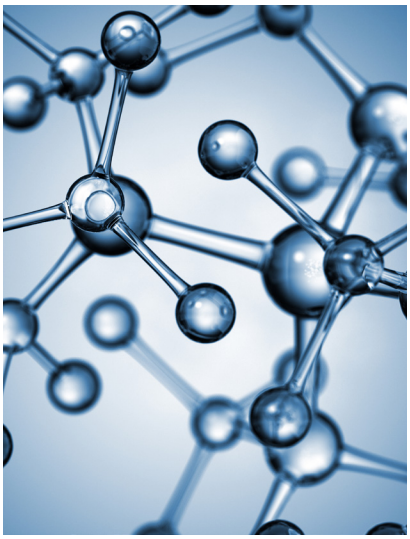
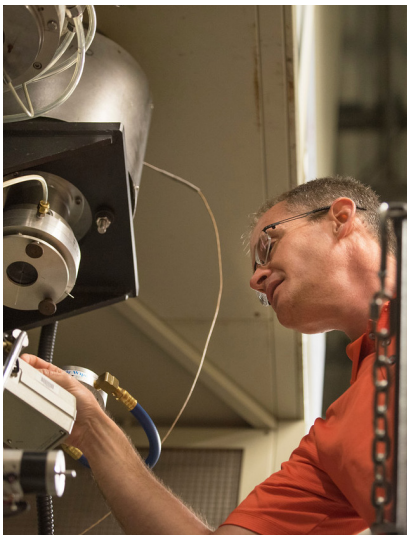





RESEARCH PORTFOLIO

Clemson University Department of Materials Science and Engineering

Department of
MATERIALS SCIENCE AND ENGINEERING

TABLE OF CONTENTS

Department of MATERIALS SCIENCE AND ENGINEERING

The Materials Science and Engineering faculty are active in innovative research across all areas of Materials Science and Engineering, an interdisciplinary field. We have 21 faculty with research labs on the main campus and the nearby Advanced Materials Research Laboratory. All research groups have broad collaborations--with industry, national labs, and universities around the world.

JOHN BALLATO cecas.clemson.edu/ballato

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

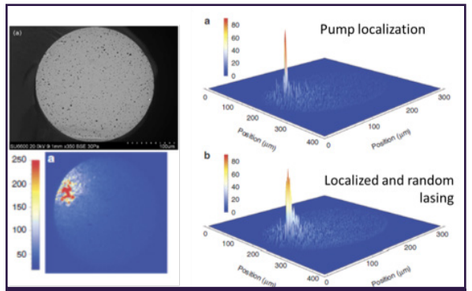
- Optical materials
- Glass
- (Real) fiber fabrication
- Lasers

Recent Projects –

- DoD: A Unified Materials Approach to Mitigating Nonlinearities in HEL Optical Fibers
- DoD MURI: Internal Cooling of Fiber and Disc Lasers by Radiation Balancing and other Optical or Phonon Processes

Publications/Patents –

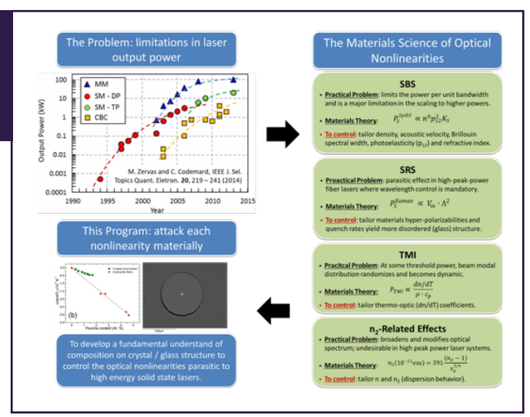
- "Materials for optical fiber lasers: A review," Applied Physics Reviews 5, 041301 (2018); invited review.
- "Laser restructuring and photoluminescence of glass-clad GaSb/Si-core optical fibres," Nature Communications 10, 1790 (2019).
- "In-fiber silicon photonics," Optics and Photonics News, pages 32 - 39, March 2019; invited Feature Article.
- "Low-loss silicon core fibre platform for mid-infrared nonlinear photonics," (Nature) Light: Science & Applications (in press, 2019).



Novel fibers, fiber structures, and fiber materials
e.g., Anderson localization; and random lasing.

Novel fibers, fiber structures, and fiber materials
e.g., Semiconductors, in-fiber semiconductor structures

Materials science of optical nonlinearities
Leverage our Group's unique combination of expertise in optical materials science and fiber formation / engineering to address the biggest problems plaguing fiber laser systems through materials development.



VINCENT BLOUIN clemson.edu/cecas/departments/mse/people/faculty

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

- Sustainability of the built environment
- Integration of smart materials and technologies in buildings

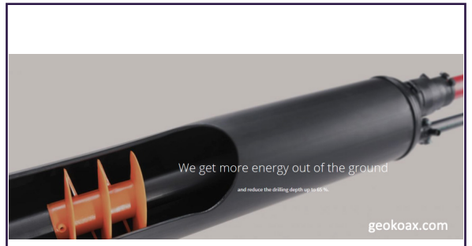
Recent Projects –

- Usability of electrochromic glazing in commercial buildings for visual comfort and energy consumption
- Thermodynamics of closed-loop geothermal system

Publications/Patents –

- G. Nikyema, V. Blouin, *"Barriers to adoption of green building materials and technologies in developing countries: The case of Burkina Faso,"* SBE19, Thessaloniki, Oct. 2019.
- M. Hamidpour, V. Blouin, *"Development of a Comparison-Based Control Strategy of Electrochromic Glazing for the Management of Indoor Lighting and Energy Efficiency,"* SimBuild, Chicago, Sept. 2018.
- N. Wonoto, V. Blouin, *"Using Grounded Theory for the Development of a Structural Optimization Tool as a Form-Finding Method for Architectural Schematic Design,"* J. Arch. Eng. & Tech., Vol 7(1), 2018.
- D. Albright et al., *Building Framing System,* CURF, Patent No. US 1,156.67 B2, Dec. 2018

Electrochromic Glazing
Develop and test a new performance-based control strategy to optimize trade-off between visual comfort, energy consumption and usability.



Thermodynamics of Geothermal Systems
Numerical simulation and experimental testing of coaxial heat exchangers enhanced with turbulators (vortex generators).

Patented Building Construction System: Sim[PLY]
CNC-cut plywood assembled as 3D puzzle held in place with metal zip ties.

RAJENDRA BORDIA scepscoridea.org/MADEinSC/about_MADEinSC.html

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

- Materials and Mechanics
- Microstructure Optimization
- Ceramics for Energy Conversion and Storage, and Extreme Environments

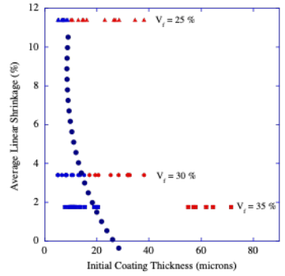
Recent Projects –

- NSF: Materials Assembly and Design Excellence in SC (MADE in SC) funded High Energy Density Li-ion Batteries
- DOE-NETL: Integrated TBC/EBC for SiC/SiC Composites
- NSF: Fundamental Investigation of Sintering Anisotropy

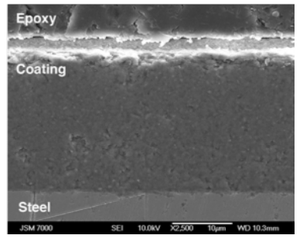
Publications/Patents –

- R.K. Bordia, S.-J.L. Kang, E.A. Olevsky J. of Am. Ceramic Society, 100, 2314 (2017).
- A. Lichtner, D. Roussel, D. Röhrens, D. Jauffres, J. Villanova, C.L. Martin, and R.K. Bordia Acta Mater., 155, 343 (2018).
- H. Shang, E.A. Olevsky, R.K. Bordia J. of Am. Ceramic Society, 102, 768 (2019).
- G. Barroso, Q. Li, R.K. Bordia, G. Motz J. of Materials Chemistry A, 7 (5), 1936 (2019).

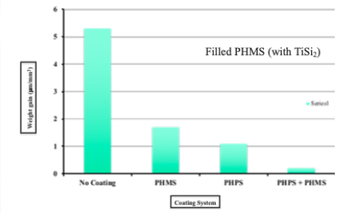
Processing and Mechanics of Ceramic Coatings for Extreme Environment
Molecular precursor derived coatings for metals and ceramics



Calculated and experimentally verified critical coating thickness

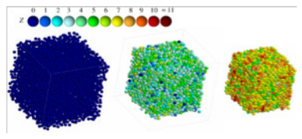


Crack free polymer derived ceramic (PDC) coating on steel

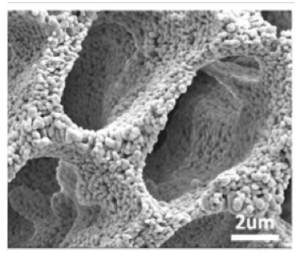


Oxidation protection provided by PDC coatings

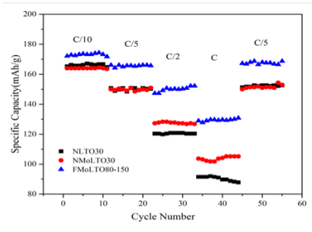
Porous Ceramics for Energy Conversion and Storage
Simulation guided optimization of porous ceramics for SOFCs and batteries



Simulation of sintering



Optimized hierarchical anisotropic porous ceramics



Higher capacity and capacity retention for optimized Li-ion battery electrodes

KYLE BRINKMAN cecas.clemson.edu/ceramicmaterials4energy

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

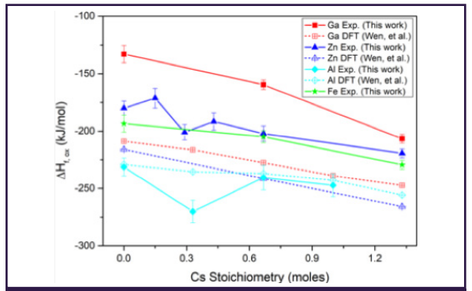
- Electrochemistry
- Ceramic Processing
- Nuclear Materials
- “Interface” between disciplines

Recent Projects –

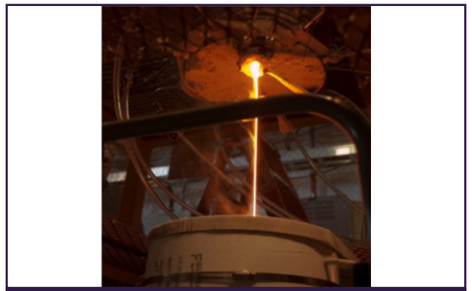
- DOE-NEUP i) Crystalline Ceramic Waste Forms, ii) Tritium Management, using Proton Ceramic Membranes
- DOE-NETL: Proton Ceramics for Intermediate Temperature Fuel Cells

Publications/Patents –

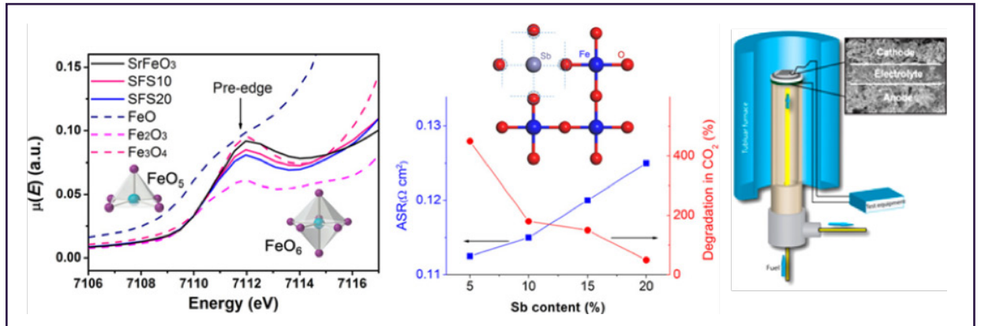
- M.Zhao, Y. Xu, L. Shuller-Nickles, J.Amoroso, A.Frenkel, Y. Li, W. Gong, K.Lilova, A.Navrotsky, K.Brinkman Journal American Ceramic Society, 102 (7), 4314 (2019).
- R. Grote, M. Zhao, L. Shuller-Nickles, J. Amoroso, W. Gong, K. Lilova, A. Navrotsky, M. Tang, K.S. Brinkman, Journal of Materials Science, 54 (2), 1112, (2019).
- Y.Meng, L. Sun, W. Tan, C. Chen, J. Yi, H.J. M. Bouwmeester, Z Sun, J. Gao, K. Brinkman, ACS Applied Materials and Interfaces, 11, 11498, (2019).



Thermodynamics
Experimental studies with implications on long term durability



Nuclear Material Waste Forms
Materials and processing



Fuel Cells, Solid State Batteries, and Membrane Separations
Solid state ionic conductor material and device development

PHIL BROWN clemson.edu/cecas/departments/mse/people/faculty

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

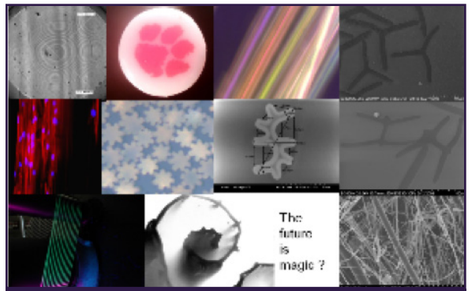
- Fiber production/characterization
- Polymer melt processing
- Polymer solution processing
- Multicomponent fiber materials

Recent Projects –

- ACRE i) Moisture and Ammonia Mitigation,
- Natick Army ii) Super-omniphobic textile surfaces

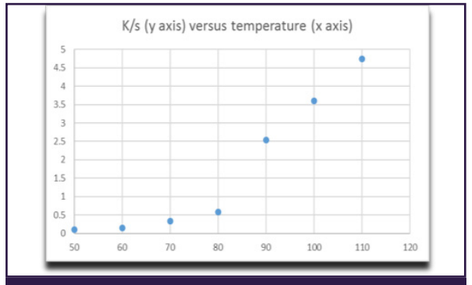
Publications/Patents –

- Bicomponent Fiber Extraction Process for Textile Applications, Philip Mooney, John Shearer, Joey Mead, Carol Barry, Quoc Truong, Elizabeth A. Welsh Richard Pang, Walter Zukas, Peter Stenhouse, Philip Brown, and Nicole Hoffman, Journal of Engineered Fibers and Fabrics Volume 3, Issue 1 – 2018.
- Tugba Demir,Liying Wei,Naoki Nitta, Gleb Yushin, Philip J. Brown, and Igor Luzinov, Applied Materials and Interfaces, American Chemical Society, pp 24318-24330, 9, 2017.

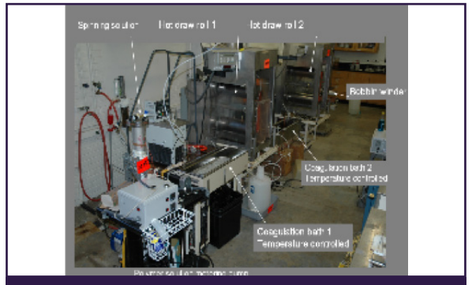


Fiber Fabrication
Production and characterization of complex fibers via melt extrusion, solution processing and multi-component spinning

Fiber melt processing
Quadra multi-component system



Color Science
Dyeing transition temperature



Fiber solution processing

STEPHEN FOULGER tahoe.clemson.edu

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

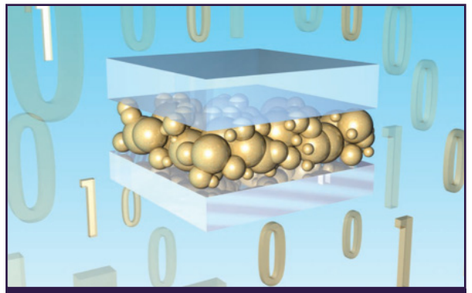
- Colloid Chemistry
- Polymer Chemistry
- Optoelectronic Devices
- Theranostic Colloids

Recent Projects –

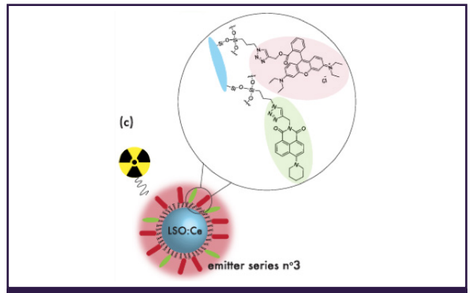
- NSF-DMR “Conductance Variability in Non-Conjugated Polymers: Memristors for Neuromorphic Applications”
- NSF-OIA “Track-II “RII Track-2 FEC: The Creation of Next-Generation Tools for Neuroscience - Noninvasive Radioluminescence Approaches to Optogenetics.”

Publications/Patents –

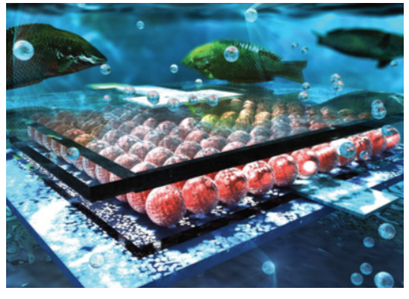
- Burdette, Bandera, Gray, and Foulger, “Dynamic Emission Tuning of X- ray Radioluminescent Crystalline Colloidal Arrays: Coupling the Optical Stop Band with Sequential Förster Resonance Energy Transfers”, Advanced Optical Materials, 7, 1801142 (2019).
- Burdette, Bandera, Zhang, Trofimov, Dickey, Foulger, Kolis, Cannon, Bartley, Dobrunz, Bolding, McMahon, and Foulger, “Organic Fluorophore Coated Polycrystalline Ceramic LSO:Ce Scintillators for X-ray Bioimaging”, Langmuir, 35, 171-182 (2019).

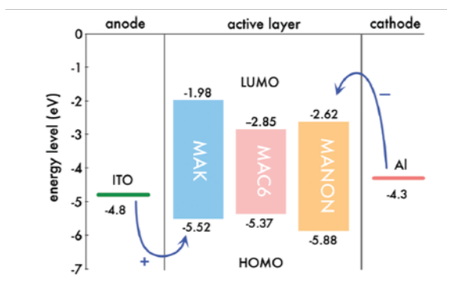


Organic Memristors
Colloid memristors for synaptic mimicry



Theranostic Colloids
X-ray nanoparticles for optogenetics





BioBased Printed Batteries, OLEDs, and Conductive Polymers
Multifunctional devices through polymer structure-property synthesis

LUIZ JACOBSOHN cecas.clemson.edu/~luiz/

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

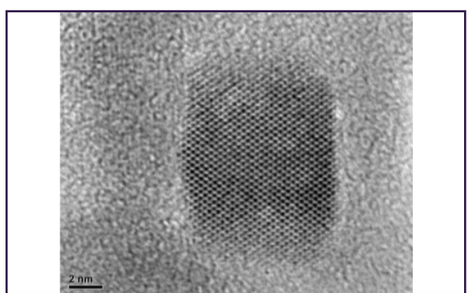
- Luminescence Dosimeters
- Scintillators
- Luminescent Materials
- Optical Materials
- Synthesis, Processing and Characterization of Ceramics
- Radiation Damage

Recent Projects –

- NSF: CAREER - Towards Engineering Electronic Defects in Inorganic Luminescent Materials
- DTRA: Reactive Membranes for Rapid Isotopic Analyses of Waterborne Special Nuclear Material

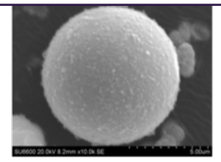
Publications/Patents –

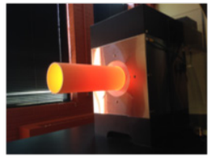
- L. Pan, S. Sholom, S.W.S. McKeever, and L.G. Jacobsohn, Journal of Alloys and Compounds 880, 160503 (2021).
- A.A. Trofimov, T.A. DeVol, and L.G. Jacobsohn, Journal of Luminescence 238, 118229 (2021).
- M.W. Kielty, L. Pan, M.A. Dettmann, V. Herrig, U. Akgun, and L.G. Jacobsohn, Journal of Materials Science: Materials in Electronics 30, 16774-16780 (2019).

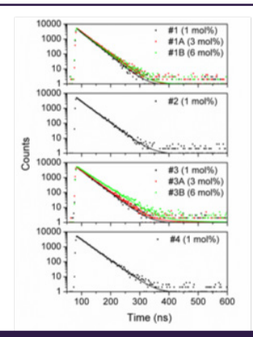


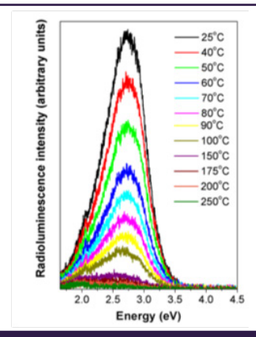
Nanoparticles, Powders, Transparent Ceramics, Glasses
Variety of forms of luminescent materials

Scintillators, Dosimeters
Ionizing radiation interaction with matter
Photoluminescence, Lifetime, Radioluminescence, Thermoluminescence, OSL









Design, Synthesis, Processing and Characterization of Inorganic Luminescent Materials
Materials design and characterization

MARK JOHNSON researchgate.net/scientific-contributions/2056721905_Mark_Johnson

Department of Materials Science and Engineering, Clemson University

Research Areas and Interests –

- Compound Semiconductor Materials & Devices:
  - Wide-Bandgap Materials and Structures
  - MBE and MOCVD Growth and Functional Processing
- Clean Energy Technologies:
  - Energy Storage (Stationary), Rare Earth Materials and System Enabling Material
- Advanced Manufacturing Technologies
  - Information Technology and SMART Manufacturing
  - AI/ML and HPC for Materials Manufacturing
- Technology Commercialization
  - Early-Stage Venture formation
- Science and Energy Related Public Policy

All of Clemson Effort: Research, Education and OutreachSouth Carolina State Appropriation ($4M in FY20) –

- Education: AM Senior Experience at ICAR (Start with ME, plus CSC)
- Research: Matching Funds for Competitive Solicitations
- Outreach: Enhance Innovation Eco-System
- Partnerships: Workshops and Thought Leadership

Focus Areas

- Clemson Already Doing "Advanced Manufacturing" in >40 Groups, Labs, Centers and Institutes. Catalyze for Whole > Parts.
- Advanced Materials and their Manufacturing is High Opportunity

CLEMSON® UNIVERSITY CENTER FOR
ADVANCED MANUFACTURING

CLEMSON®
VEHICLE ASSEMBLY CENTER

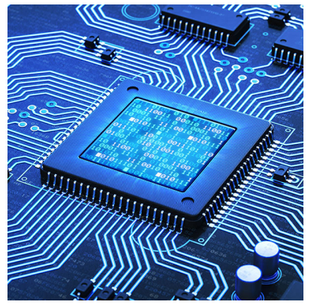
CLEMSON®
ADVANCED ROBOTICS
MANUFACTURING CENTER

CLEMSON®
PRODUCT LIFE CYCLE MANAGEMENT

CUCWD

CA²VES

CLEMSON
COMPOSITES
CENTER



M. KENNEDY cecas.clemson.edu/kennedylab/Kennedy_Research_Group/Overview

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

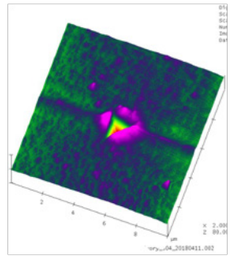
- Thin film mechanical behavior and tribology
- Engineering education: self-efficacy, undergraduate research

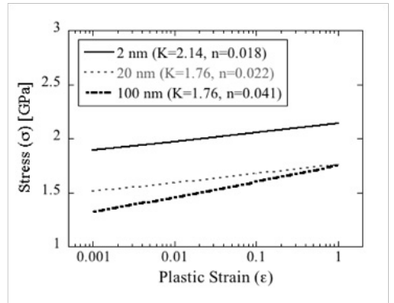
Recent Projects –

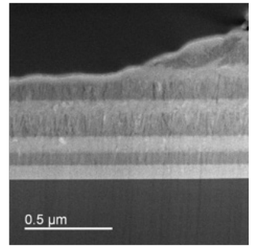
- NSF - Student Perspectives on Researcher Identity and Transformed Epistemologies
- DoD - Preventing Infection by Surface Modification of Orthopaedic Fracture Fixation Implants for Improved Limb Salvage Outcomes
- SRNL- Silicon Carbide Permeation

Publications/Patents –

- In-situ observations of the fracture and adhesion of Cu/Nb multilayers on polyimide substrates, M.J. Cordill et al, Materials Science and Engineering: A (2018).
- Electrochemical Behavior of Copper and Niobium Monolithic and Layered Thin Films, C. Sewell et al, CORROSION 2019 (2019).
- Dynamics of Researcher Identity and Epistemology: The Development of a Grounded-theory Model, ASEE (2019).

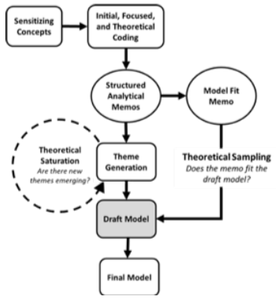


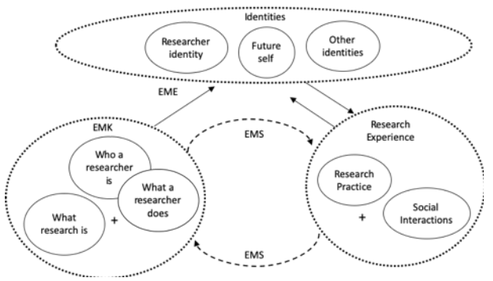




Role of Microstructure in Mechanical, Tribological and Fatigue Performance

Engineering Education





Model Development | **Results Using Grounded Theory**

KOSTYA KORNEV cecas.clemson.edu/kornevlab/

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

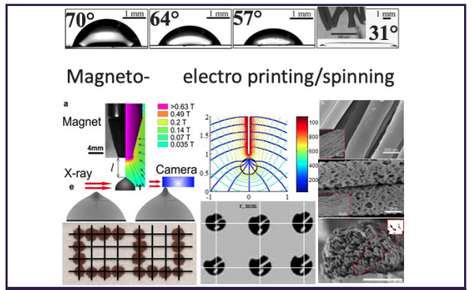
- Thermodynamics & continuum mechanics of materials
- Capillarity & wetting
- Magnetic colloids for analytics
- Nanomanufacturing in electric & magnetic fields
- Biomechanics of insects

Recent Projects –

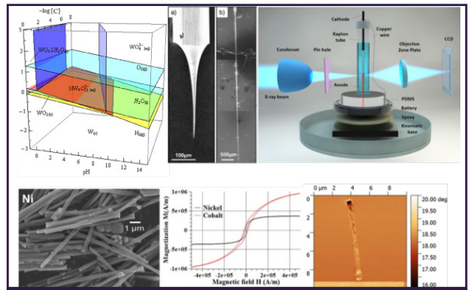
- National Science Foundation
- Air Force Research Laboratory
- NASA EPSCoR

Publications/Patents –

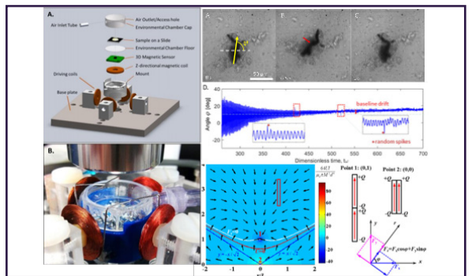
- Aprelev, P., Bruce, T.F., Beard, C.E., Adler, P.H., Kornev, K.G., Scientific Reports, 9, 3451(2019)
- Zhang, C. , Beard, C. E., Adler, P.H., Kornev, K.G., R. Soc. open



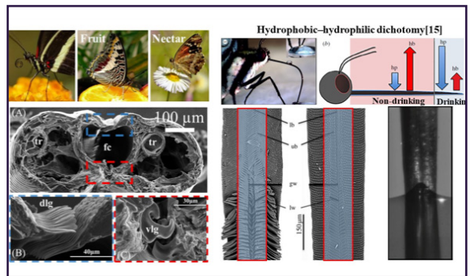
Capillarity & wetting
Materials science of coating, printing & adhesion



Electrochemical nanomanufacturing
Theory and the real time X-ray nanotomography of electrochemical nanomanufacturing



Magnetic colloids for analytics
Development of Magnetic Rotational Spectroscopy & magnonics



Insect materials & biomechanics
Materials science of natural multifunctional microfluidic complexly shaped fibers

OLGA KUKSENOK kuksenok.github.io/

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

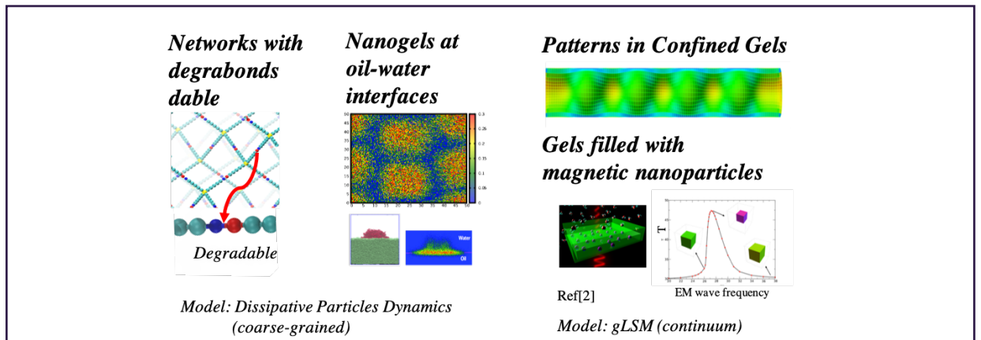
- Dynamics of responsive polymer gels
- Modeling of multicomponent polymer blends
- Pattern formation out-of-equilibrium

Recent Projects –

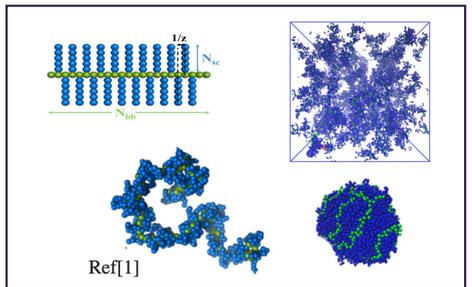
- ACS PRF "Multi-Scale Modeling of Dynamics of Polymer Gels in Oil-Water Mixtures"
- NSF MADE in SC EPSCoR, NSF Biophysics REU

Publications/Patents –

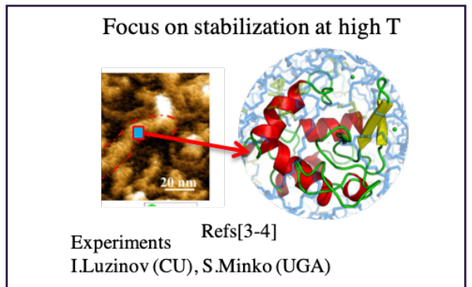
- [1] Tu, S., Choudhury, C. K., Luzinov, I., Kuksenok., O. "Recent advances towards applications of molecular bottlebrushes and their Conjugates". Current Opinion in Solid State and Materials Science 23, 1, pp 50-61 (2019)
- [2] Savchak, O., Morrison, T., Kornev, K.G. and Kuksenok, O., Controlling deformations of gel-based composites by electromagnetic signals within the GHz frequency range. Soft matter, 14(43), pp.8698-8708 (2018)
- [3] Choudhury, C.K.; Tu, S.; Luzinov, I.; Minko, S.; Kuksenok, O. "Designing Highly Thermostable Lysozyme–Copolymer Conjugates: Focus on Effect of Polymer Concentration" Biomacromolecules 19 (4), 1175-1188 (2018)
- [4] Yadavalli NS, Borodinov N, Choudhury CK, Quiñones-Ruiz T, Laradji, Tu S., Lednev IK, Kuksenok O, Luzinov I, Minko S. "Thermal Stabilization of Enzymes with Molecular Brushes", ACS Catalysis, 7 (12) 8675-8684 (2017)



Dynamics of Polymer networks



Bottlebrushes in Multicomponent Mixtures



Enzyme-Polymer Conjugates

IGOR LUZINOV clemson.edu/cecas/departments/mse/people/faculty

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

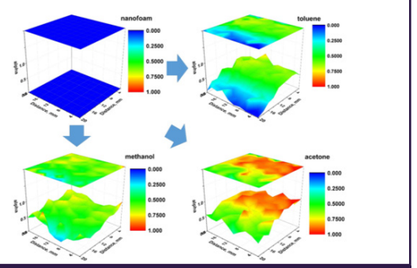
- Polymers and composites
- Thin films and coatings
- Fibrous materials
- Interfaces and adhesion
- 3D printing

Recent Projects –

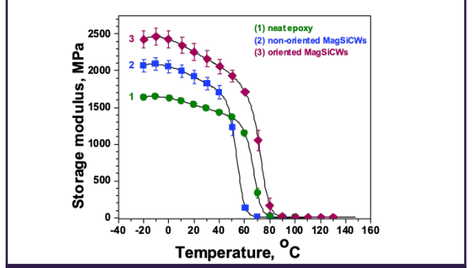
- NSF CMMI: Highly Conductive Reduced Graphene Oxide Films for High Performance Electronic Devices
- DECAF Inc. : Molecularly Imprinted Fibers for Decaffeination.

Publications/Patents –

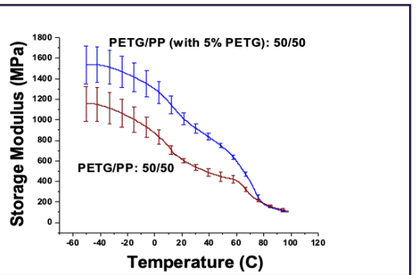
- Van Tooren, M., Luzinov, I. US Patent 10,240,012, March 26, 2019.
- Saychak, M Luzinov, I. et al, ACS Appl. Materials & Interfaces 2018, 10 (4), 3975.
- Wei, L. Y.; Luzinov, I. Et al. Langmuir 2018, 34, 12934.
- Townsend, J.; Luzinov, I. et al. ACS Appl. Materials & Interfaces 2017, 9 (27), 22927.
- Borodinov, N.; Luzinov, I. et al. ACS Nano 2016, 10 (12), 10716.



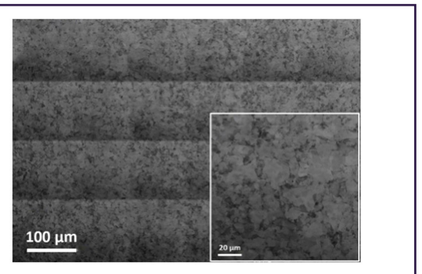
Functional Polymer Films
Polymer Nanofoams for Encrypted Recording of Chemical Events



Polymer Composites
Composites with orientable magnetic (SiC whiskers) fillers



3D printing of multi-materials
Robust two-component structures



Reduced Graphene Oxide
Highly conductive and transparent rGO film

ENRIQUE MARTINEZ SAEZ

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

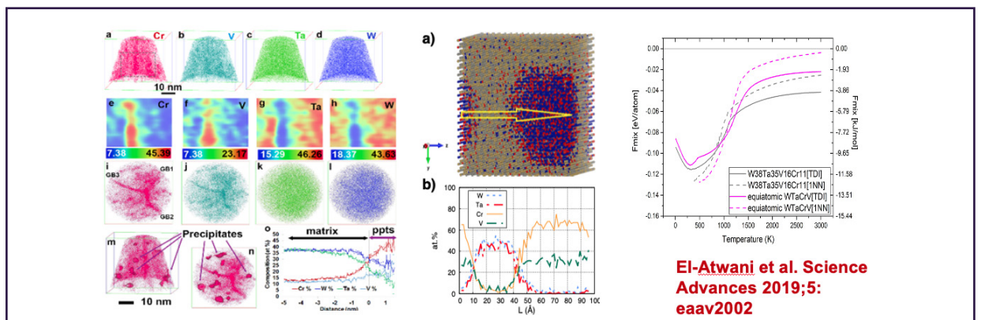
- Microstructure evolution
- Thermodynamics and kinetics of metallic alloys
- Advanced manufacturing
- Mechanical response

Recent Projects –

- DOE (BES-ASCR): Plasma Surface Interactions: Predicting the Performance and Impact of Dynamics Plasma-Facing-Components Surfaces
- DOE-EXAALT: Molecular Dynamics at Exascale for Materials Science (Exascale Computing Project)
- LANL (LDRD): Shocked Chemistry Dynamics in High Explosives

Publications/Patents –

- Outstanding Radiation Resistance of Tungsten-based High Entropy Alloys, O. El-Atwani, et al., Science Advances 2019; 5: eaav2002.
- Role of Sink Density in Nonequilibrium Chemical Redistribution in Alloys, E. Martinez, et al., Physical Review Letters 120 (2018) 106101.
- Relative relevance of mobility and driving force on edge dislocation climb by the vacancy mechanism, E. Martinez, et al., Computational Materials Science 193 (2021) 110378.



El-Atwani et al. Science Advances 2019;5: eaav2002

Optimized Microstructure: Refractory High-Entropy Alloys

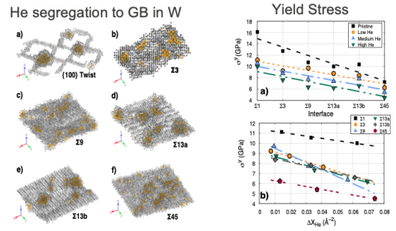
$$E_0 = \frac{1}{N}\sum_i n_i^{VC-SGC} E_i$$

$$c_0 = \frac{1}{N}\sum_i n_i^{VC-SGC} c_i$$

$$s_0 = \frac{1}{N}\sum_i n_i^{VC-SGC} (c_i - c_0)^2$$

$$n_i^{VC-SGC} \left| N = Z_{VC-SGC}^{-1} \exp\left[-\beta \Delta E_i - \phi c_i - \kappa c_i^2\right]\right.$$

$$P^{VC-SGC}(i \to j) = \min[1, \exp(-\beta(E_j - E_i) - \phi(c_j - c_i) - \kappa(c_j^2 - c_i^2))]$$



The development of the VC-SGC algorithm allows for the study of segregation in alloys inside the miscibility gap with large efficiency and full atomistic information, which enables the study of the effect of segregation on the mechanical properties.

Sadigh et al. PRB 85 (2012) 184203; Martinez et al. Nuclear Fusion 57 (2017) 086044

Advanced Theory and Modeling: The Variance Constraint Semi-Grand Canonical Monte Carlo Algorithm

THOMPSON MEFFORD meffordresearch.com

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

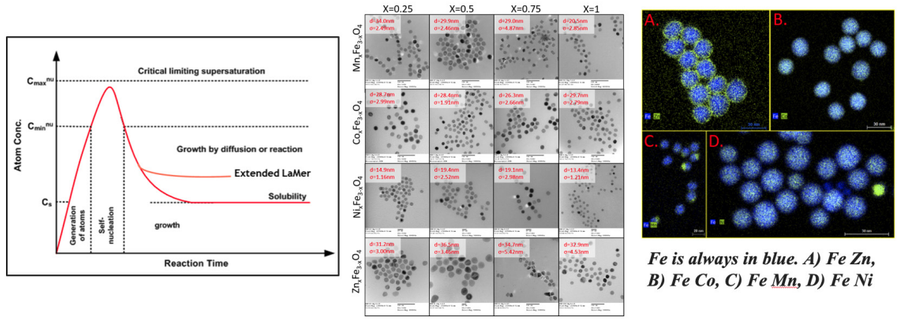
- Nanoparticle Synthesis
- Polymer Synthesis
- Magnetic Materials
- Biomaterials
- Surface Chemistry

Recent Projects –

- MRI contrast agents to measure mild traumatic brain injuries
- Selective binding/inactivation of target pathogen Neisseria gonorrhoeae

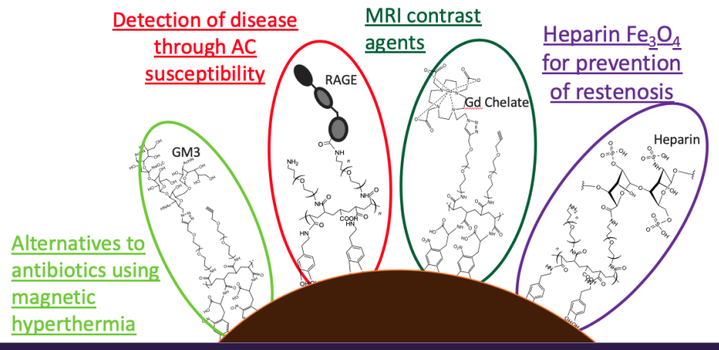
Publications/Patents –

- Fellows, Benjamin D., et al. “In vitro studies of heparin-coated magnetic nanoparticles for use in the treatment of neointimal hyperplasia.” Nanomedicine: Nanotechnology, Biology and Medicine 14.4 (2018): 1191-1200
- Davis, Kathleen, et al. “The effect of post-synthesis aging on the ligand exchange activity of iron oxide nanoparticles.” Journal of colloid and interface science 511 (2018): 374-382.
- Andrew, Jennifer S. et al. “Synthesis and Surface Functionalization of Ferrite Nanoparticles.” Nanomagnetic Actuation in Biomedicine. CRC Press, 2018. 9-40



Fe is always in blue. A) Fe Zn, B) Fe Co, C) Fe Mn, D) Fe Ni

Metal Ferrite Nanoparticle Synthesis and Characterization
Development of novel synthetic routes leading to controlled crystalline structures



Surface Modification with Functional Polymers
Custom heterobifunctional polymer synthesis allows for application specific functionality

FEI PENG cecas.clemson.edu/peng

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

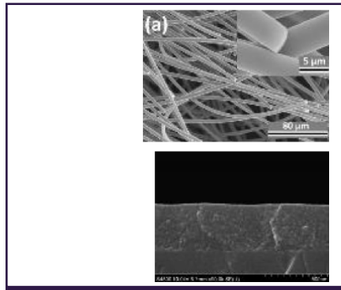
- Sol-gel processing
- Laser sintering of ceramics
- Integrated additive/subtractive manufacturing
- Nuclear Materials

Recent Projects –

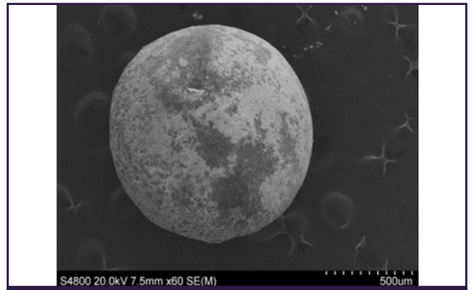
- NIH-COBRE: in vivo characterization of contact stress distribution in hip replacement.
- BWXT/NASA: Fabrication of uranium nitride microspheres.
- DoE-NETL: Integrated TBC/EBC for SiC Fiber Reinforced SiC Matrix Composites for Next Generation Gas Turbines.
- DoE-EERE: Additive manufacturing of proton electrolyzer.

Publications/Patents –

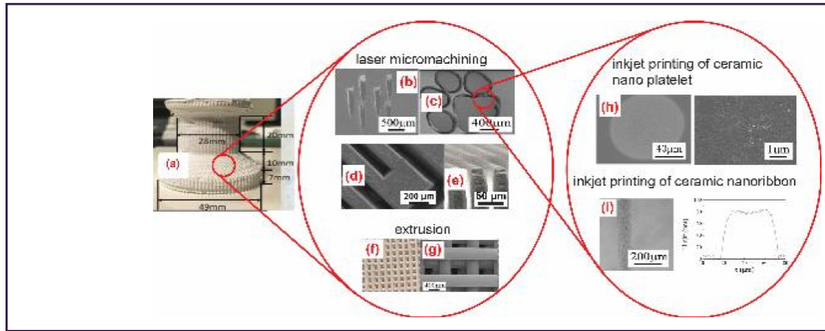
- Lei, Jincheng, et al. “The effect of laser sintering on the microstructure, relative density, and cracking of sol-gel derived silica thin films.” Journal of the American Ceramic Society. https://doi.org/10.1111/jace.16640
- Hong, Yuzhe, et al. “Fabricating ceramics with embedded microchannels using an integrated additive manufacturing and laser machining method.” Journal of the American Ceramic Society 102.3 (2019): 1071-1082.



Low dimensional ceramics
Ceramic fibers and coatings



Uranium nitride microspheres



Integrated additive/subtractive manufacturing of ceramics

ULF D. SCHILLER clemson.edu/cecas/departments/mse/people/faculty

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

- Computational and Data-enabled Materials Science
- Multiscale Modeling of Soft Matter and Complex Fluids
- High Performance Computing

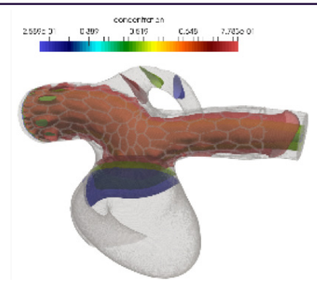
Recent Collaborations –

- MADE in SC: i) Coalescence Filtration in Porous Media, ii) Electrochemical Transport in Porous Electrodes
- Prisma Health: Patient-specific modeling of hepatic blood flow for noninvasive prediction of portal pressure

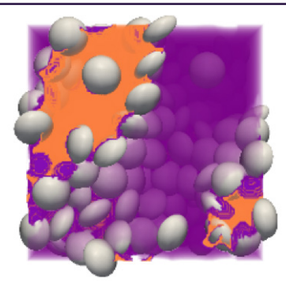
Publications –

- Schiller, U.D., Kuksenok, O., In Reviews in Computational Chemistry, Volume 31, pp. 1–61, Wiley (2018).
- Schiller, U.D., Wang, F., MRS Commun. 8, 358–371 (2018).
- Groen, D., Richardson, R.A., Coy, R., Schiller, U.D., Chandrashekar, H., Robertson, F., Coveney, P.V., Front. Physiol. 9, 721 (2018).
- Schiller, U.D., Krüger, T., Henrich, O., Soft Matter 14, 9–26 (2017).

Transport of Multicomponent Fluids in Porous Media
Wetting and capillary phenomena, coalescence filtration



Computational Biomedicine
Simulation-driven design of drug-eluting stents



Particle-stabilized Emulsion Gels
Phase morphology and kinematics

MING TANG clemson.edu/cecas/departments/mse/people/faculty

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

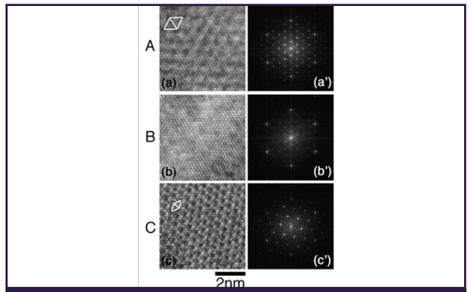
- Structure/Property
- Radiation Damage
- Nuclear Energy Materials
- Electron Microscopy

Recent Projects –

- DOE-NE-FCT: Glass Ceramic/Crystalline Ceramic Waste Forms
- DOE-EM-WRPS: Low-Temperature Glass Waste Forms for Tc-99
- DOE-BES: Relationship between Defects Kinetics & Crystalline Disorder

Publications/Patents –

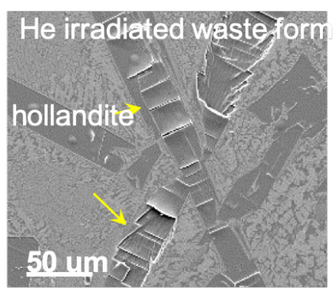
- C. Kreller, J. Valdez, T. Holesinger, Y. Wang, M.Tang, F.Garzon, R. Mukundan, B.Uberuaga, “Massively enhanced ionic transport in irradiated crystalline pyrochlore”, Journal of Materials Chemistry A, 7 (2019) 3917.
- Y. Zhou, S. Li, M. Tang, L. Yan, “One-step Ion Beam Irradiation Manufacture of 3D Micro/Nanopatterned Structures in SiC Materials with Tunable Work Functions”, Carbon, 148 (2019) 387.
- B. Clark, S.K. Sundaram, J. Amoroso, J. Marra, M. Tang, “Radiation damage of hollandite in multiphase ceramic waste forms”, Journal of Nuclear Materials, 494 (2017) 61.



TEM/STEM
Microstructure in irradiated oxides

Materials and processing (Tellurium glass with cold simulant)

Radiation induced microcracks



Nuclear Waste Forms

JOSHUA TONG cecas.clemson.edu/tonggroup

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

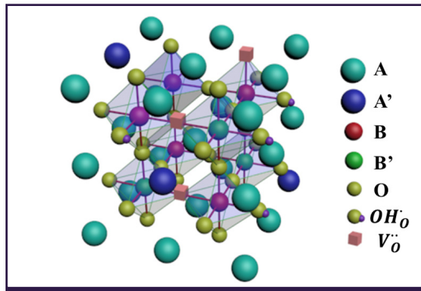
- Energy Materials an Devices
- Electrochemical Cells and Membrane Reactors
- Solar Fuel Production
- 3D Printing and Laser Processing of Ceramics

Recent Projects –

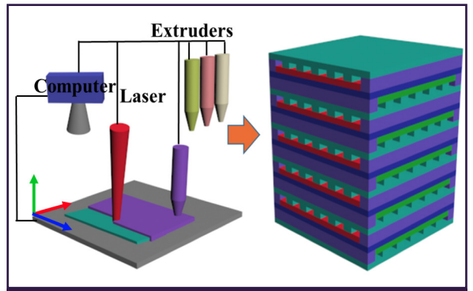
- DOE-EERE: Laser 3D printing of protonic ceramic electrolyzer stack
- ACS-PRF: Co-production of ammonia and ethene from natural gas
- DOE-ORNL: Go! Program

Publications/Patents –

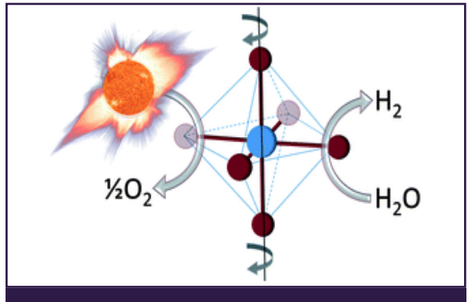
- C. Duan, J. Tong, M. Shang, S. Nikodemski, M. Sanders, S. Ricote, A. Almansoori, R. O'Hayre, Science, 2015, 249, 1321.
- D.R. Barcellos, M.D. Sanders, J. Tong, A.H. McDaniel, R. P O'Hayre, Energy & Environmental Science, 2018, 11, 3256.
- S. Mu, Z. Zhao, J. Lei, Y. Hong, T. Hong, D. Jiang, Y. Song, W. Jackson, K.S. Brinkman, F. Peng, H. Xiao, J. Tong, Solid State Ionics, 2018, 320, 369.
- D. Jiang, Z. Zhao, S. Mu, V. Phaneuf, J. Tong, International journal of Hydrogen Energy, 2019, 44, 18360.



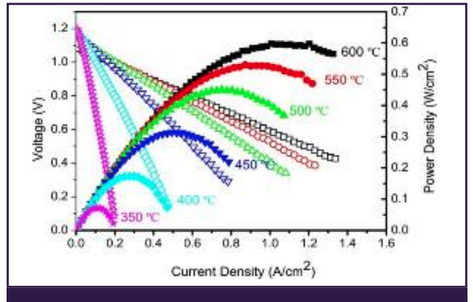
Discovery of Energy Materials
Discovery of energy material by machine learning and high throughput experiments



Laser 3D Printing of Ceramics
Manufacturing energy devices such fuel cells and sold state batteries



Solar Fuel Production
High-temperature solar thermal solid oxide materials and devices



Electrochemical Cells and Membrane Reactors
Improve energy conversion and storage efficiency

MAREK URBAN cecas.clemson.edu/urbanresearch

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

- Polymer Science
- Polymer Synthesis; Polymerization
- Stimuli-Responsive Polymers
- Self-Healing Commodity Polymers
- Polymer Spectroscopy/Chemical Imaging

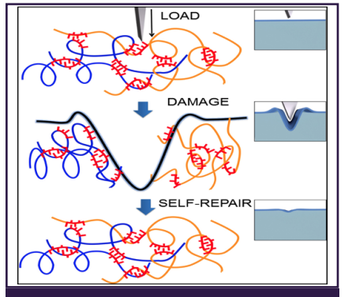
Science, 2018, 362, 220; Science, 2009, 323, 1458; CHEM, 2018, 4(8), 1928; Adv. Mater., 2017, 29, 1603334 ; J. Mater. Chem., 2011, 21, 14473; Angew. Chem. Int. Ed., 2014, 53, 12142; Polym. Chem., 2017, 8, 303; Nature Chem., 2012, 4, 80-82.

Recent Projects –

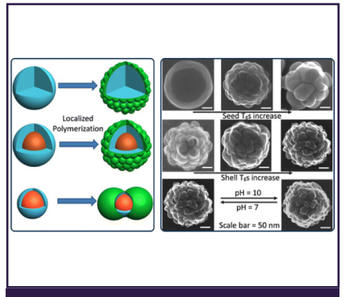
- DMR NSF Self-Healing Copolymers
- DOE Humidity-Responsive Polymers
- NSF IUCRC Self-Healing Copolymers
- NSF EPSCoR Stimuli-Responsive Copolymers

Publications/Patents –

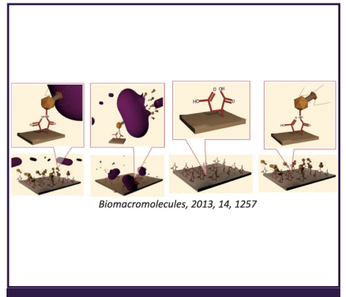
- M.W. Urban, et al, Key-and-Lock Self-Healing Commodity Copolymers, Science, 2018, .
- C. Hornat, Y. Yang, D. Davidovich, Advanced Materials, 1603334, 29, 2017.
- Y. Yang, D. Davidivich, C.C. Hornat, X. Liu, M.W. Urban, CHEM, 2018, 4(8), 1928-36
- S. Wang, M.W. Urban, Advanced Materials Reviews, 2019, in press.
- M.W. Urban, Stimuli-Resopnsive Materials, Royal Society of Chemistry, UK, 2016 (ISBN: 978-1-84973-656-5; 978-1-78801-809-8)
- Journal of Nuclear Materials, 494 (2017) 61.



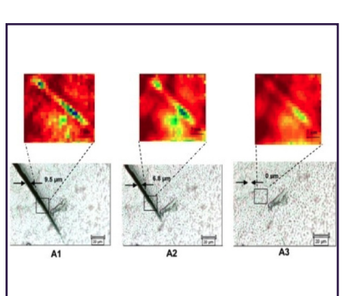
Self-Healing Commodity Copolymers
Experimental and Molecular Dynamic (MD) Simulations



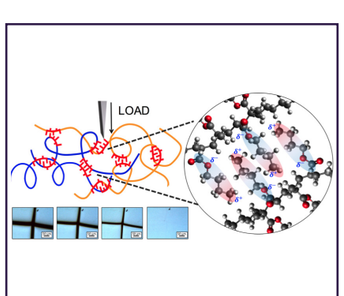
Stimuli-Responsive Nanomaterials



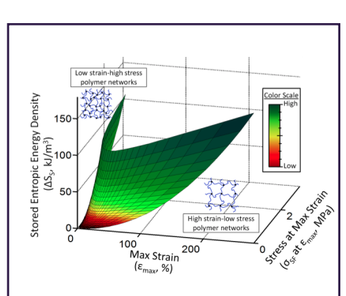
Bio-Active Polymeric Surfaces/Interfaces



Chemical Imaging
Raman and IR 2D Spectroscopy



Chain Topology & 'Key-and-Lock' van der Waals Interactions



Shape-Memory Materials

KIMBERLY WEIRICH

Department of Materials Science and Engineering, Clemson University

Areas of Expertise –

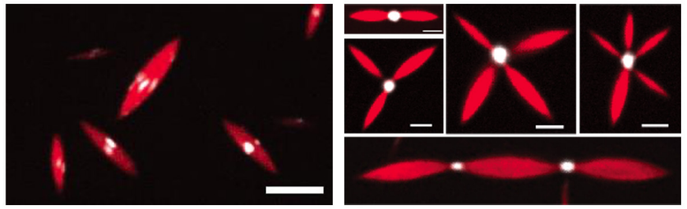
- Biological and bioinspired materials
- Soft and active materials
- Liquid crystals
- Biopolymers

Recent Projects –

- Self-organization and shape change in active droplets
- Designing motile synthetic cells—structural biomaterials
- Composite biopolymer liquid crystals

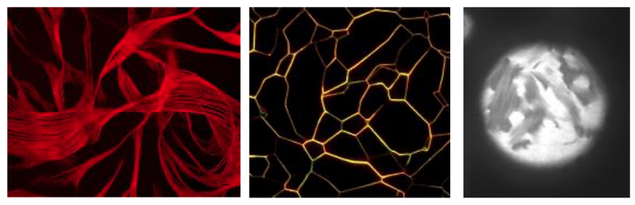
Publications/Patents –

- Self organizing motors divide active liquid droplets, K. L. Weirich, et al., Proceedings of the National Academy of Sciences; 116 (23):11125-11130 (2019)
- Tuning shape and internal structure of protein droplets via biopolymer filaments, D. Scheff, et al., Soft Matter 16 (8): 2135-2140 (2020).
- Actin bundle Architecture and mechanics regulates myosin II activity, K. L. Weirich, et al., Biophysical Journal 120 (10): 1957-1970 (2021).
- Liquid behavior of cross-linked actin bundles, K. L. Weirich, et al., Proceedings of the National Academy of Sciences; 114 (9): 2131-2136 (2017).



In these biopolymer liquid crystalline materials, active and passive colloidal particles self-organize into bio-inspired assemblies, where particles align at the midplane and divide the droplet into two or more separate, spindle shaped droplets.
Weirich et al., PNAS 2019, Weirich et al., PNAS 2017, Scheff et al. Soft Matter 2020

Active shape-changing, self-organizing materials



Cytoskeletal filament materials form the soft polymer material that regulates shape and is the basis for the unusual mechanics found in biological cells. Using purified proteins, we make biomimetic cytoskeletal assemblies and investigate the influence of microstructure on these exotic materials.
Weirich et al. Biophys. J. 2021, Scholz et al. Soft Matter 2020, Stam et al. PNAS 2017

Mechanics and microstructure in active biopolymer materials

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