2021 Winter Workshop

Welcome to the 6th Winter Workshop! This annual event is designed for ceramic and glass students and young professionals from around the world. The year's workshop features noted scientists who will share progress and perspective in key areas of ceramics research from additive manufacturing to ceramics for space applications. Attendees will also participate in presentations and group discussions on the topics of diversity, inclusion, and research in a global environment.

Thursday, January 28, 2021 – *All times are Pacific Standard Time*

7:00-7:15 am	Welcome
7:15-7:45	Icebreaker
7:45-8:15	*Data Science for Advancing Ceramic Science* by Krishna Rajan, University at Buffalo
8:15-8:45	*CMC TPS and Hot Structures for Hypersonic Vehicles* by David Glass, NASA Langley Research Center
8:45-9:30	*Culture and Support Systems* Facilitators: Lynnora Grant, Rachel Woods-Robinson, Jessica Wade
9:30-10:15	*Break*
10:15-10:45	*Social Impact of Ceramic Technology* by Tim Dyer, Elcon
10:45-11:15	*Challenges on Clays and Concrete in Infrastructure and the Built Environment* by Claudiane Ouellet-Plamondon, Montreal
11:15-11:30	ACerS PCSA Info
11:30-11:45	ECerS YCN Info

Friday, January 29, 2021 – *All times are Pacific Standard Time*

7:00-7:15 am	Welcome
7:15-7:45	Icebreaker
7:45-8:15	*Additive Manufacturing for Advanced Ceramics* by Nick Ku
8:15-8:45	Twitter (tentative title) by Jessica Wade
8:45-9:15	Collaborative Research Exchange / Student presentations (1-3)
9:15-10:00	*Break*
10:00-10:45	Collaborative Research Exchange / Student presentations (4-7)
10:45-11:00	Break
11:00-11:30	Collaborative Research Exchange / Breakout discussions
11:30-12:00	Collaborative Research Exchange / Report-out and Wrap-up
12:00-12:15	Workshop Wrap-up

Speaker Info

Krishna Rajan

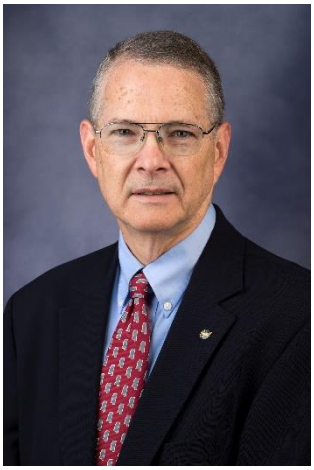
Krishna Rajan is SUNY Distinguished Professor and the inaugural Erich Bloch Chair of the Department of Materials Design and Innovation at the University at Buffalo: the State University of New York– a position he assumed in the summer of 2015 to form this new department. Professor Rajan is the leading proponent of the field of Materials Informatics. His research is on the application of information science and data intensive methodologies for the discovery, characterization and modeling of materials. He has received numerous awards and recognitions, including the Alexander von Humboldt Award from Germany, the CSIRO Distinguished Visiting Scientist Award- Australia, the CNRS Visiting Professorship from France and the Presidential Lecture Award from the National Institute of Materials Science of Japan. Dr. Rajan is presently a member of the Science and Technology Experts Group for the National Academies of Sciences, Engineering and Medicine. He received his undergraduate education at the University of Toronto and a doctorate from MIT followed by a postdoctoral appointment at Cambridge University.

Data Science for Advancing Ceramic Science

In this presentation, we explore the unique challenges in ceramic science where harnessing data science methods in the interpretation of experimental and computational data can provide new scientific insights into structure-property relationships. The talk will also address the value of materials informatics as not just as a tool to search for data but to discover and uncover information that can influence behavior across length scales. The discussion will build on examples in the field of high temperature and multifunctional materials.

David Glass

Dr. David E. Glass has an undergraduate degree in math and physics from Wake Forest University, a master's degree from the University of North Carolina, and a master's and Ph. D. in Mechanical Engineering from North Carolina State University. He began his career at NASA Langley Research Center in 1988 and is focused on high-temperature structures and materials, with an emphasis on hot structures for hypersonic vehicles. He led the NASA team overseeing the development of the carbon/carbon leading edges for the Hyper-X Mach 10 flight vehicle. Those leading edges helped enable a successful flight in November 2004, setting a world record for the fastest airbreathing airplane. He also led a "Tiger Team" for the development and testing of a small area repair for the Space Shuttle Return to Flight after the Columbia accident. He led a multi-disciplinary effort for two NASA programs with a focus on airframe technology development for reusable launch vehicles. David has mentored over 40 undergraduate and graduate student interns at NASA Langley.



Ceramic Matrix Composite (CMC) Thermal Protection Systems (TPS) and Hot Structures for Hypersonic Vehicles

Thermal protection systems (TPS) and hot structures are required for a range of hypersonic vehicles ranging from ballistic reentry to hypersonic cruise vehicles, within both Earth's atmosphere and non-Earth atmospheres. The focus of this talk is on air-breathing hypersonic vehicles in the Earth's atmosphere. This includes single-stage-to-orbit (SSTO) and two-stage-to-orbit (TSTO) accelerators, access to space vehicles, and hypersonic cruise vehicles. We will examine the argument that as we move from rocket-based vehicles to air-breathing vehicles, we need to move away from the "insulated airplane" approach used on the Space Shuttle Orbiter to a wide range of TPS and hot structure approaches. We will discuss issues and design options for ceramic matrix composite (CMC) TPS and hot structure components, including leading edges, acreage TPS, and control surfaces. The two primary technical challenges impacting the use of CMC TPS and hot structures for hypersonic vehicles are environmental durability and fabrication, and they will be discussed briefly.

Lynnora Grant

Lynnora studies the mechanics of sintering 3D printed ceramics. She seeks to elucidate the relationship between the microstructure of the green body and the extent of distortion, with the goal of preserving shape during densification using reactive binders. Her research integrates theory and experiment and involves a combination of materials processing, microstructure characterization, and high-temperature mechanical testing.

Lynnora received her BS in Mechanical Engineering from West Virginia University in 2017 and is currently in the fourth year of her PhD in Materials Science & Nanoengineering at Rice University. Her research advisers are Dr. Zachary Cordero (MIT) and Dr. C. Fred Higgs III (Rice University). Lynnora is a recipient of the NSF-GRFP (2017) and Ford Foundation Predoctoral Fellowship (2019). Her favorite PhD memories include mentoring undergraduate students, teaching high school students about additive manufacturing, and forming a band with lab group members.

Rachel Woods-Robinson

Rachel is a graduate student who spends much of her time bicycling up mountains and daydreaming about how connections and energy flow on small scales shift what emerges on larger scales. In her PhD in the Persson group at UC Berkeley, she designs materials from the nanoscale up that convert solar energy into electricity that can sustainably power our world, focusing on a type of material rare in nature that is both transparent to sunlight and conductive of electricity. Her research spans from high-throughput calculations to experimental solar cell fabrication, involving collaborations with interdisciplinary teams at Berkeley Lab, NREL, SLAC, and EPFL. She's equally interested in understanding the connectivity between science, history, and society, collaborating on climate change and climate justice solutions, and building spaces to connect practicing scientists to the next generation of scientists. In 2015 alongside glaciologist Elizabeth Case, Rachel co-founded Cycle for Science, an adventure-based science outreach organization that brings scientists to K-12 classrooms via bicycle tours to teach hands-on STEM lessons about renewable energy and climate change, and with Cycle for Science has bicycled across the USA, across California, and across the Netherlands to teach. In the meantime, while in-person outreach is not feasible, she's been exploring virtual outreach and organizing around STEM, wellness, and how to build supportive inclusive academic environments in the midst of a global pandemic.

Jessica Wade

Jess Wade is an Imperial College Research Fellow working in the Department of Materials at Imperial College London. Her research considers new materials for optoelectronic devices, with a focus on chiral organic semiconductors. She previously worked as a postdoctoral researcher in the Fuchter group at Imperial College London, where she optimized these chiral systems such that can absorb/emit circularly polarized light as well as transport spin-polarized electrons. For her PhD Jess concentrated on photovoltaics and the development of advanced characterization techniques to better understand molecular packing. Outside of the lab, Jess is involved with several science communication and outreach initiatives. She is committed to improving diversity in science, both online and offline, and since the start of 2018 has written the Wikipedia biographies of women and people of color scientists every single day.

Timothy Dyer

Timothy Dyer is the president of Elcon Precision in San Jose California since 2017 and has over 25 years' experience working in technical ceramics, refractory materials, and semiconductor capital equipment. Prior to Elcon, Timothy worked at Enovix Inc., making compact 3-D Silicon anode MEMS based lithium-ion batteries for wearable electronic devices. He was also chief technology officer and ceramist for Energy Recovery Inc, director of technology at Morgan Technical Ceramics, Ltd., and manager of laser chamber technology development at Cymer Inc in San Diego. Timothy has also held management and engineering positions with Lam Research and Applied Materials, Inc. He holds a B.S. in Materials Science and an M.S. in Mechanical Engineering from the University of California, Davis. Timothy currently holds 34 US patents and has published numerous technical papers that have helped shape best practices within the technical ceramics and material science fields. Timothy is also a senior technical analyst for Techcet and is on the Technical Advisory Board for CRC Inc. He is a member of The American Ceramic Society and American Society for Metals.

Claudiane Ouellet-Plamondon

Claudiane Ouellet-Plamondon is an associate professor in the department of construction engineering at École de technologie supérieure, in Montreal. She completed her PhD at the University of Cambridge in United Kingdom on the characterization and modification of geomaterials for environmental applications. She completed a postdoctoral fellow at the Swiss Federal Institute of Technology, ETH Zurich, on advanced bioinspired materials and on sustainable materials for construction. At ETS, she does research and teach in construction materials. Her current research is on the valorization of industrial by-products into supplementary cementitious, calcined clays, geopolymers, and 3D printing and robotics of cementitious materials. In May 2021, she will start the Canada Research Chair in Sustainable Multifunctional Construction Materials.

Nick Ku

Dr. Nicholas Ku is a materials engineer at CCDC-US Army Research Laboratory within the Ceramics and Transparent Materials Branch. He received his PhD from the Materials Science and Engineering Department at Rutgers University in May 2015 for work in the area of fine particle cohesion and granulation. He also spent time at the University of Leeds as a visiting researcher conducting research on powder flowability. Dr. Ku was then hired as a postdoctoral researcher at CCDC-ARL in July 2015, working in the area of particle synthesis and colloidal processing of nanocomposites. After being converted to a civilian employee in May 2018, Dr. Ku became the technical lead in ceramic additive manufacturing research within CTMB. His current research areas include direct-ink write, vat polymerization, and binder jet manufacturing, as well as powder/colloidal processing and particulate suspension rheology. He has authored or co-authored multiple publications and technical reports, as well as a pending US patent.

Additive Manufacturing for Advanced Ceramics

Ceramic additive manufacturing research at the CCDC US Army Research Lab is focused on enabling the ability to produce heterogeneous dense ceramics with mesoscale tailoring. Mesoscale structures, such as functional gradients or biomimetic structures, have been shown to exhibit unique fracture paths unlike those found in monolithic structures. This presentation will discuss the ongoing investigation into utilizing additive manufacturing to improve the performance of lightweight protective system through mesoscale tailoring. Efforts in direct-ink write, vat polymerization, and binder jetting will all be discussed with emphasis on the advantages and shortcomings of the different additive manufacturing technologies. Post-processing and sintering challenges of the printed parts will also be discussed. Finally, ongoing characterization work will be presented as processing-structure-property-performance relationships are developed for ceramic parts produced by additive manufacturing.

Collaborative Research Exchange - Speakers

Menne, David	david.menne@kit.edu	Karlsruher Institut für Technologie (KIT)	Germany
Camille PERRIERE	camille.perriere@unilim.fr	Limoges University	France
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Malgorzata Sojka	malgorzata.sojka@chem.uni.wroc.pl	University of Wroclaw	Poland
Iva Milisavljevic	IM6@alfred.edu	Alfred University	USA
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Victoria Christensen	victoriachristensen@ucsb.edu	UCSB	USA
Florent Cassouret	florent.cassouret@chimieparistech.psl.eu		France

David Menne

After completing his M.Sc. in Chemical Engineering at the RWTH Aachen University in 2017, David started his Ph.D. studies at the Institute for Mechanical Process Engineering and Mechanics in the Applied Mechanics Group at the Karlsruher Institute of Technology (KIT) under the supervision of Prof. Norbert Willenbacher. He is working with the development of applications for porous ceramics based on capillary suspensions, e.g., the 3D printing of bone substitute materials, and a different project on the construction of a functional and market-ready soil water potential sensor with a porous ceramic as the core element. During this period (in 2020), David joined the Functional Materials and Materials Chemistry Group under the supervision of Assoc. Prof. Julia Glaum at the Norwegian University of Science and Technology for three months as a visiting researcher working with active biomedical ceramics.

Camille Perrière

Camille Perrière is a third year PhD student at the Institute of Research for Ceramics (IRCER) in Limoges (France). Research works at IRCER are devoted to the understanding and control of various steps used in the elaboration processes, for ceramics and surface treatments, to produce components, layers… with specific or improved properties.

Her doctoral research investigates the development of transparent ceramics, more precisely Yttrium Aluminum Garnet (YAG) ceramics, for laser applications. Her strategy is to control shaping and sintering processes by establishing a fundamental understanding of powder shaping (stability of aqueous suspensions, casting, powder compaction) and ceramic sintering (kinetics of densification and grain growth) influence on the achievement of specific architecture-microstructure-property objectives. She is also a specialist of structural, microstructural analyses and optical properties of transparent ceramics.

She holds an engineering diploma in Industrial Ceramics at ENSCI, Limoges, France in 2017. During her training, she studied in Spain with an Erasmus program during a term and she holds an internship in Belgium and another one in New Zealand. Thanks to these experiences, she was immersed in different cultures and traditions and met amazing persons. Through various research projects, she gained knowledge about ceramics for different fields: glass fibers to reinforce thermoplastics, refractories for aluminum furnaces, ceramic oxides for electrical/optical applications. In 2018, she worked as engineer at IRCER on a research project focused on transparent ceramics properties destined to jewelry and watchmaking sector. This first professional experience made her desire to work in this research domain. She has already published one publication and participated in two national and two international symposia.

Elisa Zanchi

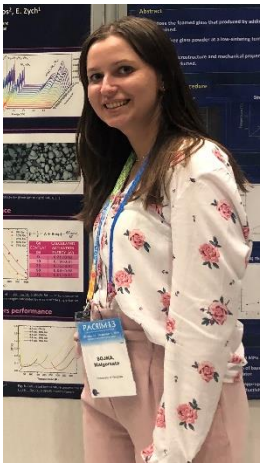
Elisa Zanchi is a PhD student at the Department of Applied Science and Technology, Politecnico di Torino (Italy), under the mentorship of Prof. Federico Smeacetto. She is part of the GLANCE group (headed by Prof. Monica Ferraris) whose main research activity focuses on glass, glass-ceramics and composites for joining and coating applications.

Elisa received the MSc degree in Materials Engineering at Politecnico di Torino in 2018, with a thesis on the characterization of iron-doped manganese cobaltite spinel coatings for Solid Oxide Cell (SOC) interconnects, that she carried out at the Department of Energy Conversion and Storage, Technical University of Denmark. Her current PhD project deals with the use of electrophoretic deposition (EPD) technique to process innovative spinel-based ceramic coatings for SOC metallic interconnects, including high temperature corrosion and electrical characterization, in collaboration with Gdańsk University of Technology and AGH University of Science and Technology (Poland). She is also involved in the EU project “NewSOC”, working on the surface modification of metallic interconnects, to improve the interface with innovative glass-ceramic sealants.

In 2019 Elisa received a KMM-VIN fellowship for the optimization of novel EPD suspensions, for a stay at the Friedrich–Alexander University (Erlangen, Germany) under the supervision of Prof. Aldo R. Boccaccini. She was an oral presenter at the ICACC 2020, having been awarded with a full ECerS and JECS Trust travel grant.

Malgorzata Sojka

Małgorzata Sójka received her M.Sc degree in Chemistry from University of Wroclaw in 2017 for her research on thermoluminescent properties of Lu_2O_3:Tb,Zr sintered ceramics. Since 2017 Małgorzata is a PhD student in Luminescent Materials Group headed by Professor Eugeniusz Zych. Her PhD research project focuses on developing new luminescent thermometers working in a broad range of temperatures. Presently it is 10-700 K, but Małgorzata aims to get to the range of 10-1000 K. In 2018, she has completed a 3-month internship at the University of Aveiro, Portugal under the supervision of Professor Luis D. Carlos. Małgorzata has also performed research on ancient artefacts in 2019 at University of Palermo in Sicily, Italy for one month. She co-authored five publications and is now working on her next paper.



Iva Milisavljevic

Iva Milisavljevic is a third-year PhD student in Ceramic Engineering at Alfred University (USA), working as a graduate research assistant under the supervision of her thesis advisor, Dr. Yiquan Wu. Her general research focus is on the methods of fabrication of ceramic materials for different optical and laser applications. Iva's current research project involves the investigation of the mechanisms and the kinetics of the novel technique of the Solid-state Single Crystal Growth (SSCG) and how it can be applied to the controlled growth of single crystals of various compositions. Additionally, a part of her research interests is also focused on the methods of fabrication of transparent ceramics and transparent nanoceramics as a way of achieving either higher performance or exploring new possibilities of optical ceramics.

Iva hold BSc and MSc degrees in Chemical Engineering from Belgrade University (Serbia). She has found the transition from the field of chemical to ceramic engineering quite exciting and inspirational because it allowed her to broaden her knowledge and face new challenges. She is a member of the Society of Women Engineers (SWE) and also a member of a local SWE Club on campus, where we strive to ensure better inclusivity and work positions for women in engineering and technology fields. In her free time, she enjoys exploring nature and hiking in one of the many state parks in New York.

Arjak Bhattacharjee

Arjak Bhattacharjee is currently a third year PhD student at the school of Mechanical and Materials Engineering, Washington State University, Pullman, WA, USA. He is currently working with Prof. Susmita Bose and Prof. Amit Bandyopadhyay in the area of additive manufacturing of ceramic-based implants for orthopedic applications. He completed his Masters in 2018 from the Indian Institute of Technology, Kanpur, and received a gold medal from the current president of India, Mr. Ram Nath Kovind, for overall best performance among all postgraduate students. Apart from research, Arjak is highly passionate in several leadership and humanitarian activities and communicating science through documentaries. He directed India's first documentary on ceramics titled "Oneness with the Infinite" which won two international awards by The American Ceramic Society and in the India-International Science film festival in 2017.

Victoria Christensen

Victoria Christensen is a 3rd year PhD student at UC Santa Barbara in Frank Zok's research group. Her research is focused on studying oxidative embrittlement of SiC/SiC ceramic matrix composites. Her work is funded by IHI Corporation, a Japanese company working to develop ceramic matrix composite components for use in hot sections of turbine engines. She travelled to Japan to visit IHI's headquarters last June and frequently presents research updates in virtual meetings. Victoria will share lessons learned in preparing presentations for international audiences and best practices for networking in situations where there is a language barrier and cultural differences.

Florent Cassouret

After a first year (which correspond to the third year of higher education in the French specific system of "Ecoles d'ingénieurs") of general courses, which covered all domains of chemistry from solid state chemistry to biochemistry at Chimie ParisTech, Florent chose to specialize in solid state chemistry. During his last year in Chimie ParisTech, he decided to do a double degree with Sorbonne Université in Paris on material sciences. In 2019, he graduated from both Chimie ParisTech with an engineer degree (equivalent to a master's degree) and from Sorbonne Université with a master degree in material sciences. During both his second and last years at Chimie ParisTech, he had the opportunity to go to Japan to be a visiting scientist at the Institute for Molecular Sciences (IMS) in Prof. Takunori Taira's laboratory thanks to a collaborative partnership between this laboratory and a laboratory host in the school led by Prof. Gérard Aka (MOPE team of the Institut de Recherches de Chimie Paris). During these two exchanges with Prof. Taira's lab, he worked on non-linear optic and high-power frequency conversions in green and UV ranges using high peak-power and compact neodymium-based micro-lasers (MOPA system) emitting in the near IR. He also got the opportunity to present his work on the third harmonic generation as speaker in an international conference at Vienna in Austria in November 2019 (Advance Solid State Lasers).

Since the end of 2019, he started a PhD program in Prof. Aka's laboratory at Chimie ParisTech. He is currently working on two main topics: new laser praseodymium oxides doped with Praseodymium ions to obtain direct emission in the visible range and the development of new non-linear single crystals for frequency conversion from the visible to the UV.