

James Gordon Hemrick
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Ceramic Engineer with over twenty years of experience in refractory and advanced ceramic research and development, development and evaluation of thermal insulation materials, thermo-mechanical testing of ceramic/metallic/polymer materials, powder processing and characterization, and mechanical evaluation and analysis of nuclear fuel cladding materials. Also has experience in leading multi-disciplined research teams, managing department and project budgets and resources, and assembling diverse research teams with both academic and industrial participation in response to funding solicitations. Has mentored undergraduate and graduate students, technicians, and junior staff as well as acted as a facilitator for government facility user programs.

WORK EXPERIENCE

Mechanical Properties and Mechanics Group, Material Science and Technology Division

Oak Ridge National Laboratory

June 2020 to present

Senior Research Staff Member

- Co-Investigator on Department of Energy (DOE) National Nuclear Security Administration (NNSA) sponsored programs to provide analysis and assessment of currently employed high-temperature mechanical testing methods and powder processing techniques, along with recommendations regarding new testing methods and analysis techniques and identification and review of associated literature to make recommendations to collaborators and the Program Manager for refinements, improvements and interpretations of measured responses and techniques.
- Provide leadership to establish Oak Ridge National Laboratory as a leading organization in the research and development of refractory ceramic materials for manufacturing and energy technologies through securing of funding for new refractory ceramic materials projects and by providing refractory ceramic expertise to existing on-going or proposed collaborative projects.

University of Alabama Birmingham

October 2016 to present

Adjunct Faculty Member

- Assist in the preparation of funding proposals and the carrying out of externally funded research projects for the university.
- Prepare and deliver classroom lectures related to ceramic materials, high temperature properties and processing, mechanical properties, heat flow, and manufacturing.
- Serve on graduate advisory committees, undergraduate research project advisement, and senior design project mentorship and review panels.

Reno Refractories, Inc.

January 2017 to June 2020

Technical Director

- Led company research group in the design of new refractory ceramic compositions for new and existing industrial customers and identify new industrial applications for current refractory materials. Additionally, led efforts to improve existing product lines and maintain product portfolio based on changing raw material supplies and quality.

- Oversaw physical, thermo-mechanical and corrosion testing, characterization, and analysis of new and existing refractory ceramic products.
 - Assisted in selection and quoting of products for customer applications, and oversaw field trials, installations and bake-outs of refractory products at customer sites.
 - Oversaw post-mortem analysis of field samples to identify failure mechanisms and suggest product improvements.
- Interfaced with industrial customers through written product literature and technical presentations concerning product features and benefits and theory behind the function and performance of product offerings.
- Managed research and laboratory staff and maintain department budget. (\$1.5M annual department budget)

Reno Refractories, Inc.

February 2015 to December 2016

Senior Research Engineer

- Designed, batched, and tested refractory ceramic compositions for iron and steel, nonferrous, cement, lime, aggregate production, and glass applications.
- Performed analysis on mechanical, thermal, chemical, and physical property data generated for quality control of existing products, development of new products, and post-mortem of samples from the field.
- Assisted in the selection and quoting of products for customer applications.
- Participated in field trials, installations and bake-outs of refractory products at customer sites.

Mechanical Properties and Mechanics Group, Material Science and Technology Division

Oak Ridge National Laboratory

January 2009 to January 2015

Research Staff Member

- Principal Investigator on Department of Energy (DOE) sponsored program leading academic and industrial partners in the development of novel refractory materials for high-temperature, high-alkaline environments. This project resulted in the development of spinel and alumino-silicate based gunnable refractory materials for aluminum furnaces, lime kilns, coal gasification facilities, and other high alkali environments that were validated through full-scale industrial trials and were commercially deployed in multiple industries.
- Principal Investigator on industrial sponsored project to develop new refractory materials and refractory coatings for commercial coal gasification facilities. Successfully developed and demonstrated spinel refractory material and coating system capable of extending lining lifetimes from seven months to multiple years.
- Principal Investigator on project sponsored by DOE to perform thermo-mechanical characterization of Microtherm insulation material. This project involved the development of new unique testing capabilities to evaluate the thermo-mechanical properties of insulation material to be used for an advanced Stirling radioisotope generator (ASRG) concept for space applications.
- Co-investigator with academic partner on DOE funded project to develop ultra-highperformance concrete and advanced manufacturing methods for modular construction of nuclear structures. This project built on previous work to develop and evaluate the bonding of mechanical performance of enamel coated rebar embedded in high performance concrete for nuclear and other structural applications and on work to

perform high temperature and thermal shock testing and analysis of ultra-high strength concrete materials for use in blast and fire applications.

- Principal investigator on project to develop additive manufacturing techniques and equipment for the production of net-shaped fully sintered ceramic parts. Initial work was focused on the construction of a system for the selective melting of ceramic powder utilizing simple oxide systems. Subsequent work was focused on the additive manufacturing of advanced ceramic systems for structural applications, high-wear applications, and ultra-high temperature environments (carbides and borides).
- Designed and oversaw testing of candidate metallic and advanced ceramic materials for nuclear fuel cladding applications. This included mechanical testing and analysis of irradiated and unirradiated samples, along with statistical evaluation and finite element modeling of material behavior and lifetime prediction. Results of testing were used for the qualification of ceramic, metallic, and composite systems for nuclear applications.

Mechanical Properties and Mechanics Group, Material Science and Technology Division

Oak Ridge National Laboratory

August 2004 to December 2008

Research Associate

- Principal Investigator on DOE sponsored project leading academic and industrial collaborators representing over 18 metal and refractory companies to develop multifunctional refractory materials for molten metal applications. This project resulted in the development of a composite lining system for the aluminum industry composed of a wear resistant, low wetting hot face material which provided increased corrosion and wear resistance at the metal line backed by a castable refractory which provided improved thermal insulation/secondary containment. Such lining systems were employed by several commercial aluminum companies following completion of the project.
- Principal Investigator on project sponsored by DOE in collaboration with industrial partner to determine the technical and economic feasibility of producing nano-scale interpenetrating phase composites (IPC's) for industrial refractory, vehicle brake, and armor applications. Under this project, new nano-scale materials composed of advanced ceramic and metallic phases were produced through novel processing methods, which possessed improved mechanical properties. Results led to additional funding and further collaboration with industry and academia.
- Principal Investigator on project sponsored by DOE to perform thermo-mechanical characterization of Min-K TE-1400 insulation material. This project involved the development of unique testing capabilities to evaluate the thermo-mechanical properties of insulation material to be used around radioisotope thermoelectric generators for space applications. The testing and evaluation performed under this project was used to qualify Min-K insulation for use in the power source for the Curiosity Rover that is currently on Mars.
- Principal Investigator on project sponsor by DOE to develop carbon-based materials for heat management applications. This project designed and successfully produced woven three-dimensional composite structures composed of graphite fiber, glass fiber, and metallic tubing for use as replacement heat exchangers in micro-turbines and fuel cell vehicles.

Mechanical Characterization and Analysis Group, Metals and Ceramics Division Oak Ridge National Laboratory

January 2002 to August 2004

Postdoctoral Fellow

- Collaborator, then project lead on efforts sponsored by DOE and private industry to identify and develop containment refractory materials for black liquor gasification. These projects resulted in the development of both primary and back up refractory linings for black liquor gasifiers, which improved the lifetime of refractory containment linings used in these units from two months to three years. Two US patents were awarded for both the primary and back up lining systems developed.
- Team member on project sponsored by DOE with industrial refractory and academic collaborators looking at fusion-cast spinel materials for glass crown refractory applications. This project resulted in the validation of fusion-cast spinel materials as a replacement for traditional silica refractory crowns in furnaces employing new higher efficiency oxy-fuel combustion systems, alleviating increased corrosion and high temperature wear issues.
- Performed mechanical testing and evaluation of foam materials, membrane materials, structural ceramics, composites, polymers, and metallic thin foil materials.

EDUCATION

Ph.D. Ceramic Engineering, University of Missouri – Rolla (2001)

MS Materials Science and Engineering, Georgia Institute of Technology (1999)

BS Ceramic Engineering (minor in mathematics), University of Missouri – Rolla (1997)

AWARDS AND HONORS

ACerS Global Ambassador Award (2021)

ACerS Fellow (2018)

ACerS Richard M. Fulrath Award (2016)

ASM International Silver Medal Award (2014)

National Academy of Engineers Indo-American Frontiers of Engineering Symposium Delegate (2014)

ORNL Significant Event Award for “Contribution to the development and production of components for the Multi-Mission Radioisotope Thermoelectric Generator that powers the Curiosity for the Mars Science Laboratory Mission” (2012)

ACerS/NICE Karl Schwartzwalder-Professional Achievement in Ceramic Engineering (PACE) Award (2011)

ASM International Oak Ridge Chapter Outstanding Service Award (2011)

PROFESSIONAL AFFILIATIONS

American Ceramic Society (Fellow)

(East Tennessee Section Chair 2021-2022)

(UNITECR Executive Board Member 2017-2025, Technical Chair 2021-2022)

(Ceramics and Glass Manufacturing magazine editorial advisory board 2019-present)

(ACerS Education and Professional Development Committee 2021-present)

(ACerS Strategic Planning and Emerging Opportunities Committee 2017-2018)

(ACerS Meetings Committee 2014-2018, Chair 2018)

(Manufacturing Division – Executive Board Member at Large 2018-2019, Program Committee 2020-present, Fellows Committee 2020-present)

(Refractory Ceramics Division – Editorial Committee Chair 2016-2017, Executive Board Member 2011-2012, Chair 2010, Vice Chair 2009, Secretary 2008)

(Inaugural Ceramics Expo Advisory Board Member 2013-2015)

(ACerS Energy Task Force 2010-2011)

ASM International

(National Nominating Committee 2016)

(National Volunteerism Committee 2012 to 2018 – Student Connections SubCommittee Chair 2015-2018)

(Oak Ridge Chapter – Executive Board Member at Large 2011, Long-Range Planning Chair 2010, Chair 2009, Vice Chair 2008, Treasurer 2007, Secretary 2006) (Co-organizer for local ASM Teachers Camp 2012-2014 and local ASM Industry Night 2010 and 2011)

AIST Member and Refractory Systems Technology Committee Member (2016-2020)

ASTM C8 Committee on Refractories

(C8.01 Strength of Refractories Sub-Committee chair)

Keramos Ceramic Honor Fraternity

University of Alabama Birmingham Material Science and Engineering Department Industrial Advisory Council Member (2016-2020)

Associate Editor for International Journal of Applied Ceramic Technology and International Journal of Ceramic Engineering and Science

PATENTS, PUBLICATIONS AND PRESENTATIONS (full list available upon request)

Four US Patents

Over sixty-five refereed publications

Over fifteen published technical reports

Two books edited and one book chapter written

Assisted in preparation or major revision of four ASTM Standards

Over twenty invited presentations given