

# James Gordon Hemrick

## PUBLICATIONS AND PRESENTATIONS

**Selected publications from over fifty refereed publications** (full list available upon request)

### Refractory Development and Testing

- J.G. Hemrick**, A. Rodrigues-Schroer, D. Colavito, J.D. Smith, and K. O'Hara, "Development and Deployment of Shotcrete Refractories for Aluminum Rotary Furnace Application," *Refractories World Forum*, Vol. 5, No. 1, January (2013).
- J.G. Hemrick**, B. Armstrong, J.D. Smith, K. O'Hara, A. Rodrigues-Schroer, and D. Colavito, "Novel Spinel-Family Refractories for High Temperature, High-Alkaline Environments," *Proceedings of the 48th Symposium on Refractories*, St. Louis, Missouri, March (2012).
- J.G. Hemrick**, R.B. Dinwiddie, E.R. Loveland, and A. Prigmore, "Development of a Test Technique to Determine the Thermal Diffusivity of Large Refractory Ceramic Test Specimens," *International Journal of Applied Ceramic Technology*, Vol. 9, Issue 1, January/February (2012).
- J.G. Hemrick**, B. Armstrong, A. Rodrigues-Schroer, D. Colavito, J. D. Smith, and K. O'Hara, "Development of Novel Spinel Refractories For Use in Coal Gasification Environments," *Proceedings of 28th Annual International Pittsburgh Coal Conference*, Pittsburgh, Pennsylvania, September (2011).
- J.G. Hemrick**, A. Rodrigues-Schroer, D. Colavito, and J.D. Smith, "Improved Furnace Efficiency Through the Use of Refractory Materials," *Light Metals 2011: Furnace Efficiency – Energy and Throughput*, TMS, March (2011).
- J.G. Hemrick**, J.R. Keiser, and R.A. Meisner, "Material Characterization and Analysis for Selection of Refractories Used in Black Liquor Gasification," *Materials Challenges in Alternative & Renewable Energy: Ceramic Transactions*, Volume 224, December (2010).
- J.G. Hemrick**, J.D. Smith, K. O'Hara, D. Colavito, and A. Rodrigues-Schroer, "Novel Spinel-Family Refractories for High-Temperature, High-Alkaline Environments," *Proceedings of the 2010 Advances in Refractories V, 5th International Symposium, The Michel Rigaud Symposium*, Vancouver, British Columbia, Canada, October (2010).
- J.R. Keiser, **J.G. Hemrick**, R.A. Meisner, P.J. Blau, and B.A. Pint, "Selection and Performance of Materials for Biomass Gasifiers", *Proceedings of the 2010 International Chemical Recovery Conference*, Williamsburg, Virginia, March (2010).
- J.G. Hemrick** and K.M. Peters, "Advanced Ceramic Composites for Molten Aluminum Contact Applications," *UNITECR' 09 Proceedings*, Salvador, Brazil, October (2009).
- J.G. Hemrick, J.D. Smith, and J. Damiano, "Novel Spinel-Family Refractories for High-Temperature, High-Alkaline Environments", *UNITECR' 09 Proceedings*, Salvador, Brazil, October (2009).
- J.G. Hemrick** and A.A. Wereszczak, "Non-Classical Creep Behavior of Fusion-Cast  $\alpha/\beta$  Alumina Refractories," *Refractory Applications Transactions*, Vol. 4, No. 1 (2009).
- J.G. Hemrick**, K.M. Peters, and J. Damiano, "Energy Saving Strategies for the Use of Refractory Materials in Molten Material Contact," *Energy Technology Perspectives: Conservation, Carbon Dioxide Reduction and Production from Alternative Sources*, TMS, February (2009).
- J.G. Hemrick**, W.L. Headrick, and K.M. Peters, "Development and Application of Refractory Materials for Molten Aluminum Applications," *International Journal of Applied Ceramic Technology*, Vol. 5, No. 3, (2008).
- J. Xu, X. Liu, E. Barbero, **J.G. Hemrick**, and M. Peters, "Wetting and Reaction Characteristics of  $Al_2O_3/SiC$  Composite Refractories by Molten Aluminum and Aluminum Alloy," *International Journal of Applied Ceramic Technology*, Vol. 4, No. 6, (2007).

- J.G Hemrick**, J. Xu, K. Peters, X. Liu, and E. Barbero, "Wetting and Reaction Characteristics of Al<sub>2</sub>O<sub>3</sub>/SiC Composite Refractories By Molten Aluminum and Aluminum Alloy," Mechanical Properties and Performance of Engineering Ceramics and Composites III, Ceramic Engineering and Science Proceedings, Vol. 28, Issue 2, (2007).
- J.G Hemrick**, J.R. Keiser, R.A. Peascoe, C.R. Hubbard, E. Lara-Curzio "Refractory Testing and Evaluation at Oak Ridge National Laboratory for Black Liquor Gasifier Applications," UNITECR' 05 Proceedings, Orlando, Florida, November (2005).
- J.G Hemrick**, V. Sikka, and W.L. Headrick "Multifunctional Refractory Materials for Molten Metal Contact Applications," UNITECR' 05 Proceedings, Orlando, Florida, November (2005).
- M. Velez, M. Karakus, X. Liang, W. L. Headrick, R. E. Moore, **J.G Hemrick**, and J. M. Almanza, "Evaluation of Crown Refractories Under Oxyfuel Environment," Advances in Fusion and Processing of Glass III, Ceramic Transactions, Vol. 141, (2004).
- H. Wang, **J.G. Hemrick**, R.B. Dinwiddie and M.K. Ferber, "Thermal Conductivity of Salvaged Fusion Cast Alumina Used in Glass Industry," Thermal Conductivity, Vol. 26, (2002).
- J.G Hemrick** and A.A Wereszczak, "Creep Measurement and Analysis of Refractories," Fundamentals of Refractory Technology, Ceramic Transactions, Vol. 125, (2001).

#### Mechanical Testing and Analysis

- J.G Hemrick** and E. Lara-Curzio, "Constitutive Model for the Mechanical Behavior and Stress Relaxation of 430 Stainless Steel and FeCrAlY Foams in Sulfur-bearing Environments," JOM, Vol. 65, No. 3, March (2013).
- J.G. Hemrick** and E. Lara-Curzio, "Probabilistic Failure Analysis for Wound Composite Ceramic Cladding Assembly," Proceedings of the 37th International Conference and Exposition on Advanced Ceramics and Composites, Daytona Beach, Florida, January (2013).
- G. Muralidharan, N.D. Evans, K.C. Liu, **J.G. Hemrick**, M.L. Santella, P.J. Maziasz, V.K. Sikka, and R.I. Pankiw, "Precipitation and Its Effects on the Creep Properties of Certain Cast H-Series Austenitic Steels," Proceedings of an International Conference on Solid-Solid Phase Transformations in Inorganic Materials 2005, Vol. 1, (2005).
- J.G Hemrick**, E. Lara-Curzio, K. Liu, and B. Min, "Mechanical Properties of Thermally Cycled Nylon Bonded Nd-Fe-B Permanent Magnets," Journal of Materials Science, Vol. 39, No. 21, (2004).
- A.A. Wereszczak, **J.G Hemrick**, T.P. Kirkland, J.A. Haynes, T.J. Fitzgerald, and J.E. Junkin, "Stress Relaxation of MCrAlY Bond Coat Alloys as a Function of Temperature and Strain", ASME Paper No.98-GT-403, Presented at International Gas Turbine and Aeroengine Congress and Exhibition, Stockholm, Sweden, June 2-5, (1998).

#### Thermal Insulation/Conduction Materials and Thermal Properties Evaluation

- J.G Hemrick**, E. Lara-Curzio, E.R. Loveland, K.W. Sharp, and R. Schartow, "Development and Testing of Prototype Ultra-light Weight Heat Exchangers Utilizing Graphite-based Woven Technology," Carbon, Vol. 49, Issue 14, November (2011).
- J.G Hemrick**, E. Lara-Curzio, and J.F. King, "Long-Term Temperature Gradient Stress Relaxation Testing and Modeling of Ceramic Insulation Materials," Mechanical Properties and Performance of Engineering Ceramics and Composites IV, Ceramic Engineering and Science Proceedings, Vol. 30, Issue 2, (2010).

**J.G Hemrick** and E.R. Loveland, “Technique Development for Large Sample Thermal Conductivity Measurement,” UNITECR’ 05 Proceedings, Orlando, Florida, November (2005).

**J.G Hemrick**, C.W. Kistler, A.A Wereszczak, M.K. Ferber, “Thermal Conductivity of Alumina Measured with Three Techniques,” Journal of Testing and Evaluation, Vol. 31, No. 4 (2003).

#### Materials Design and Development

K.R. Wilkerson, J.D. Smith, T.P. Sander, and **J.G Hemrick**, “Solid Solution Effects on the Thermal Properties in the MgAl<sub>2</sub>O<sub>4</sub>-MgGa<sub>2</sub>O<sub>4</sub> System”, Journal of the American Ceramic Society, Vol. 96, No. 3, March (2013).

currently available on-line at: (<http://onlinelibrary.wiley.com/doi/10.1111/jace.12125/pdf>)

X. Liu, J. Xu, M. A. Bright, **J.G Hemrick**, and E. Barbero, “Reactive Wetting of an Iron-Based Superalloy MSA2020 and 316 Stainless Steel by Molten Zinc Alloy,” TMS Metallurgical and Materials Transactions A, Vol. 39, No. 6, (2008).

S.D. Conzone, **J.G Hemrick**, and D.E. Day, “Glass Formation and Chemical Durability of Dysprosium Lithium Borate Glasses Intended for In-Vivo Radiation Synovectomy,” Glastechnische Berichte – The International Journal of Glass Science and Technology, Vol. 74, No. 2, (2001).

#### Rapid Prototyping

**J.G Hemrick**, T.L Starr, and D.W. Rosen, “Release Behavior for Powder Injection Molding in Stereolithography Molds,” Rapid Prototyping Journal, Vol. 7, No. 2, (2001).

#### **Book edited**

G. Oprea and **J.G Hemrick**, “2010 Advances in Refractories V, 5th International Symposium, The Michel Rigaud Symposium”, The Metallurgical Society of the Canadian Institute of Mining, Metallurgy and Petroleum, (2010).

#### **Book chapter written**

C.C. Harvey, W.L. Headrick, and **J.G Hemrick**, “Refractory Clays”, 7th Edition of Industrial Minerals and Rocks, Society of Mining and Metallurgy, (2006).

#### **Selected technical reports from over fifteen published** (full list available upon request)

##### Refractory and Insulation Material Development and Testing

**J.G. Hemrick**, J.D. Smith, K. O’Hara, A. Rodrigues-Schroer, and D. Colavito, “Novel Refractory Materials for High Alkali, High Temperature Environments,” ORNL Technical Report, ORNL/TM-2012/245, (2012).

**J.G Hemrick**, M. Hu, K.M. Peters, and B. Hetzel, “Nano-Scale Interpenetrating Phase Composites (IPC’S) for Industrial and Vehicle Applications,” ORNL Technical Report, ORNL/TM-2010/80, (2010).

JX. Liu, B. Kang, B. Gopalakrishnan, **J. Hemrick**, V. Sikka, and C. Irwin, “Multifunctional Metallic and Refractory Materials for Energy Efficient Handling of Molten Metals,” DOE Project Final Report, DE-FC36-04GO13038, (2009).

**J.G Hemrick**, E. Lara-Curzio, and J.F. King, “Characterization of Min-K TE-1400 Thermal Insulation,” ORNL Technical Report, ORNL/TM-2008/089, (2008).

J.R. Keiser and **J.G Hemrick**, “Improved Materials for High-Temperature Black Liquor Gasification,” ORNL Technical Report, ORNL/TM-2006/71, (2006).

M.K. Ferber, A.A. Wereszczak, **J.G Hemrick**, “Compressive Creep and Thermophysical Performance of Refractory Materials,” ORNL Technical Report, ORNL/TM-2005/134, (2006).

- J.G Hemrick**, H.W. Hayden, P. Angelini, R.E. Moore, and W.L. Headrick, “Refractories for Industrial Processing: Energy Reduction Opportunities,” Prepared for the DOE-EERE Industrial Technologies Program, (2005).
- W.L. Headrick, R.E. Moore, M. Karakus, X. Liang, M.K. Ferber, and **J.G Hemrick**, “Characterization and Structural Modeling of Magnesia Alumina Spinel Glass Tank Refractories,” DOE Project Final Report, DOEID14250FIN, (2003).
- J.G Hemrick**, A.A. Weresczack, M. Karakus, K.C. Liu, H. Wang, B.A. Pint, T.P. Kirkland, and R.E. Moore, “Compressive Creep and Thermomechanical Performance of Mullite Refractories,” ORNL Technical Report, ORNL/TM-2002/84, (2002).

#### Material Testing and Analysis

- JJ.J. Wang, **J.G Hemrick**, and F. Ren, “Basic Research on the Materials Characterization of Ultra-High Performance Concretes: High Temperature and Rapid Heating,” ORNL Technical Report, ORNL/TM-2012/162, (2012).

#### Nuclear Materials

- J.G Hemrick** and E. Lara-Curzio, “Probabilistic Failure Analysis for Wound Composite Ceramic Cladding Assembly,” ORNL Technical Report, ORNL/TM-2012/413, (2012).
- R.N. Morris, C.A. Baldwin, R. Battiste, J.M. Giaquinto, I.C. Gauld, **J.G Hemrick**, K.J. Leonard, H.F. Longmire, W.J. McAfee, J.K. McCoy, J. Myers, S.L. Voit, and Y. Yan, “MOX PIE Fuel and Clad Examination Final Report,” ORNL Technical Report, ORNL/MD/LTR-352 Rev 1, (2012).

#### **US Patent**

- R.A. Peascoe-Meisner, J.R. Keiser, **J.G. Hemrick**, C.R. Hubbard, J.P. Gorog, and A. Gupta, “MgAl<sub>2</sub>O<sub>4</sub> SPINEL REFRACTORY AS CONTAINMENT LINER FOR HIGH-TEMPERATURE ALKALI CONTAINING ENVIRONMENTS” (US Patent 7,438,004 issued 10/21/2008)

#### **Invited Presentations and Classes Taught**

- J.G. Hemrick**, A. Rodrigues-Schroer, D. Colavito, J.D. Smith, and K. O’Hara, “Development and Application of Improved Shotcrete Refractory for Aluminum Rotary Furnace Applications,” UNITECR 2013, Victoria, British Columbia, September (2013).
- J.G Hemrick**, J.D. Smith, K. O’Hara, A. Rodrigues-Schroer, and D. Colavito, “Refractory Materials based on Magnesia-Alumina Spinel for Improved Performance in Coal Gasification Environments,” 49th Symposium on Refractories, St. Louis, Missouri, March (2013).
- J.G Hemrick**, B. Armstrong, J.D. Smith, K. O’Hara, A. Rodrigues-Schroer, and D. Colavito, “Novel Spinel-Family Refractories for High Temperature, High-Alkaline Environments”, 48th Symposium on Refractories, St. Louis, Missouri, March (2012).
- J.G Hemrick**, “Refractory Ceramics, An Opportunity for Improved Energy Efficiency,” Oak Ridge Chapter of ASM International Technical Meeting and Awards Night, Knoxville, Tennessee, May (2010).
- J.G Hemrick**, “Refractory Ceramics,” unit for Materials Processing Class (MSE 370) , University of Tennessee, Knoxville, Tennessee, Spring (2010).
- J.G Hemrick**, “Refractory Ceramics, An Opportunity for Improved Energy Efficiency,” Chattanooga Engineers Club Technical Meeting, Chattanooga Convention Center, Chattanooga, Tennessee, January (2009).
- J.G Hemrick**, J.R. Keiser, R.A. Peascoe-Meisner, J.P. Gorog, and W. Ray Leary, “Material Characterization and Analysis for Selection of Refractories Used in Black

Liquor Gasification,” 44th Symposium on Refractories, St. Louis, Missouri, March (2008).

- J.G Hemrick**, R.B. Dinwiddie, E.R. Loveland, and A.L. Prigmore, “Use of IR Techniques to Determine Thermal Conductivity of Ceramic Insulation,” Materials Technology Institute (MTI) 94th TAC Meeting, Hilton Head, South Carolina, October (2007).
- J.G Hemrick** and S. Dillich, “DOE-EERE Industrial Technologies Program (ITP) and Refractory Related Efforts,” 43rd Symposium on Refractories, St. Louis, Missouri, March (2007).
- J.G Hemrick**, R.B. Dinwiddie, and E.R. Loveland, “Technique Development for Large Sample Thermal Conductivity Measurement of Refractory Ceramics,” 43rd Symposium on Refractories, St. Louis, Missouri, March (2007).
- J.G Hemrick**, E.R. Loveland, and E. Lara-Curzio, “Refractory Characterization, Analysis and Development at ORNL with Emphasis on Technique Development for Large Sample Thermal Conductivity Measurement,” American Petroleum Institute (API) 71st Spring Refining and Equipment Standards Meeting, Dallas, Texas, May (2006).
- J.G Hemrick**, “Refractory Ceramics, An Opportunity for Improved Energy Efficiency,” Oak Ridge Institute for Continued Learning (ORICL), Roane State Community College, Oak Ridge, Tennessee, Winter (2006).
- J.G Hemrick**, “Refractory Characterization Efforts at ORNL,” University of Missouri – Rolla, Ceramic Engineering Department Seminar Series, Rolla, Missouri, November (2000).