

# AMIT SHYAM

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## EDUCATION

**Michigan Technological University** 1997 – 2002

- PhD in Materials Science and Engineering
- GPA: 4.0 / 4.0

**Indian Institute of Technology (IIT), Kanpur** 1993 – 1997

- B.Tech in Materials and Metallurgical Engineering

## RESEARCH INTERESTS

- Structural materials
- Alloy design and Integrated Computational Materials Engineering
- Mechanical behavior of materials
- High temperature aluminum alloys

## EMPLOYMENT EXPERIENCE

### Oak Ridge National Lab (ORNL)

Oak Ridge, TN (Nov 2004 to present)

*Post-Doctoral Research Associate (Nov 2004 – Dec 2008)*

*Research Associate, R & D Staff, Senior R & D Staff Scientist (Jan 2009 – Present) in Alloy Behavior and Design Group*

- Lead Principal Investigator (PI) in multiple efforts
- Experienced in developing programs, writing proposals, interacting with customers and leading large multi-institution research teams

### University of Tennessee

Knoxville, TN (August 2015 to present)

*Assistant Professor, The Bredesen Center for Interdisciplinary Research and Graduate Education*

- Advise doctoral students

### Colorado School of Mines

Golden, CO (November 2017 to present)

*Affiliate Professor, Metallurgical and Materials Engineering*

- Advise doctoral students

### University of Michigan and Ford Research Laboratories

Ann Arbor, MI (Oct 2002 to Oct 2004)

*Post Doctoral Research Fellow*

- Developed an automated small fatigue crack growth detection system
- Studied and modeled the effect of temperature on small crack growth in a cast Aluminum alloy
- Developed fatigue testing system for superalloys at high temperature (600°C) and ultrasonic frequencies
- Mentored undergraduate and graduate students on their research projects
- Assisted in proposal writing and taught guest lectures

### Michigan Technological University

Houghton, MI (August 1997 to Sept 2002)

*Graduate Research Assistant*

- Dissertation Title: Deformation and Fatigue Behavior of the Nickel-Base Superalloy KM4
- Quantified fracture surface using stereomicroscopy and related it to deformation mechanisms
- Characterized planar slip using atomic force microscopy (AFM) and TEM
- Modeling of slip irreversibility, fracture surface roughness and fatigue crack propagation threshold
- Provided failure analysis consultancy to local companies

### Indian Institute of Technology

Kanpur, India (August 1996 to May 1997)

*Undergraduate Research Assistant*

- Thesis title: Growth during recrystallisation in boron doped Ni<sub>76</sub>Al<sub>24</sub>
- Other Research: Reaction synthesis of Iron Aluminides

## HONORS AND ACTIVITIES

- Technical Reviewer for – Acta Materialia; Nature Scientific Reports, Metallurgical and Materials Transactions A; Journal of Power Sources; Journal of the American Ceramic Society; Scripta Materialia; International Journal of Fatigue; Journal of Materials Science; JOM; Surface and Coatings Technology; Experimental Mechanics; Acta Biomaterialia; Materials Science and Engineering A; Optics and Lasers in Engineering; Journal of Pressure Vessel Technology; Journal of the European Ceramic Society; International Journal of Applied Ceramic Technology; ACS Nano; DOE Small Business Innovation Research (SBIR) Proposals; Naval Research Laboratory (NRL/ASEE); ORNL internal papers and proposals
- Team Lead - UT Battelle Award for Team Accomplishment for ACMZ Cast Al Alloys, September 2018
- TMS – EPD Materials Characterization Best Poster Award – Third Place – TMS Annual Meeting – Phoenix, March 2018
- R & D 100 Award Winner in 2017 for ACMZ Cast Aluminum Alloys – November 2017
- Journal Cover, Advanced Materials & Processes, October 2017
- Chair (2018-2019), Vice-chair (2017) and Secretary (2016) – Oak Ridge Chapter of ASM International
- Member – Mechanical Behavior of Materials Committee – TMS
- TMS/EPD Materials Characterization Best Poster Award – Third Place – March 2017
- Physical Sciences Directorate Professional Development Committee – ORNL – 2017
- ORNL Significant Event Award (SEA) - New High Temperature Cast Aluminum Alloys – December 2016
- ASM IIM Visiting Lecturer Award 2015
- ORNL Data Expert for LightMat Consortium
- Board of Review (Key Reader), Metallurgical and Materials Transactions E
- Member, SNS Target Advisory Panel for Analysis and Materials, May 2015
- Co-organizer, High-temperature Systems for Energy Conversion and Storage, TMS Annual Meeting, San Diego, February 2017
- Co-organizer, High-temperature Systems for Energy Conversion and Storage, TMS Annual Meeting, Nashville, February 2016
- Lead Editor, Special Issue of International Journal of Fatigue on Fatigue and Microstructure, December 2013.
- 2014 Excellence in Technology Transfer Award, FLC Southeast Region - SYMMETRIX® HPX-F Lithium-Ion Battery Nanocomposite Separator
- Poster Session Judge, 38th International Conference and Expo on Advanced Ceramics and Composites, Daytona Beach – January 2014
- Winner, 2013 TMS Micrograph Project
- R & D 100 Award in 2013 for SYMMETRIX® HPX-F Lithium-Ion Battery Nanocomposite Separator
- 2014 Award for Excellence in Technology Transfer by the Federal Laboratory Consortium (FLC) – SYMMETRIX® HPX-F Lithium-Ion Battery Nanocomposite Separator
- Co-organizer of Symposium on Materials Performance, THERMEC 2013 – December 2013
- International Scientific Committee, THERMEC 2013 – December 2013
- Co-organizer, High-temperature Systems for Energy Conversion and Storage, TMS Annual Meeting, Orlando, March 2015
- Materials Genome Initiative (MGI) Digital Data Community Development Team Member – TMS
- Finalist, The next big idea competition - ORNL - April 2014
- Oak Ridge Postdoctoral Symposium, Poster Session Judge, July 2014
- Poster Session Judge, 37th International Conference and Expo on Advanced Ceramics and Composites, Daytona Beach – January 2013
- Lead organizer, Fatigue and Microstructure: A Symposium on Recent Advances, MS&T 2011
- Co-organizer, ASM Educational Symposium on Innovations in Mechanical Testing, Oak Ridge, April 2011
- Journal Cover, Journal of the American Ceramic Society, July 2008
- Executive Committee Member, Oak Ridge Chapter of ASM International, 2007-2011
- Judge, Oak Ridge Chapter of ASM Scholarship, 2007
- Best Student Paper Award, Magnesium Technology 2005, Light Metals Division – TMS
- Finishing Fellowship, Michigan Technological University, Summer 2002
- Challenge Fellowship, Michigan Technological University, 1998 to Feb 2000
- Forging Achievement Award, Forging Industry Educational Research Foundation (FIERF), 1999
- Member, Honor Society of Phi Kappa Phi, 1999
- Award for Academic Excellence, Academic Senate, IIT Kanpur, 1996
- Member, The Minerals, Metals and Materials Society (TMS)
- Member, ASM International
- Member, The American Ceramic Society (ACerS)

## SELECTED ORNL PROJECTS

- *Propulsion Material Core Programs* – Co-PI/Thrust Lead. DOE, Office of Vehicle Technologies (VTO-EERE). Lead PI on project with total funding of \$30 million over 5 years (PI on projects totaling ~\$10 million in funding over 5 years)
- *Supercomputers to Superalloys* – PI on LDRD project that directly contributed to the successful proposal from VTO-EERE for the Propulsion Material Core Program (October 2016 – September 2018). \$0.9 million in funding.
- *Commercialization of ACMZ alloys* – PI on TIP project with General Motors as partner (\$190K in funding). January – December 2018.
- *High Performance Cast Aluminum Alloys for Next Generation Passenger Vehicle Engines* - A cooperative research and development agreement (CRADA) between ORNL, Chrysler and Nemak. DOE, Office of Vehicle Technologies. Lead PI on project with total funding - \$5.50 million.
- *Durability and reliability of substrates for solid oxide fuel cells (SOFCs)* – Funded at ORNL by the Solid State Energy Conversion (SECA) Program through a CRADA with LG Fuel Cell Systems (LGFCs) DOE, Office of Fossil Energy. Lead PI on project with total funding - \$ 2.35 million.
- *Remaining high cycle fatigue life prediction of main feedpump turbine blades* – Funded at ORNL by Electric Power Research Institute (EPRI). Lead PI on project.
- *High-Strength, Lightweight Engines for Heavy-Duty Diesel Trucks* – Co-PI on a cooperative research and development agreement (CRADA) between ORNL and Cummins Inc. DOE, Office of Vehicle Technologies. \$ 4.10 million.
- *Durability and reliability of solid oxide fuel cells (SOFCs)* – Funded at ORNL by the Solid State Energy Conversion (SECA) Program. DOE, Office of Fossil Energy.
- *Durability and reliability of diesel particulate filters* – A cooperative research and development agreement (CRADA) between ORNL, Cummins Inc and Corning Inc. DOE, Office of Vehicle Technologies.
- *Materials for High-Pressure Fuel Injection Systems* – A cooperative research and development agreement (CRADA) between ORNL and Caterpillar Inc. DOE, Office of Vehicle Technologies.
- *Materials for Advanced Turbocharger Designs* – A cooperative research and development agreement (CRADA) between ORNL and Honeywell. DOE, Office of Vehicle Technologies.
- *Mechanical characterization of materials for innovative levee strengthening systems* – A project with Jackson State University sponsored by the Department of Homeland Security.
- *High Temperature Materials Laboratory User Program* – Executed >10 projects as staff member in the HTML User Program.

## ARCHIVAL JOURNAL PUBLICATIONS

- D. Pierce, A. Haynes, J. Hughes, R. Graves, P. Maziasz, G. Muralidharan, **A. Shyam**, B. Wang, R. England and C. Daniel, “High Temperature Materials for Heavy Duty Diesel Engines: Historical and Future Trends” *Progress in Materials Science*, Volume 103, pp. 109-179, June 2019.
- P. Shower, J. R. Morris, D. Shin, B. Radhakrishnan, L. F. Allard and **A. Shyam**, “Temperature-dependent stability of  $\theta'$ -Al<sub>2</sub>Cu precipitates investigated with phase field simulations and experiments” *Materialia*, Volume 5, pp. 100185, March 2019.
- G. Bruno, M. Kachanov, I. Sevostianov and **A. Shyam**, “Micromechanical modeling of non-linear stress-strain behavior of polycrystalline microcracked materials under tension” *Acta Materialia*, Volume 164, pp. 50-59, February 2019.
- J. Wang, Y. Nobakht, J. D. Blanks, D. Shin, S. Lee, **A. Shyam**, H. Rezayat and S. Shin, “Machine Learning for Thermal Transport Analysis of Aluminum Alloys with Precipitate Morphology” *Advanced Theory and Simulations*, 1800196, January 2019.
- J. Wang, S. Shin, A. Y. Nobakht and **A. Shyam**, “Structural Deformation and Transformation of  $\theta'$ -Al<sub>2</sub>Cu Precipitate in Al Matrix via Interfacial Diffusion” *Computational Materials Science*, Volume 156, pp. 111–120, January 2019.
- S. Bahl, S. Dryepondt, L. F. Allard, S. Suwas and **A. Shyam**, “Retardation of small creep-fatigue crack in Gr. 91 steel through the combined effects of stress relaxation, microstructural evolution and oxidation” *Metallurgical and Materials Transactions A*, Volume 49, pp. 6110–6121, December 2018.
- E. Cakmak, N. Sridharan, S. V. Venkatakrisnan, H. Z. Bilheux, L. J. Santodonato, **A. Shyam** and S. S. Babu, “Feasibility Study of Making Metallic Hybrid Materials Using Additive Manufacturing”, *Metallurgical and Materials Transactions A*, Volume 49, pp. 5035–5041, October 2018.

- A. R. Moustafa, R. B. Dinwiddie, A. E. Pawlowski, D. A. Splitter, **A. Shyam** and Z. C. Cordero, "Mesosstructure and porosity effects on the thermal conductivity of additively manufactured interpenetrating phase composites" *Additive Manufacturing*, Volume 22, pp. 223-229, August 2018.
- A. S. Sabau, S. Mirmiran, C. Glaspie, S. Li, D. Apelian, **A. Shyam**, J. A. Haynes and A. F. Rodriguez, "Hot-tearing assessment of multicomponent non-grain refined Al-Cu alloys for permanent mold castings based on load measurements in a constrained mold" *Metallurgical and Materials Transactions B*, Volume 49, pp. 1267-1287, June 2018.
- B. R. Müller, R. C. Cooper, A. Kupsch, A. Lange, M. Wheeler, M. P. Hentschel, A. Staude, A. Pandey, **A. Shyam** and G. Bruno, "Stress-induced microcrack density evolution in  $\beta$ -eucryptite ceramics: experimental observations and possible route to strain hardening" *Acta Materialia*, Volume 144, pp. 627-641, February 2018.
- D. Shin, **A. Shyam**, S. Lee, Y. Yamamoto and J. A. Haynes, "Solute Segregation at the Al/ $\theta'$ -Al<sub>2</sub>Cu Interface in Al-Cu Alloys" *Acta Materialia*, Volume 141, pp. 327-340, December 2017.
- A. E. Pawlowski, Z. C. Cordero, M. R. French, J.K. Carver, T. R. Muth, R. B. Dinwiddie, A. M. Elliott, **A. Shyam** and D. A. Splitter, "Producing hybrid metal composites by combining additive manufacturing and casting" *Advanced Materials & Processes*, vol. 175, no. 7, pp. 16-21, October 2017 (**Invited feature article and cover page**).
- D. Shin, S. Lee, **A. Shyam** and J. A. Haynes, "Petascale Supercomputing to Accelerate the Design of High-Temperature Alloys", *Science and Technology of Advanced Materials*, vol. 18, no. 1, pp. 828-838, 2017 (**Invited article**).
- D. Shin, S. Roy, T. R. Watkins and **A. Shyam**, "Lattice Mismatch Modeling of Aluminum Alloys" *Computational Materials Science*, Volume 138, pp. 149-159, October 2017.
- A. E. Pawlowski, Z. C. Cordero, M. R. French, J.K. Carver, T. R. Muth, R. B. Dinwiddie, A. M. Elliott, **A. Shyam** and D. A. Splitter, "Damage-tolerant metallic composites via melt infiltration of additively manufactured preforms" *Materials & Design*, Volume 127, pp. 346-351, August 2017.
- R. C. Cooper, G. Bruno, M. Wheeler, A. Pandey, T. R. Watkins, **A. Shyam**, "Effect of microcracking on the uniaxial tensile response of  $\beta$ -eucryptite ceramics: experiments and constitutive model" *Acta Materialia*, Volume 135, pp. 361-371, August 2017.
- P. Shower, S. Roy, C. S. Hawkins, **A. Shyam**, "The Effects of Microstructural Stability on the Compressive Response of two Cast Aluminum Alloys up to 300°C", *Materials Science & Engineering A*, Volume 700, pp. 519-529, July 2017.
- S. Roy, L. F. Allard, A. Rodriguez, T. R. Watkins and **A. Shyam**, "Comparative evaluation of cast Aluminum alloys for automotive cylinder heads: Part I - Microstructure evolution", *Metallurgical and Materials Transactions A*, Volume 48, Issue 5, pp 2529-2542, May 2017.
- S. Roy, L. F. Allard, A. Rodriguez, W. D. Porter and **A. Shyam**, "Comparative evaluation of cast Aluminum alloys for automotive cylinder heads: Part II: Mechanical and thermal properties", *Metallurgical and Materials Transactions A*, Volume 48, Issue 5, pp 2543-2562, May 2017.
- R.C. Cooper, G. Bruno, Y. Onel, A. Lange, T. R. Watkins and **A. Shyam**, "Young's modulus and Poisson's ratio changes due to machining in porous microcracked cordierite", *Journal of Materials Science*, vol. 51, no. 21, pp. 9749-9760, November 2016.
- A. Pandey, R. Wheeler, **A. Shyam** and T. B. Stoughton, "Onset of Plasticity via Relaxation Analysis (OPRA)", *Experimental Mechanics*, vol. 56, no. 6, pp. 1095-1107, July 2016.
- **A. Shyam**, G. Bruno, T. R. Watkins, A. Pandey, E. Lara-Curzio, C. M. Parish and R. J. Stafford, "The effect of porosity and microcracking on the mechanical properties and thermal expansion of cordierite diesel particulate filter materials", *Journal of the European Ceramic Society*, vol. 35, no. 16, pp. 4557-4566, December 2015.
- R. Wheeler, A. Pandey, **A. Shyam**, T. Tan and E. Lara-Curzio, "Small scale mechanical characterization of thin foil materials via pin load microtesting", *Experimental Mechanics*, vol. 55, no. 7, pp. 1375-1387, September 2015.
- J. Shingledecker, **A. Shyam**, Y. Yamamoto and B. Kuhn, "Materials Research for Advanced Power Engineering in Europe: A Perspective on the 10th Liège Conference", *Advanced Materials & Processes*, vol. 173, no. 3, pp. 24-27, March 2015.
- A. Pandey, **A. Shyam**, Z. Liu and R. Goettler, "In-situ Young's Moduli of the Constitutive Layers in a Solid Oxide Fuel Cell", *Journal of Power Sources*, vol. 273, pp. 522-529, January 2015.
- G. Dwivedi, V. Viswanathan, S. Sampath, **A. Shyam** and E. Lara-Curzio, "Fracture toughness of plasma-sprayed thermal barrier ceramics: Influence of processing, microstructure, and thermal aging", *Journal of the American Ceramic Society*, vol. 97, no. 9, pp. 2736-2744, September 2014.
- **A. Shyam**, S. Hawkins, D. Erdman, R. England and G. Muralidharan, "Constrained thermal fatigue performance of several cast ferrous alloys", *Materials Science Forum*, vol. 783-786, pp. 2388-2393, May 2014.
- **A. Shyam**, P. J. Blau, T. Jordan and N. Yang, "Effect of submillimeter size holes on the fatigue limit of a high strength tool steel", *Fatigue and Fracture of Engineering Materials and Structures*, vol. 37, no. 4, pp. 368-379, April 2014.

- A. Pandey, **A. Shyam**, T. R. Watkins, E. Lara-Curzio, R. J. Stafford and K. J. Hemker, “The uniaxial tensile response of porous and microcracked ceramic materials”, *Journal of the American Ceramic Society*, vol. 97, no. 3, pp. 899-906, March 2014. (One of three **featured articles** in the issue (out of total of >50)).
- **A. Shyam**, S. K. Jha and M. J. Caton, “Preface to special issue on fatigue and microstructure”, *International Journal of Fatigue*, vol. 57, page 1, December 2013.
- **A. Shyam**, R. Trejo, D. McClurg, A. Ladouceur, M. Kirkham, X. Song, J. Howe and E. Lara-Curzio, “Microstructural evolution in two alkali multicomponent silicate glasses as a result of long-term exposure to solid oxide fuel cell environments,” *Journal of Materials Science*, vol. 48, no. 17, pp. 5880-5898, September 2013.
- Z. Chen, **A. Shyam**, J. Huang, R.F. Decker, S.E. LeBeau, and C.J. Boehlert,” The small fatigue crack growth behavior of an AM60 magnesium alloy,” *Metallurgical and Materials Transactions A*, vol. 44, no. 2, pp. 1045–1058, February 2013.
- R. Trejo, E. Lara-Curzio, **A. Shyam**, M. Kirkham, V. Garcia-Negron and Y. Wang, “Physical and mechanical properties of barium alkali silicate glasses for SOFC sealing applications,” *International Journal of Applied Glass Science*, vol. 3, no. 4, pp. 369–379, December 2012.
- **A. Shyam**, J. Muth and E. Lara-Curzio,” The elastic properties of  $\beta$ -eucryptite in the glassy and microcracked states,” *Acta Materialia*, vol. 60, no. 16, pp. 5867–5876, September 2012.
- G. Bruno, V. O. Garlea, J. Muth, A. M. Efremov, T. R. Watkins and **A. Shyam**, “Microstrain temperature evolution in  $\beta$ -eucryptite ceramics: Measurement and model,” *Acta Materialia*, vol. 60, no. 12, pp. 4982–4996, July 2012.
- **A. Shyam**, E. Lara-Curzio, A. Pandey, T. R. Watkins and K. L. More,” The thermal expansion, elastic and fracture properties of porous cordierite at elevated temperatures,” *Journal of the American Ceramic Society*, vol. 95, no. 5, pp. 1682–1691, May 2012.
- Y-S Chou, E.C. Thomsen, R.T. Williams, J.-P. Choi, N.L. Canfield, J.F. Bonnett, J.W. Stevenson, **A. Shyam**, E. Lara-Curzio, “Compliant alkali silicate sealing glass for solid oxide fuel cell applications: Thermal cycle stability and chemical compatibility,” *Journal of Power Sources*, vol. 196, no. 5, pp. 2709-2716, March 2011.
- T. Gordon, **A. Shyam** and E. Lara-Curzio, “The Relationship between Microstructure and Fracture Toughness for Fibrous Materials for Diesel Particulate Filters”, *Journal of the American Ceramic Society*, vol. 93, no. 4, pp. 1120-1126, April 2010.
- Y. Tan, **A. Shyam**, W. B. Choi, E. Lara-Curzio and S. Sampath, “Anisotropic elastic properties of thermal spray coatings determined via resonant ultrasound spectroscopy”, *Acta Materialia*, vol. 58, no. 16, pp. 5305-5315, September 2010.
- **A. Shyam** and E. Lara-Curzio, “A model for the formation of fatigue striations and its relationship with small fatigue crack growth in an aluminum alloy”, *International Journal of Fatigue*, vol. 32, no. 11, pp. 1843-1852, November 2010.
- E. L. Corral, J. Cesarano III, **A. Shyam**, E. Lara-Curzio, N. Bell, J. Stuecker, N. Perry, M. Di Prima, Z. Munir, J. Garay and E. V. Barrera, “Engineered nanostructures for multifunctional single-walled carbon nanotube reinforced silicon nitride nanocomposites” *Journal of the American Ceramic Society*, vol. 91, no. 10, pp. 3129-3137, October 2008. (Micrograph from this paper selected as **cover image** for July 2008 issue of this journal).
- **A. Shyam**, E. Lara-Curzio, T.R. Watkins and R. J. Parten, “Mechanical characterization of diesel particulate filter (DPF) substrates” *Journal of the American Ceramic Society*, vol. 91, no. 6, pp. 1995-2001, June 2008.
- **A. Shyam**, J. E. Allison, C. J. Szczepanski, T. M. Pollock and J. W. Jones, “Small fatigue crack growth in metallic materials: A model and its application to engineering alloys”, *Acta Materialia*, vol. 55, no. 19, pp. 6606-6616, November 2007.
- X. Zhu , **A. Shyam**, J.W. Jones, H. Mayer, J.V. Lasecki and J.E. Allison, “Effects of microstructure and temperature on fatigue behavior of E319-T7 cast aluminum alloy in very long life cycles” *International Journal of Fatigue*, vol. 28, no. 11, pp. 1566-1571, November 2006.
- **A. Shyam** and E. Lara-Curzio, “The double-torsion testing technique for determination of fracture toughness and slow crack growth behavior of materials: A review” *Journal of Materials Science*, vol. 41, no. 13, pp. 4093-4104, July 2006.
- **A. Shyam**, J. E. Allison and J. W. Jones, “A small fatigue crack growth relationship and its application to cast aluminum”, *Acta Materialia*, vol. 53, no. 5, pp. 1499-1509, March 2005.
- **A. Shyam** and W. W. Milligan, “A model for slip irreversibility, and its effect on the fatigue crack propagation threshold in a nickel-base superalloy”, *Acta Materialia*, vol. 53, no. 3, pp. 835-844, February 2005.
- **A. Shyam**, Y. N. Picard, J. W. Jones, J. E. Allison and S.M. Yalisove, “Small fatigue crack propagation from micronotches in the cast aluminum alloy W319”, *Scripta Materialia*, vol. 50, no. 8, pp. 1109-1114, April 2004.
- **A. Shyam** and W. W. Milligan, “Effects of deformation behavior on fatigue fracture surface morphology in a nickel-base superalloy”, *Acta Materialia*, vol. 52, no. 6, pp. 1503-1513, April 2004.
- **A. Shyam**, S. A. Padula II, S. I. Marras and W. W. Milligan, “Fatigue crack propagation thresholds in nickel-base superalloys at high frequencies and temperatures”, *Metallurgical and Materials Transactions A*, vol. 33A, no. 7, pp. 1949-1962, July 2002.

- J. K. Lee, M. Hiratani, K. Kalaitzidou and **A. Shyam**, "Coherency strain induced ordering in substitutional alloys", *Metals and Materials*, vol. 5, no. 6, pp. 519-523, December 1999.
- S. A. Padula II, **A. Shyam**, R. O. Ritchie and W. W. Milligan, "High frequency fatigue crack propagation behavior of a nickel-base turbine disk alloy", *International Journal of Fatigue*, vol. 21, no. 7, pp. 725-731, August 1999.
- A. K. Jena, **A. Shyam** and M. C. Chaturvedi: "Growth of recrystallising grains in boron doped Ni<sub>76</sub>Al<sub>24</sub>", *Materials Science and Technology*, vol. 15, no. 1, pp. 53-56, January 1999.
- **A. Shyam**, S. Suwas and S. Bhargava: "Microstructural features of iron aluminides formed by the reaction between solid iron and liquid aluminum", *Praktische Metallographie*, vol. 34, no. 6, pp. 264-277, June 1997.

## CONFERENCE PROCEEDINGS

- M. R. French, W. A. Yarberr III, A.E. Pawlowski, **A. Shyam**, D. A. Splitter, A. M. Elliott, J. K. Carver, Z. C. Cordero, "Hypervelocity Impact of Additively Manufactured A356/316L Interpenetrating Phase Composites" *2017 Solid Freeform Fabrication Symposium Proceedings* (SFF Symposium 2017).
- A. S. Sabau, S. Mirmiran, C. Glaspie, S. Li, D. Apelian, **A. Shyam**, J. A. Haynes and A. F. Rodriguez, "Hot-tearing of multicomponent Al-Cu alloys based casting load measurements in a constrained permanent mold" *TMS 2017 146<sup>th</sup> Annual Meeting & Exhibition Supplemental Proceedings*, pp. 465-473, February 2017.
- A. Sabau, W. D. Porter, S. Roy and **A. Shyam**, "Process simulation role in the development of new alloys based on integrated computational material science and engineering", in review, *Proceedings of the ASME 2014 International Mechanical Engineering Congress & Exposition*, Paper No. IMECE2014-37982, pp. V014T11A007, November 2014.
- **A. Shyam**, S. Hawkins, S. Roy, S. Dryepondt, D. Erdman and P. Maziasz, "The effect of steam on the elevated temperature high cycle fatigue life of Alloy 282" in *Proceedings: 10th Liege Conference : Materials for Advanced Power Engineering 2014*, Eds. J. Lecomte-Beckers, O. Dedry, J. Oakey, B. Kuhn, 2014, pp. 646-655.
- R. J. Stafford, K. B. Golovin, A. Dickinson, T. R. Watkins, **A. Shyam**, E. Lara-Curzio, "Comparison of Elastic Moduli of Porous Cordierite by Flexure and Dynamic Test Methods" in *Advances in Bioceramics and Porous Ceramics V*, John Wiley & Sons, Inc. 2012, pp. 197-203.
- **A. Shyam**, P. J. Blau, T. Jordan, N. Yang and M. J. Pollard, "The Very High Cycle Fatigue behavior of Tool Steel Materials" in the *Proceedings of the Fifth International Conference on High Cycle Fatigue*, Eds. C. Berger and H.-J. Christ, DVM, 2011, pp. 525-530.
- D. Kumar, B. A. Pint, S. Dryepondt, B. L. Armstrong, Y. Zhang, **A. Shyam**, J. A. Haynes and E. Lara-Curzio, "Performance of Diffusion Aluminide Coatings Applied On Alloy CF8C-Plus At 800°C," *Proceedings of Corrosion 2011*, NACE International, Document ID 11197, 2011.
- P. Davulis, **A. Shyam**, E. Lara-Curzio and M. P. da Cunha, "High Temperature Elastic Constants of Langatate from RUS Measurements up to 1100°C", *Proceedings of the 2008 IEEE International Ultrasonics Symposium*, Beijing, pp. 2150-2153.
- **A. Shyam**, E. Lara-Curzio, H-T Lin and R. Parten, "Fracture Toughness of Porous Cordierite", *Ceramic Engineering and Science Proceedings*, vol. 27, no. 2, pp. 75-81, 2007.
- **A. Shyam**, J. W. Jones and J. E. Allison, "On small fatigue crack growth in structural materials" *Proceedings of Fatigue 2006*, the 9th International Fatigue Congress, Atlanta (GA), 2006.
- **A. Shyam**, C. J. Torbet, C. J. Szczepanski, S. K. Jha, M. J. Caton, J. M. Larsen, T. M. Pollock and J. W. Jones, "Ultrasonic fatigue of a nickel-base turbine disk alloy at room and elevated temperatures" in *Materials Damage Prognosis*, J.M. Larsen, L. Christodoulou, J.R. Calcaterra, M.L. Dent, M.M. Deriso, W.J. Hardman, J.W. Jones and S.M. Russ, eds., TMS, Warrendale, PA, pp. 247-252, 2005.
- C. J. Szczepanski, **A. Shyam**, S. K. Jha, J. M. Larsen, C. J. Torbet, S. J. Johnson and J. W. Jones, "Characterization of the role of microstructure on the fatigue life of Ti-6Al-2Sn-4Zr-6Mo using ultrasonic fatigue" in *Materials Damage Prognosis*, J.M. Larsen, L. Christodoulou, J.R. Calcaterra, M.L. Dent, M.M. Deriso, W.J. Hardman, J.W. Jones and S.M. Russ, Eds., TMS, Warrendale, PA, pp. 315-320, 2005.
- **A. Shyam**, J.E. Allison and J.W. Jones, "Modeling small fatigue crack growth in cast aluminum alloys", *Proceedings of the 11<sup>th</sup> International Conference on Fracture (ICF 11)*, Alberto Carpinteri *et al.*, eds., CD-ROM Edition, Turin, Italy, March 20-25, 2005.
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- **A. Shyam**, C. J. Torbet, S. K. Jha, J. M. Larsen, M. J. Caton, C. J. Szczepanski, T. M. Pollock and J. W. Jones, "Development of ultrasonic fatigue for rapid, high temperature fatigue studies in turbine engine materials" in *Superalloys 2004*, K.A. Green *et al.*, eds., TMS, Warrendale, PA, pp. 259-268, 2004.
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- M. E. Lorimer, T. L. Ristau, and **A. Shyam**, "Measurement and computer modeling of the strain distribution in an aluminum forging", in Proceedings of the *22nd Forging Industry Technical Conference*, Lake Geneva, Wisconsin.
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- **A. Shyam**, D. Shin, G. Samolyuk, M. Eisenbach, J. Poplawsky, D. Ma and P. Shower, "Supercomputers to Superalloys", LDRD Final Report, February 2019.
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- J. Siefert, G. Pritchard, J. Parker, I. Perrin and **A. Shyam**, "Optimization of Advanced Steels for Cyclic Operation through an Integration of Material Testing, Modeling and Novel Component Test Validation", DOE Report (DOE-EPRI-FE0026260), September 2018.
- T. R. Watkins, **A. Shyam**, E. Lara-Curzio and R. Stafford, "Durability of Diesel Particulate Filters", CRADA Final Report (ORNL/TM-2016/698), November 2016.
- **A. Shyam** and J. Shingledecker, "Strain Induced Precipitation Hardening of Stainless Steels: Development of an Improved Test Method" EPRI Technical Update # 3002003361, December 2014.
- **A. Shyam**, A. Pandey and R. Goettler, "Durability and reliability of materials for application in SOFC", CRADA Final Report (ORNL/TM-2014/552), October 2014.
- B. Radhakrishnan, S. B. Gorti, S. Simumovic, R. M. Patton, W. H. Peter, Z. Feng, **A. Shyam** and R. R. Dehoff, "Integrated computational modeling and innovative processing to eliminate rare earths from wrought magnesium alloys", LDRD Final Report, December 2013.
- **A. Shyam** and S. Hesler, "Feedpump Turbine Blade Life Assessment: Phase 1 – Component Fatigue Testing" EPRI Report # 1026667 (ORNL/TM-2012/569), December 2012.
- P. J. Blau, **A. Shyam**, C. R. Hubbard, J. Y. Howe, R. M. Trejo, N. Yang and M. J. Pollard, "Materials for High-Pressure Fuel Injection Systems" CRADA Final Report (ORNL/TM-2011/401), October 2011.
- **A. Shyam** and E. Lara-Curzio, "Mechanical characterization of materials for innovative levee strengthening systems" SERRI Report 80009-01, ORNL/TM-2010/352, February 2011.
- P. J. Maziasz, **A. Shyam** and N. D. Evans, "Cast CF8C-Plus Stainless Steel for Turbocharger Applications" CRADA Final Report (ORNL/TM-2010/86), June 2010.
- M. A. Khaleel, B. Koeppe, K. Recknagle, E. Stephens, X. Sun, B. Nguyen, E. Lara-Curzio, **A. Shyam**, Y. Wang, J. Powers, R. Swayne, B. White, T. Shultz and W. Surdoval, "Solid Oxide Fuel Cell Design Guide" American Society of Mechanical Engineers (ASME), August 2009.

## PATENTS AND INVENTION DISCLOSURES

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- W. Surdoval, T. Shultz, E. Lara-Curzio, **A. Shyam**, R. Trejo, J. Muth, Y. Wang, B. Armstrong, J. Stevenson and Y.-S. Chou, “Engineered Glass Seals for Solid Oxide Fuel Cells” US Patent # 9,564,643, Issued February 7, 2017.
- B. Radhakrishnan, **A. Shyam** and C. M. Parish “Exploiting Acoustic Plasticity in the Processing of Intermetallics”, ORNL Invention Disclosure Number 201403338, May 2014.
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- B. Radhakrishnan, Z. Feng, W. H. Peter and **A. Shyam**, “Mechanically alloyed high performance magnesium alloys”, ORNL Invention Disclosure Number 201303055, April 2013.
- T. A. Burress, R. Balasubramaniam, **A. Shyam** and S. Simunovic, “Use of Acoustic Plasticity in Automotive Safety”, ORNL Invention Disclosure Number 201503473, March 2015.
- **A. Shyam**, Y. Yamamoto, D. Shin, S. Roy, J. A. Haynes, P. Maziasz, A. Rodriguez, J. A. Gonzalez, J. Talamantes, L. Zhang and C. Gaspie, “Cast aluminum alloys with improved microstructural stability and strength at 350°C” ORNL Invention Disclosure Number 201503569, July 2015.
- **A. Shyam**, Y. Yamamoto, D. Shin, S. Roy, J. A. Haynes, P. Maziasz, A. Sabau, A. Rodriguez, J. A. Gonzalez, J. Talamantes, L. Zhang, S. Mirmiran and C. Gaspie, “Cast Aluminum Alloys having Improved Microstructural Stability and Strength at 350 °C” ORNL Invention Disclosure Number 201603642, February 2016.
- **A. Shyam**, Y. Yamamoto, D. Shin, S. Roy, J. A. Haynes, P. Maziasz, A. Sabau, A. Rodriguez, J. A. Gonzalez, J. Talamantes, L. Zhang, S. Mirmiran and C. Gaspie, “Aluminum alloy compositions and methods of making and using the same” US Patent Application Number 15/160,926, Filed May 20, 2016.
- **A. Shyam**, Y. Yamamoto, D. Shin, J. A. Haynes, A. Sabau, A. Rodriguez, J. A. Gonzalez, S. Mirmiran and C. Gaspie, “Cast Aluminum Alloys Having Improved Hot Tearing Response” ORNL Invention Disclosure Number 201603804, November 2016.
- A. Pawlowski, Z. Cordero, **A. Shyam**, D. Splitter and A. Elliott, “Additive Manufactured Interpenetrating Phase Composite” ORNL Invention Disclosure Number 201703866, January 2017.
- **A. Shyam**, Y. Yamamoto, D. Shin, J. A. Haynes, A. Sabau, A. Rodriguez, J. A. Gonzalez, S. Mirmiran and C. Gaspie, “Aluminum alloy compositions and methods of making and using the same” US Patent Application Number 15/594,434, Filed May 12, 2017.
- **A. Shyam**, J. A. Haynes, A. Rodriguez, J. A. Gonzalez, S. Mirmiran, C. Gaspie and G. Black, “Heat Treatments for High Temperature Cast Aluminum Alloys and Components Fabricated from Them” ORNL Invention Disclosure Number 201703963, August 2017.
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- **A. Shyam**, Y. Yamamoto, D. Shin, J. A. Haynes, A. Sabau, A. Rodriguez, J. A. Gonzalez, S. Mirmiran and C. Gaspie, “Aluminum alloy compositions and methods of making and using the same” US Patent Application Number 15/594,434, Filed May 14, 2018.
- **A. Shyam**, J. A. Haynes and Y. Yamamoto, “High temperature cast aluminum alloys with improved ductility at lower temperatures” ORNL Invention Disclosure Number 201804221, August 2018

## **STUDENTS SUPERVISED**

- Post-doctoral Researchers
  - Sumit Bahl – January 2019 to present
  - Amit Pandey – October 2011 to October 2013 – Current position – ANSYS/Granta Design.
  - Shibayan Roy – November 2013 to November 2015 – Current position – Assistant Professor, Indian Institute of Technology, Kharagpur, India
  - Ryan Cooper – February 2014 to July 2016 – Current position – Assistant Professor in Residence, Mechanical Engineering, University of Connecticut
- Graduate Students
  - Brian Milligan (Colorado School of Mines – PhD) – September 2017 - present
  - Alexander Ladouceur (UT Knoxville - MS) – May 2010 – May 2011
  - Zach Ladouceur (UT Knoxville – BS+MS) – June 2011 – November 2014
  - Patrick Shower (UT Knoxville Bredesen Center – PhD) – January 2015 – present
- Technician Interns – Tyson Jordon (Pellissippi State Community College), Dana McClurg (Pellissippi State Community College), Rick Lowden (Pellissippi State Community College)

- Undergraduate Students – Joseph Muth (Purdue University), Cary Kuliasha (UT Knoxville), Zach Ladouceur (UT Knoxville), Marshall Ishmael (Rose-Hulman), Matthew Wheeler (Ohio State University), Brian Milligan (Colorado School of Mines), Phil Staublin (Michigan Technological University)

## **PRESENTATIONS**

- R. Wheeler *et al.* “Evolving Methods in the Measurement of Micromechanical Properties of Materials” **(Invited Presentation)** TMS Annual Meeting, San Antonio, March 2019.
- A. Shyam, D. Shin, P. Shower, L. Allard, J. Poplawsky, Y. Yamamoto, J. Morris and J. A. Haynes, “Mechanisms of Phase Stabilization in AlCuMnZr (ACMZ) Alloys” TMS Annual Meeting, San Antonio, March 2019.
- P. Shower, J. Morris, D. Shin and A. Shyam, “The Thermodynamic and Kinetic Effects of Microalloying Elements in Al-Cu Alloys” **(Invited Presentation)** TMS Annual Meeting, San Antonio, March 2019.
- B. Milligan, D. Ma, A. Shyam, A. Clarke, L. F. Allard and F. Coury, “Examining Deformation Mechanisms in Al-Cu Alloys with In-situ Neutron Diffraction” MS&T 2018, Columbus, October 2018.
- P. Shower, D. Shin, L. Allard, J. Morris, J. Poplawsky and A. Shyam, “ $\theta'$  to  $\theta$  Transformation in Al-Cu Alloys Investigated with Phase Field Simulations, Advanced Characterization, and Mathematical Analysis” MS&T 2018, Columbus, October 2018.
- A. Shyam, P. Shower, D. Shin, Y. Yamamoto, J. Morris, L. Allard, J. Poplawsky and J. A. Haynes, “Solute Interfacial Segregation as an Elevated Temperature Strengthening Mechanism in Precipitation Hardened Alloys” ICSMA 2018, Columbus, July 2018
- B. Milligan, A. Shyam, A. Clarke and D. Ma, “Observation and Modeling of Strain Hardening Anisotropy in Al-Cu Alloys” ICSMA 2018, Columbus, July 2018 (poster presentation).
- A. Shyam *et al.*, “Prevention of Coarsening Induced Phase Transformations in Al-Cu Alloys: Role of Interfaces” TMS Annual Meeting, Phoenix, March 2018.
- S. Bahl, S. Dryepondt, L. Allard, S. Suwas and A. Shyam, “Creep-oxidation-small Fatigue Crack Interaction in Grade 91 Steel” TMS Annual Meeting, Phoenix, March 2018.
- Z. Cordero, M. French, A. Pawlawski, D. Splitter and A. Shyam, “Additive Manufacturing of Periodic Metal-metal Composite” **(Invited Presentation)** TMS Annual Meeting, Phoenix, March 2018.
- D. Shin, S. Roy, T. R. Watkins and A. Shyam, “Lattice Mismatch Modeling of Aluminum Alloys” TMS Annual Meeting, Phoenix, March 2018.
- K. Unocic, A. Shyam, S. Dryepondt and P. Maziasz, “Effects of CO<sub>2</sub> on Fatigue and Creep Properties of the Ni-base Alloy 282” TMS Annual Meeting, Phoenix, March 2018.
- B. Milligan, D. Ma, L. Allard, A. Clarke and A. Shyam, “Impact of Microstructural Features on the Grain-orientation Dependent Strain Hardening and Softening Mechanisms in Al-Cu Alloy” TMS Annual Meeting, Phoenix, March 2018.
- P. Shower, J. Morris, D. Shin, B. Radhakrishnan, L. Allard, J. Poplawsky and A. Shyam, “A Phase Field Theory Based Study of the Role of Microalloying Elements in Determining the Microstructural Stability of Al-Cu Alloy” TMS Annual Meeting, Phoenix, March 2018.
- A. Pawlawski *et al.*, “Additive Manufacturing of Interpenetrating Phase Composites with Exceptional Damage-tolerance”, MS&T 2017, October 2017.
- T. R. Watkins *et al.* “Characterization of Aluminum Alloys for Cylinder Heads” Denver X-Ray Conference, August 2017.
- A. Sabau *et al.* “Hot-tearing of multicomponent Al-Cu alloys based casting load measurements in a constrained permanent mold” ICME 2017 Conference, Ypsilanti, May 2017.
- P. Shower *et al.* “The evolution of  $\theta'$  precipitates in an Al-Cu alloy investigated with Phase Field theory” (invited talk for Patrick in Gordon Research Seminar and Gordon Research Conference Poster 2017).
- D. Shin, A. Shyam and J. A. Haynes “High temperature cast aluminum alloys for next generation automotive engines” NASA JPL, Los Angeles, CA, April 2017.
- A. Shyam, D. Shin and J. A. Haynes “High temperature cast aluminum alloys for next generation automotive engines” SpaceX, Los Angeles, CA April 2017.
- A. Shyam, D. Shin, S. Roy, L. F. Allard Jr., Y. Yamamoto, T. R. Watkins and J. A. Haynes, “High temperature aluminum alloy development: computational thermodynamics and kinetics” **(Invited Presentation)** TMS Annual Meeting, San Diego, February 2017.
- S. Dryepondt, A. Shyam, S. Bahl, C. S. Hawkins and D. McClurg, “Creep-Fatigue-Oxidation Interactions under Fossil Energy Service Conditions” **(Invited Presentation)** TMS Annual Meeting, San Diego, February 2017.
- B. Milligan, S. Roy, C. S. Hawkins, P. Shower and A. Shyam, “Creep behavior of cast Aluminum-Copper alloys at 300°C” (Poster Presentation) TMS Annual Meeting, San Diego, February 2017.
- T. R. Watkins, A. Shyam, Y. Yamamoto, N. Sridharan, E. Cakmak, K. Unocic, R. Dehoff, S. Gorti, S. Simunovic and S. S. Babu, “Multiphase samples built by additive manufacturing” TMS Annual Meeting, San Diego, February 2017.

- A. Pandey, R. Wheeler, A. Shyam and T. Stoughton, "Elastic-Anelastic-Inelastic Boundaries in Materials for High Temperature Applications" TMS Annual Meeting, San Diego, February 2017.
- T. R. Watkins, S. Roy, L. F. Allard Jr., A. Shyam, D. Shin, and J. A. Haynes, "X-ray and microstructural study of a set of cast aluminum alloys" (Poster Presentation) TMS Annual Meeting, San Diego, February 2017.
- A. Shyam, D. Shin, S. Roy, A. Sabau, Y. Yamamoto, and J. A. Haynes, "An assessment of modeling tools for high temperature aluminum alloy development: The Good, the Bad and the Ugly" (**Invited Presentation**) TMS Annual Meeting, San Diego, February 2017.
- A. S. Sabau, S. Mirmiran, C. Glaspie, S. Li, D. Apelian, A. Shyam, J. A. Haynes, and A. F. Rodriguez, "Hot-tearing of multicomponent Al-Cu alloys based casting load measurements in a constrained permanent mold" TMS Annual Meeting, San Diego, February 2017.
- R. C. Cooper, G. Bruno, Y. Onel, A. Lange, T. R. Watkins, A. Shyam, "Young's Modulus and Poisson's ratio changes in machined porous microcracked cordierite" TMS Annual Meeting, San Diego, February 2017.
- P. T. Shower, B. Radhakrishnan, J. R. Morris and A. Shyam, "The evolution of  $\theta'$  precipitates in an Al-Cu alloy investigated with Phase Field theory" TMS Annual Meeting, San Diego, February 2017.
- D. Shin, S. Roy, L.F. Allard Jr., J. A. Haynes and A. Shyam, "Solute Segregation in Aluminum Alloys" TMS Annual Meeting, San Diego, February 2017.
- A. Shyam, "High temperature cast aluminum alloys for next generation automotive engines" Rice University, December 2016. (**Invited Presentation**)
- D. Shin, A. Shyam and J. A. Haynes, "Petascale Supercomputing to Accelerate the Design of High-Temperature Alloys" WMRIF 5th International Workshop for Young Scientists, Tsukuba, Japan, November 2016.
- T. R. Watkins, A. Shyam, Y. Yamamoto, N. Sridharan, E. Cakmak, K. Unocic, R. Dehoff, S. Gorti, S. Simunovic and S. S. Babu, "Multiphase samples built by additive manufacturing" Denver X-ray conference, August 2016.
- A. Shyam, "High performance cast aluminum alloys for next generation passenger vehicle engines" DOE Vehicle Technologies Annual Merit Review, Washington DC, June 2016.
- P. T. Shower, S. Roy, C. S. Hawkins, L.F. Allard Jr. and A. Shyam, "The high temperature compression response of Al 319-T7" TMS Annual Meeting, February 2016.
- A. Shyam, M. Sangid, S. Roy, S. Dryepontd, D. Saha and P. Maziasz, "The effect of microstructure and steam environment on the fatigue behavior of Alloy 282" (**Invited Presentation**) 7th International Conference on Creep, Fatigue and Creep-Fatigue Interaction, Kalpakkam, India, January 2016.
- R. C. Cooper, G. Bruno and A. Shyam, "Evolution of microcrack density under tensile loading in  $\alpha$ -eucryptite" MRS Fall Meeting, Boston, December 2015.
- S. Roy, B. Mazumder, L. F. Allard, D. Shin, T. R. Watkins and A. Shyam, "Crystallographic and compositional evolution of nano-scale precipitates in 206 aluminum alloy" (Poster Presentation) Gordon Conference on Physical Metallurgy, July 2015.
- P. T. Shower, S. Roy, C. S. Hawkins and A. Shyam, "Elevated temperature deformation response in a 319 aluminum alloy" (Poster Presentation) Gordon Conference on Physical Metallurgy, July 2015.
- A. Shyam, "High performance cast aluminum alloys for next generation passenger vehicle engines" DOE Vehicle Technologies Annual Merit Review, Washington DC, June 2015.
- S. Roy, L. F. Allard and A. Shyam, "Micro and meso-scale strength modeling of cast aluminum alloys" TMS Annual Meeting, Orlando, March 2015.
- R. C. Cooper, A. Pander, Z. R. Ladouceur, A. Shyam and T. R. Watkins, "Nonlinear and anisotropic mechanical response of porous microcracked ceramics" TMS Annual Meeting, Orlando, March 2015.
- R. C. Cooper, S. Roy, A. Sabau, C. S. Hawkins and A. Shyam, "Defect modeling and endurance limit prediction for cast aluminum alloys" (**Invited Presentation**) TMS Annual Meeting, Orlando, March 2015.
- M. Wheeler, A. Kinnard, R. C. Cooper, A. Shyam and A. Pandey, "Thermomechanical response of porous and microcracked ceramic materials" TMS Annual Meeting, Orlando, March 2015.
- R. C. Cooper, A. Pandey, R. J. Parten, E. Lara-Curzio, G. Bruno, A. Shyam and T. R. Watkins, "The effect of machining on the mechanical properties of porous microcracked cordierite" 38th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2015.
- R. C. Cooper, A. Pandey, Z. R. Ladouceur, A. Shyam and T. R. Watkins, "Nonlinear mechanics of porous microcracked ceramics" MRS Fall Meeting, Boston, December 2014.
- S. Roy, C. S. Hawkins, D. R. McClurg, G. Muralidharan and A. Shyam, "Microstructure-mechanical property correlation in several cast aluminum alloys", MS&T 2014, October 2014.
- A. Shyam, S. Roy, S. N. Dryepontd, P. J. Maziasz, M. D. Sangid and D. Saha, "Microstructural variables that affect the fatigue crack initiation location in a nickel-base superalloy at elevated temperature" (**Invited Presentation**) 51st Annual SES Technical Meeting, West Lafayette, October 2014.
- G. Muralidharan, M. P. Brady, A. Shyam, Y. Yamamoto, J. A. Haynes, R. Weldon, R. England, "New materials for high temperature exhaust manifolds" SAE commercial vehicle engineering congress, October 2014.
- A. Shyam, S. Hawkins, S. Roy, S. Dryepontd, D. Erdman and P. Maziasz, "The effect of steam on the elevated temperature high cycle fatigue life of Alloy 282" 10th Liege Conference on Materials for Advanced Power Engineering, Liege (Belgium), September 2014 (poster presentation).

- R. Wheeler, D. Bhattacharya, A. Pandey, A. Shyam, A. Shiveley and D. Sergison, "Structure-property investigations via SEM in-situ micromechanical testing" Microscopy & Microanalysis 2014, Hartford, August 2014.
- A. Shyam, "The thermomechanical behavior of porous microcracked ceramics" Materials and Chemistry Seminar Series, Oak Ridge National Laboratory, May 2014.
- A. Shyam, "The thermomechanical behavior of porous microcracked ceramics" Oak Ridge Chapter of ASM Seminar, Knoxville, May 2014.
- A. Pandey, A. Shyam, Z. Liu, R. Goettler and G. Agnew, "An overview of the mechanical properties of the thick substrate and thin active layers in a planar Solid-Oxide Fuel Cell (SOFC)" Fuel Cells 2014 Science & Technology, Amsterdam, April 2014.
- T.R. Watkins, A. Shyam, C. M. Parish and K. J. Wright, "Proposed mechanism for increase in the fracture toughness of porous SiC at elevated temperature" MRS Meeting, San Francisco, April 2014.
- A. Pandey, A. Shyam, Z. Liu and R. Goettler, "Elastic properties of thin ceramic multilayers in a solid oxide fuel cell" TMS Annual Meeting, San Diego, March 2014.
- M. Wheeler, A. Pandey, G. Bruno and A. Shyam, "The uniaxial tensile response of  $\beta$ -eucryptite with varying levels of microcracking: experiments and modeling" 37th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2014.
- A. Shyam, S. Hawkins, D. Erdman, R. England and G. Muralidharan, "Constrained thermal fatigue performance of several cast ferrous alloys" (**Invited Presentation**) THERMEC 2013, Las Vegas, December 2013.
- B. Radhakrishnan, A. Shyam, C. M. Parish, J. M. Miller and T. A. Burrell, "Development of Fe-6.5Si-B steels for electric vehicle applications" Advanced Power Electronics and Electric Motors R&D Meeting, Oak Ridge, November 2013.
- A. Pandey, A. Shyam, T. R. Watkins and K. J. Hemker, "Elastic Moduli of Porous and Microcracked Ceramics: Effect of Temperature and Loading" Mach Conference 2013, Annapolis (MD), April 2013. (Poster Presentation)
- A. Pandey, R. Wheeler and A. Shyam, "Microscale Observations on the Definitions of Elastic Limit and Yield Point" TMS Annual Meeting, San Antonio, March 2013. (Poster Presentation)
- A. Shyam, A. Pandey, Z. Feng, W. H. Peter, S. R. Agnew and B. Radhakrishnan, "The mechanical behavior of magnesium alloys subjected to severe plastic deformation" Magnesium Technology 2013, TMS Annual Meeting, San Antonio, March 2013. (Poster Presentation)
- A. Shyam, D. McClurg, A. Pandey, R. Trejo, A. Marquez, R. Lowden, E. Lara-Curzio and R. Goettler, "An overview of the mechanical behavior of solid oxide fuel cell substrates" (**Invited Presentation** to the symposium on Materials in Clean Power Systems VIII: Durability of Materials) TMS Annual Meeting, San Antonio, March 2013.
- A. Pandey, A. Shyam, E. Lara-Curzio, T. R. Watkins and R. J. Stafford, "Uniaxial tensile response of microcracked porous ceramics" 37th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2013.
- A. Shyam, D. McClurg, A. Pandey, R. Trejo, E. Lara-Curzio and R. Goettler, "The mechanical behavior of solid oxide fuel cell substrates in relevant environments" 37th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2013.
- G. Dwivedi, V. Viswanathan, A. Shyam, E. Lara-Curzio, S. Sampath, "Effect of microstructure on the fracture toughness of plasma sprayed thermal barrier coatings" 37th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2013.
- K. Hoff, G. Bruno, T. Montigny, X. Luo, A. Shyam, T. R. Watkins and R. J. Parten, "Influence of specimen preparation on the double torsion fracture toughness results for two extruded porous microcracked cordierite compositions" 37th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2013.
- A. Pandey, R. Wheeler, T. Tan, E. Lara-Curzio and A. Shyam, "Efficient Specimen Fabrication for In-situ Micromechanical Testing" MS&T 2012, Pittsburgh, October 2012.
- A. Pandey, A. Shyam, T. R. Watkins and E. Lara-Curzio, "The uniaxial stress-strain response of microcracked porous ceramics" Gordon Research Conference on Solid State Studies in Ceramics, South Hadley (MA), August 2012 (Poster Presentation).
- E. Lara-Curzio, A. Pandey, A. Shyam and T. R. Watkins, "Characterization of crack healing in porous ceramics due to thermal cycling" 4th International Congress on Ceramics (ICC4), Chicago, July 2012.
- A. Pandey, R. Wheeler, A. Shyam and E. Lara-Curzio, "Deformation behavior of Li-ion cell materials" Gordon Research Conference on Thin Films, Waterville (ME), July 2012 (Poster Presentation).
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- Z. Chen, A. Shyam, J. Huang, R. Decker, S. LeBeau and C. Boehlert, "The Small Fatigue Crack Growth Behavior of an AM60 Magnesium Alloy" MS&T 2011, Columbus, October 2011.
- A. Shyam, P. J. Blau, T. Jordan and N. Yang, "The fatigue behavior of high strength tool steel materials" MS&T 2011, Columbus, October 2011.
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- A. Shyam, R. M. Trejo, Y. Wang and E. Lara-Curzio, "Mechanical Properties of a Barium Silicate Glass Seal for Solid Oxide Fuel Cells (SOFC)" MS&T, Pittsburgh, October 2010.
- Y-S Chou, E. Thomsen, J-P Choi, N. Canfield, J. Bonnett, J. Stevenson, E. Lara-Curzio, A. Shyam, R. Trejo and Y. Wang "Evaluation of a compliant silicate-based sealing glass for solid oxide fuel cells" MS&T, Pittsburgh, October 2010.
- E. Lara-Curzio and A. Shyam, "Mechanical Properties of Porous Ceramics" MS&T, Pittsburgh, October 2010.
- D. Kumar, A. Shyam, P. J. Maziasz and E. Lara-Curzio, "Fatigue behavior of CF8C plus alloy in the temperature range of 600°C-900°C" MS&T, Pittsburgh, October 2010.
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- A. Shyam, J. T. Muth and E. Lara-Curzio, "Aspects of equivalence in the elastic properties of glasses and microcracked crystalline ceramics" MS&T, Pittsburgh, October 2010.
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- Y. Tan, A. Shyam, G. Dwivedi, D. Welch, E. Lara-Curzio and S. Sampath, "Elastic and Damping Properties of Plasma-sprayed Thermal Barrier Coatings", 34th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2010.
- T. R. Watkins, A. Shyam, E. Lara-Curzio and R. J. Stafford, "Microstructure and select mechanical properties of aluminum titanate diesel particulate filter (DPF) substrates" 34th International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2010.
- A. Shyam and E. Lara-Curzio, "Advanced Mechanical Characterization of Plasma Sprayed Thermal Spray Coatings" 2010 Fall Consortium Meeting and Workshop for Thermal Spray Technology in June 2010 in SUNY Stonybrook, June 2010.
- E. Lara-Curzio, A. Shyam, R. M. Trejo, D. R. McClurg, J. T. Muth, M. J. Kirkham and J. Y. Howe, "Reliability of Materials and Components for Solid Oxide Fuel Cells" 11th Annual SECA Workshop, Pittsburgh, July 2010.
- A. Shyam, R. M. Trejo, D. R. McClurg, J. T. Muth and E. Lara-Curzio, "Characterization of glasses for SOFC sealing applications" 11th Annual SECA Workshop, Pittsburgh, July 2010 (Poster Presentation).
- A. Shyam, D. R. McClurg, R. M. Trejo, A. J. Ladouceur, M. J. Lance, M. J. Kirkham and E. Lara-Curzio, "Effect of long-term exposure to Solid Oxide Fuel Cell (SOFC)-relevant environments on the microstructure, physical and mechanical properties of 8YSZ" Gordon Conference on Ceramics, New London, August 2010 (Poster Presentation). "The Effect of Porosity on the Mechanical Properties of Cordierite Diesel Particulate Filter Substrates", A. Shyam, E. Lara-Curzio, T. R. Watkins, R. J. Stafford and T. M. Yonushonis, 33rd International Conference on Advanced Ceramics and Composites, Daytona Beach, January 2009.
- "Microstructure-property relationships in diesel particulate filter (DPF) substrates", MS&T, Pittsburgh 2008 (with E. Lara-Curzio and T.R. Watkins).
- "Small fatigue crack growth modeling and its implications for worst-case life prediction", MS&T, Pittsburgh 2008 (with E. Lara-Curzio, J.W. Jones and J.E. Allison).
- "Determination of Elastic Properties of Solids at High Temperatures by Resonant Ultrasound Spectroscopy", in Ultra-High Temperature Ceramics: Materials for Extreme Environment Applications, Engineering Conferences International, Lake Tahoe 2008 (with M. Radovic, E. Lara-Curzio, M. Manisha, F. Pavia and M.W. Barsoum).
- "Cathode-Interconnect Interfacial Properties", 9<sup>th</sup> Annual SECA Workshop, Pittsburgh 2008 (with Edgar Lara-Curzio, Yanli Wang, Rosa Trejo, Beth Armstrong, John Henry, Claire Chisholm and Tom Watkins).
- "Reliability of Materials and Components for Solid Oxide Fuel Cells", DOE SECA Merit Review, Pittsburgh 2008 (with Edgar Lara-Curzio, Yanli Wang, Rosa Trejo and Beth Armstrong).
- "Durability of Diesel Engine Particulate Filters", DOE Office of Vehicle Technologies Merit Review, Washington DC 2008 (with Thomas Watkins, Edgar Lara-Curzio, Randy Stafford, Thomas Yonushonis and Cheryl Klepser).
- "Mechanical characterization of interfaces in SOFCs", 8<sup>th</sup> Annual SECA Workshop, San Antonio 2007 (with Edgar Lara-Curzio, Rosa Trejo, Scott Bell, Beth Armstrong and John Henry).
- "Fracture mechanical characterization of porous cordierite ceramics", MS&T, Detroit 2007 (with E. Lara-Curzio and T.R. Watkins).
- "Effect of thermal fatigue on the mechanical properties of Lead-Antimony-Silver-Tellurium (LAST) thermoelectric materials", MS&T, Detroit 2007 (with J.E. Ni, F. Ren, E.D. Case and E. Lara-Curzio).
- "Ceramic Particulate Filters", Diesel Engine-Efficiency and Emissions Research (DEER) Conference, Detroit, 2007 (with T. Yonushonis, R. Stafford, C. Klesper, T. Watkins and E. Lara-Curzio).
- "Fracture toughness of porous cordierite", 30th International Conference on Advanced Ceramics and Composites, Cocoa Beach, 2006 (with E. Lara-Curzio, H.-T. Lin and R. J. Parten).

- “Accelerated Development of High-Fatigue-Performance Cast Aluminum Alloys for Automotive Applications”, MS&T, New Orleans 2004 (with X. Zhu, Y.N. Picard, S.M. Yalisove, J.E. Allison and J.W. Jones).
- “Ultrasonic Fatigue of a Nickel-base Superalloy at Room and Elevated Temperatures”, MS&T, New Orleans 2004 (with C. J. Torbet, C. J. Szczepanski, A. Salem, T.M. Pollock, J.W. Jones, J.M. Larsen, S.K. Jha and M.J. Caton).
- “Characterization of the Role of Microstructure on the Fatigue Life of Ti-6Al-2Sn-4Zr-6Mo Using Ultrasonic Fatigue” MS&T, New Orleans 2004 (with C. J. Szczepanski, S. K. Jha, J. M. Larsen, C. J. Torbet, S. J. Johnson and J. W. Jones).
- “Ultrasonic Fatigue of Nickel-base Superalloys at Elevated Temperatures”, Superalloys 2004 (Poster Presentation).
- “Ultrasonic Fatigue of Nickel-base Superalloys at Elevated Temperatures”, Gordon Research Conference on Physical Metallurgy 2004 (Poster Presentation).
- “Fatigue of Structural Alloys for Engine Applications”, Oak Ridge National Lab, Oak Ridge 2004.
- “The Use of Accelerated Test Methods in Assessing the Very Long Fatigue Life of Structural Materials”, MS&T, Chicago 2003 (with J. W. Jones, J. M. Larsen, T. M. Pollock and J. E. Allison).
- “Determination of the Fatigue Behavior of Thixomolded® Magnesium AZ91D Using Ultrasonic Techniques”, MS&T, Chicago 2003 (with A. R. Moore, C. J. Torbet and J. W. Jones).
- “Fatigue Crack Initiation and Early Propagation Behavior from Micronotches in W319 Cast Aluminum Alloy”, MS&T, Chicago 2003 (with J. W. Jones, J. E. Allison, Y.N. Picard, S.M. Yalisove and H-H Liu).
- “The Use of Ultrasonic Fatigue in the Modeling of Very Long Fatigue Life”, TMS Annual Meeting, San Diego 2003 (with J. W. Jones and M. J. Caton).
- 7th National Turbine Engine High Cycle Fatigue Conference (Materials Session), West Palm Beach 2002.
- ASME Mechanics and Materials Conference (Fatigue of Advanced Materials Session), San Diego 2001.
- TMS Conference (Fatigue and Fracture of High Temperature Materials Session), St Louis 2000.
- TMS Conference (General Abstracts Session), Cincinnati 1999.