

Michael S. Kesler
Oak Ridge National Laboratory

Objective:

A research position focusing on processing, characterization and analysis in the field of physical metallurgy

Education:

2006-2011: Doctor of Philosophy in Materials Science and Engineering at the University of Florida

2003-2006: Bachelor's degree in Materials Science and Engineering at the University of Florida

Professional Experience:

R&D Associate (07/19-Present)

Alloy Behavior and Design Group of the Materials Science and Technology Division in the Thermomagnetic Processing Laboratory at Oak Ridge National Laboratory and Member of the Critical Materials Institute: A Department of Energy Hub (CMI)

- Magnetic Heating of Nanoparticles for DAC Sorbent Regeneration (LDRD)
- Induction-coupled Thermomagnetic Processing of Steel and Aluminum Alloys (AMO)
- Advanced Neutron Characterization Insert Development (AMO)
- Thermomagnetic Processing of Magnetic and Structural Materials (AMO/CMI)
- High Magnetic Field/High Heating Rate Thermal Analysis Technique Development (AMO/CMI)
- Alloy Development of Al-Ce alloys (AMO/CMI)
- Cast Heat Exchanger Using the Novel Al-Ce Alloy (BTO)
- Abnormal Grain Growth in Thermomagnetic Processed Materials (BES)
- Thermomagnetic Processing of Carbon Fiber (SEED)
- Casting Components for Magnet Gearbox (AMO/WPTO - CRADA)
- Direct Metal Write of Al-Ce Alloys (AMO - CRADA)

Postdoctoral Researcher (07/16-06/19)

Deposition Science and Technology Group of the Materials Science and Technology Division in the Advanced Processing Laboratory at Oak Ridge National Laboratory and Member of the Critical Materials Institute: A Department of Energy Hub

- Thermomagnetic Processing of Magnetic Materials (AMO/CMI)
- High Magnetic Field/High Heating Rate Calorimeter Technique Development (AMO/CMI)
- Direct Metal Writing of Al-Ce alloys (AMO/CMI)
- Alloy Development of Al-Ce alloys (AMO/CMI)
- Cast Heat Exchanger Using the Novel Al-Ce Alloy (BTO)
- Dual Phase Materials for Electric Motors (GE)
- Low-cost Phase Change Materials (BTO)

Postdoctoral Researcher (05/13-6/16)

The Materials Design and Prototyping Laboratory at the University of Florida

- Effects on microstructure and fatigue behavior of scribing marks necessary for improving automation and processing efficiency in weathering steels (FDOT)
- Self-Healing Metal-Matrix Composites (NASA)
- High Strength and High Temperature Shape Memory Alloys (NASA)
- Mentoring several undergraduate and graduate students

Adjunct Lecturer (08/12-05/13)

Department of Materials Science and Engineering at the University of Florida

- Undergraduate Lab Director (Classes: EMA 3080C and EMA 3013C)

Materials Characterization Instructor (01/12-06/16)

The Major Analytical Instrumentation Center (MAIC) at the University of Florida

- Operation, maintenance and training on an X-ray diffractometer, two transmission electron microscopes, environmental/conventional scanning electron microscopes, energy and wave length dispersive spectroscopy and electron backscattered diffraction systems for the MAIC at the University of Florida
- Data reduction and interpretation

- Preparation of training materials, instrument demos and formulation of SOPs for trained users

Transmission Electron Microscopy Laboratory Instructor (06/11-06/16)

- Instructed graduate students weekly on the basic principles and operation of the TEM JEOL 200CX (Class: EMA 6518L)

Scanning Electron Microscopy Laboratory Instructor (06/09-06/16)

- Instructed graduate students weekly on the basic principles and operation of the SEM JEOL 6400 and FEI xl-40 FEGSEM (Class: EMA 6507L)
- Conducted analysis of the structure of materials for reverse engineering projects (Class: EMA 3513C)

Mentoring

- Currently advise a Bredesen Center graduate student and a postdoc at ORNL.
- Advised and mentored several HERE, CCI, and SULI students at ORNL
- Advised and mentored many undergraduate students through the completion of their senior research
- Advised and mentored a high school student, Matthew Galbraith, for nine weeks as part of the Student Science Training Program (SSTP). He won first place in the program for, both, his paper and poster
- Advised two undergraduate students, Srishti Shrivastava and Emma Faulkner, in the REU Program

Publications:

- R.J. Lane, M.S. Kesler, K. Nawaz, R. Mirzaeifar, ***“Investigating the failure behavior of cast Al-11Ce-0.4 Mg alloys using in-situ scanning electron microscopy tensile testing”***, *Journal of Alloys and Compounds* 947, 169491 (2023).
- I.D. Khurjekar, B. Conry, MS Kesler, M.R. Tonks, A.R. Krause, J.B. Harley, ***“Automated, high-accuracy classification of textured microstructures using a convolutional neural network”***, *Frontiers in Materials* 10 (1) (2023).
- W. Yan, J. Melville, V. Yadav, K. Everett, L. Yang, M.S. Kesler, A.R. Krause, M.R. Tonks, J.B. Harley, ***“A novel physics-regularized interpretable machine learning model for grain growth.”****Materials & Design* 222, no. C (2022).
- Z.C. Sims, M.S. Kesler, H.B. Henderson, *et al.*, ***“How Cerium and Lanthanum as Coproducts Promote Stable Rare Earth Production and New Alloys”***, *Journal of Sustainable Metallurgy* (2022).
- M.S. Kesler, M.A. McGuire, B. Conner, *et al.* ***“A rapid heating and high magnetic field thermal analysis technique”***, *J Thermal Analysis and Calorimetry* 147, 7449–7457 (2022).
- B. Conry, J.B. Harley, M.R. Tonks, M.S. Kesler, A.R. Krause, ***“Engineering grain boundary anisotropy to elucidate grain growth behavior in alumina”***, *Journal of the European Ceramic Society*, **42**, 13, 5864-5873, (2022).
- J. Cui, J. Ormerod, D. Parker, *et al.*, ***“Manufacturing Processes for Permanent Magnets: Part I—Sintering and Casting”***, *JOM* 74, 1279–1295 (2022).
- J. Cui, J. Ormerod, D. Parker, *et al.*, ***“Manufacturing Processes for Permanent Magnets: Part II—Bonding and Emerging Methods”***, *JOM* 74, 2492–2560 (2022).
- D. Weiss, B. Murphy, M.J. Thompson, H.B. Henderson, O. Rios, G.M. Ludtka, A. Perron, M.S. Kesler, ***“Thermomagnetic Processing of Aluminum Alloys During Heat Treatment”***, *International Journal of Metalcasting* 15 (1), 49-59, 2021.
- E.E. Moore, P.E.A. Turchi, V. Lordi, D. Weiss, Z.C. Sims, H.B. Henderson, M.S. Kesler, O. Rios, S.K. McCall, A. Perron, ***“Thermodynamic Modeling of the Al-Ce-Cu-Mg-Si System and Its Application to Aluminum-Cerium Alloy Design”***, *Journal of Phase Equilibria and Diffusion* 41 (6), 764-783, 2020.
- X.B. Liu, M.S. Kesler, M.F. Besser, M.J. Kramer, M.A. McGuire, I.C. Nlebedim, ***“Effect of processing hydrogen pressure on magnetic properties of HDDR Nd-Fe-B magnet”***, *IEEE Transactions on Magnetics* 57 (2), 1-4, 2020.
- H.B. Henderson, E.T. Stromme, M.S. Kesler, Z.C. Sims, P. Chesser, B. Richardson, M.J. Thompson, L. Love, W. Peter, E. Morris, O. Rios, D. Weiss, ***“Additively manufactured single-use molds and reusable patterns for large automotive and hydroelectric components”***, *International Journal of Metalcasting* 14 (2), 356-364, 2020.

- C.R. Fisher, H.B. Henderson, M.S. Kesler, M.V. Manuel, ***“A Reactive Element Approach to Improve Fracture Healing in Metallic Systems”***, *Frontiers in Materials* 6, 210, 2019.
- M.S. Kesler, B. Jensen, L. Zhou, O. Palasyuk, T.H. Kim, M.J. Kramer, I. C. Nlebedim, O. Rios, M. A. McGuire, ***“Effects of High Magnetic Fields on Phase Transformations in Amorphous Nd₂Fe₁₄B”***, *Magnetochemistry* 5 (1), 16, 2018.
- M.S. Kesler, M.L. Neveau, W.G. Carter, H.B. Henderson, Z.C. Sims, D. Weiss, T.T. Li, S.K. McCall, M.E. Glicksman, O. Rios, ***“Liquid direct reactive interface printing of structural aluminum alloys”***, *Applied Materials Today* 13, 339-343, 1, 2018.
- C.R. Fisher, H.B. Henderson, M.S. Kesler, P. Zhu, G.E. Bean, M.C. Wright, J.A. Newman, L.C. Brinson, O. Figueroa III, M.V. Manuel, ***“Repairing large cracks and reversing fatigue damage in structural metals”***, *Applied Materials Today* 13, 64-68, 2018.
- M.A. McGuire, K.V. Shanavas, M.S. Kesler, D.S. Parker, ***“Tuning magnetocrystalline anisotropy by cobalt alloying in hexagonal Fe₃Ge”***, *Scientific reports* 8 (1), 14206, 2018.
- L. Zhou, T.H. Kim, B. Jensen, K. Sun, O. Palasyuk, I.C. Nlebedim, M.J. Kramer, M.A. McGuire, O. Rios, B.S. Conner, W.G. Carter, M.S. Kesler, ***“Microstructural Development in Melt-spun Nd₂Fe₁₄B Under High Magnetic Field Annealing”***, *Microscopy and Microanalysis* 24 (S1), 958-959, 2018.
- E.T. Stromme, H.B. Henderson, Z.C. Sims, M.S. Kesler, D. Weiss, R.T. Ott, F. Meng, S. Kassoumeh, J. Evangelista, G. Begley, O. Rios, ***“Ageless Aluminum-Cerium-Based Alloys in High-Volume Die Casting for Improved Energy Efficiency”***, *JOM* 70, 866-871, 2018.
- H.B. Henderson, V. Ramaswamy, A.E. Heid, M.S. Kesler, J.B. Allen, M.V. Manuel, ***“Mechanical and degradation property improvement in a biocompatible Mg-Ca-Sr alloy by thermomechanical processing”***, *Journal of the mechanical behavior of biomedical materials* 80, 285-292, 2018.
- L. Li, K. Jones, K. Jones, B. Sales, J.L. Pries, I.C. Nlebedim, K. Jin, H. Bei, B. Post M.S. Kesler, O. Rios, V. Kunc, R. Fredette, J. Ormerod, A. Williams, T.A. Lograsso, M.P. Paranthaman, ***“Fabrication of highly dense isotropic Nd-Fe-B bonded magnets via extrusion-based additive manufacturing”***, *Additive Manufacturing*, 2018.
- M.S. Kesler, S. Goyel, F. Ebrahimi, M.V. Manuel, ***“Effect of microstructural parameters on the mechanical behavior of TiAlNb (Cr,Mo) alloys with $\gamma+\sigma$ microstructure at ambient temperature”***, *Journal of Alloys and Compounds*, 695, 2672-2681, 2017.
- G.M. Ludtka, M.S. Kesler, H.B. Henderson, O. Rios, B.L. Murphy, ***“Demonstration of the Impact of Thermomagnetic Processing on Cast Aluminum Alloys”***, Oak Ridge National Lab (ORNL), Oak Ridge, TN, 2017.
- P. Zhu, Z. Cui, M.S. Kesler, J.A. Newman, M.V. Manuel, M.C. Wright, L.C. Brinson, ***“Characterization and modeling of three-dimensional self-healing shape memory alloy-reinforced metal-matrix composites”***, *Mechanics of Materials* 103, 1-10, 2016.
- M.S. Kesler, P. Feldtmann, E.S. George, S.M. Duke, and M.V. Manuel, ***“Effect of plasma marking on the fatigue properties of Grade 50W steel”***, *Journal of Materials in Civil Engineering*, *Accepted on January 7, 2016*.
- G.E. Bean, M. S. Kesler, M.V. Manuel, ***“Effect of Nb on phase transformations and microstructure in high Nb titanium aluminides”***, *Journal of Alloys and Compounds*, 613, 351-356, 2014.
- J.E.T. Channell, D.A. Hodell, V. Margari, L.C. Skinner, P.C. Tzedakis, M.S. Kesler, ***“Biogenic magnetite, detrital hematite, and relative paleointensity in Quaternary sediments from the Southwest Iberian Margin”***, *Earth and Planetary Science Letters*, 376, 99-109, 2013.
- J.E.T. Channell, C. Ohneiser, Y. Yamamoto, and M.S. Kesler, ***“Oligocene-Miocene magnetic stratigraphy carried by biogenic magnetite at sites U1334 and U1335 (equatorial Pacific Ocean)”***, *Geochemistry Geophysics Geosystems*, Vol. 14, 265-282, 2013.
- S. Goyel, O. Rios, M.S. Kesler, F. Ebrahimi, ***“Two-step nucleation of the γ -phase in a Ti-45Al-18Nb alloy”***, *Intermetallics*, Vol. 18, 2010.

- M.S. Kesler, S. Goyel, O. Rios, D.M. Cupid, H.J. Seifert, F. Ebrahimi, *"A study of phase transformation in a TiAlNb alloy and the effect of Cr addition"*, Materials Science and Engineering A, Vol. 527, 2857–2863, 2010.
- O. Rios, S. Goyel, M.S. Kesler, D.M. Cupid, H.J. Seifert and F. Ebrahimi, *"An Evaluation of High Temperature Phase Stability in Ti-Al-Nb System"*, Scripta Materialia, 2008.

Patents:

- *Aluminum-cerium-manganese alloy embodiments for metal additive manufacturing*
US Patent 11,608,546
March 21, 2023
- *Reactive matrix infiltration of powder preforms*
US Patent 11,565,318
January 31, 2023
- *Structural direct-write additive manufacturing of molten metals*
US Patent 11,535,912
December, 27, 2022
- *Production of Castable Light Rare Earth Rich Light Metal Alloys from Direct Reduction Processes*
U.S. Patent 111,365,463
Issued: June 21, 2022
- *High command fidelity electromagnetically driven calorimeter*
U.S. Patent 10,782,193
Issued: September 22, 2020
- *Enhanced anodization functionality in Al-rare earth element-based alloys*
US Patent App. 17/522,745
- *Rare earth element-aluminum alloys*
US Patent App. 16/927,787
- *Aluminum-fiber composites containing intermetallic phase at the matrix-fiber interface*
US Patent App. 16/203,881
- *Aluminum alloys with improved intergranular corrosion resistance properties and methods of making and using the same*
US Patent App. 16/132,231
- *Rapidly solidified aluminum-rare earth element alloy and method of making the same*
US Patent App. 15/901,759

Awards:

- **TechConnect Innovation Award**, Al-Ce Alloys for Additive Manufacturing
- **R&D100 Award**, ACE: Ageless Aluminum Revolution
- **NASA Group Achievement Award**: Shape Memory Alloy Self-Healing Technology Team

Presentations:

- **TMS annual meeting 2023: The Effect of Thermomagnetic Processing on the Properties and Microstructure of Aluminum and Ferrous Alloys**, Michael S. Kesler, et al
- **Colorado School of Mines Graduate School Seminar: Fereshteh Ebrahimi Memorial Lecture Series, Invited, Induction Coupled Thermomagnetic Processing: A Path Towards Enhanced Materials Properties and Energy Efficient Manufacturing**, Michael S. Kesler.
- **AMO Thermal Process Intensification: Invited, Development of High Energy Density Thermomagnetic Processing Technology for Intensification of Industrial Heat-Treatment and Increased Material Performance**, Virtual Workshop Series (Nov. 9th, 2020 @12-2pm) Michael S. Kesler.
- **CMI annual meeting 2020: Enhancing HDDR Powders**, Virtual, Michael S. Kesler, Ikenna C. Nlebedim.

- ***TMS annual meeting 2020: Invited, Processing and Calorimetry of Alnico in High Magnetic Fields.*** Michael S. Kesler, Xubo Liu, Lin Zhou, Ikenna C. Nlebedim, Matthew Kramer, Orlando Rios, Michael A. McGuire.
- ***EUROMAT 2019: A New Rapid Heating and High Magnetic Field Thermal Analysis Technique,*** Michael S. Kesler, Orlando Rios, Michael A. McGuire, Bart Murphy, Hunter B. Henderson, Gerard M. Ludtka, Ben Conner.
- ***EUROMAT 2019: Design and Fabrication of a Test Apparatus for Thermal Cycling and Property Measurement of Phase Change Materials (PCMs) Using the T- History Method,*** Tim J. LaClair, Tony Gehl, Kyle Gluesenkamp, Jason Hirschey, Orlando Rios, Yuzhan Li, Navin Kumar, Michael S. Kesler.
- ***TMS annual meeting 2019: Effect of Magnetic Field Processing on CeCo-x Bulk Cast Magnets.*** Michael S. Kesler, Andriy Palasyuk, Ryan Ott, Ikenna C. Nlebedim, Olena Palasyuk, Hunter B. Henderson, Orlando Rios, Matthew J. Kramer, Michael A. McGuire.
- ***CMI winter meeting 2019: Thermomagnetic processing and differential scanning calorimetry of magnet materials.*** Michael S. Kesler, Brandt Jensen, Ikenna C. Nlebedim, Olena Palasyuk, Andriy Palasyuk, Lin Zhou, Orlando Rios, Matthew J. Kramer, Michael A. McGuire.
- ***MS&T fall meeting 2018: Thermomagnetic Processing and Differential Scanning Calorimetry of Permanent Magnet Materials.*** Michael S. Kesler, Orlando Rios, Brandt Jensen, Ikenna C. Nlebedim, Scott K. McCall, Alexander Baker, Matthew J. Kramer, Lin Zhou, Michael A. McGuire.
- ***TMS annual meeting 2018: Microstructural Effects of Thermomagnetic Processing in Nd₂Fe₁₄B-based Permanent Magnet Materials.*** Michael S. Kesler, Brandt Jensen, Lin Zhou, Olena Palasyuk, Kewei Sun, Kevin Dennis, Ben Conner, William G. Carter, Orlando Rios, Matthew J. Kramer, Ikenna C. Nlebedim, Michael A. McGuire.
- ***CMI winter meeting 2017: Thermomagnetic processing and differential scanning calorimetry of NdFeB and SmCo magnet materials.*** Michael S. Kesler, Orlando Rios, Ikenna C. Nlebedim, Scott K. McCall, Matthew J. Kramer, William G. Carter, Michael A. McGuire.
- ***SEMS meeting 2016: Invited, Multi-scale characterization methods facilitating alloy design.*** Michael S. Kesler, Orlando Rios, Damian M. Cupid, Hans J. Seifert, Fereshteh Ebrahimi and Michele V. Manuel.
- ***TRB annual meeting 2016: The Effect of Scribing Marks on the Fatigue Properties of Weathering Steel.*** Michael S. Kesler, Peter Feldtmann, Edward S. George, Steve M. Duke, and Michele V. Manuel.
- ***TMS annual meeting 2015: Role of Precipitate Chemistry and Morphology on the Mechanical and Phase Transformation Behavior in a NiTiHfAl Shape Memory Alloy.*** Michael S. Kesler, Derek Dai Hsu, Amanda Varela, Brandon Saraydar, Oscar Figueroa III, B. Chad Hornbuckle, Gregory B. Thompson, John A. Newman, and Michele V. Manuel.
- ***MS&T annual meeting 2010: Mechanical properties of TiAlNb(Cr,Mo) alloys with γ -TiAl + σ -Nb₂Al microstructure.*** Michael S. Kesler, Sonalika Goyel and Fereshteh Ebrahimi.
- ***TMS annual meeting 2009: Beyond Near-Gamma Alloys: Development of γ + σ Alloys.*** Fereshteh Ebrahimi, Michael S. Kesler, Sonalika Goyel, Hans J Seifert.
- ***Gordon Research Conference: Physical Metallurgy 2009: The Effect of Microstructure on the Mechanical Properties of γ + σ Alloys at Ambient Temperature.*** Michael S. Kesler, Sonalika Goyel, Orlando Rios, Fereshteh Ebrahimi.
- ***MRS Fall meeting 2008: Effect of Microstructural Parameters on Toughness of Ti-Al-Nb-Cr Alloys.*** Michael S. Kesler, Sonalika Goyel, Orlando Rios, Hans J. Seifert and Fereshteh Ebrahimi.
- ***TMS annual meeting 2007: Development of TiAl-Based Alloys for High Temperature Applications.*** Fereshteh Ebrahimi, Sonalika Goyel, Michael S. Kesler, Orlando Rios, Hans J. Seifert.

Research Areas and Interests:

- Microstructure-properties relationships
- Phase transformation
- Mechanical testing

- Thermomechanical testing
- Thermomechanical processing
- Thermomagnetic processing
- Additive manufacturing
- Alloy development
- Permanent magnet processing

Characterization Expertise:

- Transmission electron microscopy (TEM, STEM, HR-TEM, SADP, HAADF)
- Scanning electron microscopy (SEM) with electron backscatter diffraction and energy dispersive spectroscopy (EDS/EBSD)
- Environmental (variable pressure) scanning electron microscopy (VP-SEM)
- Electron probe microanalysis (EPMA)
- Differential Thermal Analysis and Differential Scanning Calorimetry (DTA/DSC)
- Magnetic Field Extreme Rate Thermal Analyzer (ORNL Patented Technique)
- X-ray diffraction (XRD)
- Neutron diffraction analysis (SANS, USANS, PDF)
- Custom In-situ Neutron/TMP Characterization Insert
- Optical Microscopy
- Micro- and nanoindentation

Research Skills:

- Metallographic sample preparation
- Induction heating/melting
- Focused ion beam micromachining (FIB)
- Vacuum systems
- Arc melting
- Sand casting, die casting, and high pressure die casting (HPDC)
- Extrusion
- Machining
- Encapsulation techniques

Professional Activities:

- The Minerals, Metals & Materials Society and The Materials Society (TMS/ASM)
- TMS Committee Member: Aluminum Committee; Magnetic Materials Committee
- Outreach: WISE Camp, Middle School Science Fair Judge, SSTP, ASM Volunteer

List of References:

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