secondary Recrystallization," *International Conference on Tungsten, Refractory, and Hard Materials VII Proceedings* pp. 9-35 through 9-56, Washington, DC.
24. Ohriner, E. K., Sabau, A. S., and Ulrich, G. B., (2007), "Plastic Straining of Iridium Alloy DOP-26 During Cup Sizing Operations," ORNL/TM-2007/169, Oak Ridge National Laboratory, Oak Ridge, TN.
25. McKamey, C. G., Lee, E. H., Ulrich, G. B., Wright, J. L., and George, E. P., (2002), "Grain Growth Behavior of DOP-26 Iridium Clad Vent Set Cups Used in Radioisotope Thermoelectric Generators," ORNL/TM-2002/15, Oak Ridge National Laboratory, Oak Ridge, TN.

26. Ulrich, G. B., (1999), "The Purchase/Processing of 6061-T6 Aluminum," Y/DV-1620, Oak Ridge Y-12 Plant, Oak Ridge, TN.
27. McGuire, D. J., Moore, J. P., Ohriner, E. K., and Ulrich, G. B., (1997), "Production of Iridium Alloy and Carbon-Bonded Carbon Fiber Components for the Cassini Mission to Saturn," ORNL-6933, Oak Ridge National Laboratory, Oak Ridge, TN.
28. Ulrich, G. B., (1996), "The Effects of Vent-Notch Area on Bulging and Thinning During the Clad Vent Set Closure-Weld Operation," Y/DV-1425, Oak Ridge Y-12 Plant, Oak Ridge, TN.
29. Ulrich, G. B., Miller, L. E., (1996), "Summary of Clad Vent Set Manufacturing Data for Cassini Missions," Y/DV-1424, Oak Ridge Y-12 Plant, Oak Ridge, TN.
30. Ulrich, G. B., Woods, A. T., Ohriner, E. K., (1996), "Clad Vent Set Cup Closure-Weld-Zone Grinding Evaluation," Y/DV-1410, Oak Ridge Y-12 Plant, Oak Ridge, TN.
31. Ulrich, G. B., (1995), "Examination of Frit Vent from Sixty-Watt Heat Source Simulant Fueled Clad Vent Set," Y/DV-1393, Oak Ridge Y-12 Plant, Oak Ridge, TN.
32. Ulrich, G. B., Berry, H. W., (1995), "Summary of Decontamination Cover Manufacturing Experience," Y/DV-1368, Oak Ridge Y-12 Plant, Oak Ridge, TN.
33. Ulrich, G. B., Ohriner, E. K., Woods, A. T., (1994), "Clad Vent Set Cup Bare-Forming Process Development," Y/DV-1357, Oak Ridge Y-12 Plant, Oak Ridge, TN.
34. Ulrich, G. B., Sherrill, M. W., (1994), "Clad Vent Set Cup Open End (Closure Weld Zone) Wall-Thickness Study," Y/DV-1353, Oak Ridge Y-12 Plant, Oak Ridge, TN.
35. Ulrich, G. B., (1994), "The Metallurgical Integrity of the Frit Vent Assembly Diffusion Bond," Y/DV-1321, Oak Ridge Y-12 Plant, Oak Ridge, TN.
36. Ulrich, G. B., (1994), "Clad Vent Set Dye Penetrant Indication Study," Y/DV-1318, Oak Ridge Y-12 Plant, Oak Ridge, TN.
37. Ulrich, G. B., (1992), "Mobile Multifunction Device Propeller Set Sample Production," Y/DV-1188, Oak Ridge Y-12 Plant, Oak Ridge, TN.
38. Ulrich, G. B., DeRoos, L. F., Stinnette, S. E., (1992) " Microindentation Hardness Evaluation of Iridium Alloy Clad Vent Set Cups," Y/DV-1153/R1, Preprint for 10th Symposium on Space and Nuclear Power and Propulsion the University of New Mexico of Albuquerque, NM, January 10-14, 1993.
39. Ulrich, G. B. (September 1991), "Metallurgical Evaluation of Iridium Alloy Clad Vent Set Cups," Heat-Resistant Materials, Proceedings of the First International Conference, Fontana, WI, pp. 187-195.
40. Ulrich, G. B. (1991), "Oak Ridge Y-12 Plant Clad Vent Set (CVS) Qualification Studies," Y/DV-1028, Oak Ridge Y-12 Plant, Oak Ridge, TN.
41. Ulrich, G. B. (1990), "Iridium Alloy Clad Vent Set Manufacturing Qualification Studies," Y/DV-977, presented at the 8th Symposium on Space Nuclear Power Systems Presented by The Institute for Space Nuclear Power Studies University of New Mexico, Albuquerque, NM, January 6-10, 1991.
42. Ulrich, G. B. and Stinnette, S. E., (1987) Letter Report, "Statistical Analysis of the B83 HP9-4-20 Mid Cases," Oak Ridge Y-12 Plant, Oak Ridge, TN.
43. Ulrich, G. B. and Stinnette, S. E., (1985), Letter Report, "Statistical Analysis of the Metallurgical Characteristics of the B83 HP9-4-20 Forward Cases," Oak Ridge Y-12 Plant, Oak Ridge, TN.