



**2021/2022 Division & Class Report
to the
ACerS Board of Directors**

Division/Class: **Basic Science Division**

Current Division/Class Officers: (complete as appropriate for your Division or Class)

Chair: Yiquan Wu
Chair-Elect: Wolfgang Rheinheimer
Vice-chair: Edwin Garcia
Secretary: Amanda Krause
Secretary-Elect: Ricardo Castro
Counselors: Kristen Brosnan, John Blendell, Paul Salvador
Board of Directors Liaison: Makio Naito
PCSA Representatives: Matt Julian, Spencer Dahl

Incoming Division Officers: (complete as appropriate for your Division or Class)

Chair: Wolfgang Rheinheimer
Chair-Elect: Edwin Garcia
Vice-chair: Amanda Krause
Secretary: Ricardo Castro
Secretary-Elect: Fei Peng
Counselors: Yiquan Wu, Kristen Brosnan, John Blendell
Board of Directors Liaison: TBD
PCSA Representative: TBD

Summary of Meetings and Activities Held/To Be Held (from Oct. 2021 through Oct. 2022):

For the MS&T 2021, the BSD was the lead organizer for 2 symposia, on: 1) ACerS Robert B. Sosman Award Symposium: Bridging the Gap between Atomistic and Continuum Approaches to Interface Science; and 2) Emergent Materials under Extremes and Decisive In-Situ Characterizations — Materials Characterization at Extreme Conditions; and co-organized an additional 13 symposia on 1) Controlled Synthesis, Processing, and Applications of Structural and Functional Nanomaterials — 1D Nanostructures; 2) Glasses and Optical Materials: Current Issues and Functional Applications — Optical Properties and Processing of Amorphous Solids; 3) Grain Boundaries, Interfaces, and Surfaces in Ceramics: Fundamental Structure—Property—Performance Relationships — Continuum Approaches; 4) Thermodynamics of Materials in Extreme Environments — Thermodynamics and Stabilities of Alloys and Ceramics; 5) Additive Manufacturing of Ceramic-based Materials: Process Development, Materials, Process Optimization and Applications — Session III: Laser Powder Bed Fusion and Novel AM Processes; 6) Phase Transformations in Ceramics: Science and Applications — Computation and Predictions; 7) Materials Informatics for Images and Multidimensional Datasets; 8) Solid-state Optical Materials and Luminescence Properties; 9) Additive Manufacturing of Ceramic-based Materials: Process Development, Materials, Process Optimization and Applications — On-Demand Oral Presentations; 10) Hybrid Organic—Inorganic Materials for Alternative Energy — On-Demand Hybrid Organic—Inorganic Materials for Alternative Energy; 11) Materials Informatics for Images and Multidimensional Datasets — On-Demand Oral Presentations; 12) Mechanistic Insights

into the Synergistic Properties of Nanocomposites — On-Demand Oral Presentations; and 13) Processing and Performance of Materials Using Microwaves, Electric and Magnetic Fields, Ultrasound, Lasers, and Mechanical Work: The Rustum Roy Symposium — On-Demand Oral Presentations.

The BSD also co-organized 5 poster sessions in MS&T 21 on: 1) Controlled Synthesis, Processing, and Applications of Structural and Functional Nanomaterials; 2) Grain Boundaries, Interfaces, and Surfaces in Ceramics: Fundamental Structure—Property—Performance Relationships; 3) Phase Transformations in Ceramics: Science and Applications; 4) Thermodynamics of Materials in Extreme Environments; and 5) Mechanistic Insights into the Synergistic Properties of Nanocomposites

BSD has provided symposium support of \$8,000 (4@ \$2,000) for MS&T 2021.

The 2020 Sosman award was held in MS&T 2021 and was Wayne Kaplan from the Technion. The 2021 ACerS Robert B. Sosman Award Symposium: Bridging the Gap between Atomistic and Continuum Approaches to Interface Science, chaired by John Blendell.

The Ceramographic contest and Snow award overseen by Klaus van Benthem of BSD was held at the MS&T 2021. For MS&T 2021, 1st (\$75 award), 2nd place (\$50 award), and 3rd place (\$25) were awarded in the SEM, TEM, and Scanning Probe, with a \$1500 prize was awarded for the Roland B. Snow Award.

2021 Roland B. Snow Awardee: Title: “Single Crystalline Galaxy”, Joseph Wood from University of California – Davis.

2021 Ceramographic Competition had three different categories. 1) For SEM Awardees: First Place: Single Crystalline Galaxy (Joseph Wood from University of California – Davis); Second Place: A Starry Night (Bo Yang from Purdue University); and Third Place: Pollen Derived Carbons (Jialing Tang from Purdue University). 2) For TEM Awardee: First Place: Nano Penguin (Boyi Qu from University of California – Davis). 3) For SPM Awardees: First Place: Hummingbird Plastically Imprinted (Xufei Fang from Technical University of Darmstadt and Osaka University); Second Place: Micro Domain City (Oliver Preuss from Technical University of Darmstadt)

For 2021 GEMS Award chaired by John Blendell at MS&T 2021, there were only 3 finalists, and all were awarded at the Diamond level. The awardees were Corey Carlos, Spencer Dahl, and Eeshani Gadbole.

EMA 2022 (Co-organized by Amanda Krause and Shen Dillon from BSD) was held virtually, but in an archive. Nearly 300 attendees from 22 countries logged in to view the more than 300 oral and poster presentations. EMA 2022 provided multiple opportunities for attendees to connect with each other through events such as an industrial panel for students and young professionals, etc. BSD provided \$2,275 for supporting 19 students for the EMA and Winter workshop for their registrations. BSD selected Bilge Yildiz from MIT as the plenary speaker of the EMA 2022.

BSD led 3 symposia in EMA 2022 on: 1) Complex Oxide Thin Films and Heterostructures: From Synthesis to Strain/Interface-engineered Emergent Properties; 2) Mesoscale Phenomena in Ferroic Nanostructures: From Patterns to Functionalities; and 3) Evolution of Structure and Chemistry of Grain Boundaries and Their Networks as a Function of Material Processing, and co-led 8 symposia on 1) Characterization of Structure–Property Relationships in Functional Ceramics; 2) Advanced Electronic Materials: Processing Structures, Properties, and Applications; 3) Frontiers in Ferroic Oxides: Synthesis, Structure, Properties, and Applications; 4) Structure–Property Relationships in

Relaxor Ceramics; 5) Point Defects and Transport in Ceramics; 6) Agile Design of Electronic Materials: Aligned Computational and Experimental Approaches and Materials Informatics; 7) Functional Materials for Biological Applications; and 8) Advanced Microelectronics.

The 2020 Gordon Research Conference (GRC) on Ceramics that the BSD supports was postponed to 2022. The Gordon Research Conference on Solid State Studies in Ceramics titled Coupled Phenomena in Ceramics Across Lengths Scales was held at Mt. Holyoke College in South Hadley, MA, August 7 - 12, 2022 in conjunction with the Gordon Research Seminar (GRS) which was held the weekend prior. There were 121 registered attendees. BSD has provided \$7,000 in total for the GRC and GRS. The former BSD chair Ivar Reimanis was the 2020 Ceramics GRC chair.

Fei Peng of Clemson University was selected by BSD as 2023 Secretary-Elect. The nominating committee was chaired by Victoria Blair.

Future Planned Meetings/Activities (from Nov. 2022 – October 2023):

BSD plans to participate in MS&T 2022 at a similar level to the previous year. The BSD is the lead organizer for 5 symposia on: 1) Grain Boundaries, Interfaces, and Surfaces: Fundamental Structure-Property-Performance Relationships — Interfaces in Functional Materials; 2) Solid-state Optical Materials and Luminescence Properties — Processing and Study of Advanced Optical Materials I; 3) Synthesis, Characterization, Modeling and Applications of Functional Porous Materials — Porous Materials; 4) ACerS Robert B. Sosman Award Symposium: Advancing the Science of Materials for Extreme Environments; and 5) Emergent Materials under Extremes and Decisive In Situ Characterizations — In Situ Characterization. Meanwhile, BSD is co-organizing an additional 7 symposia on 1) Additive Manufacturing of Ceramic-based Materials: Process Development, Materials, Process Optimization and Applications; 2) Controlled Synthesis, Processing, and Applications of Structural and Functional Nanomaterials — 2D Materials Synthesis & Properties; 3) Glasses and Optical Materials: Current Issues and Functional Applications — Silicate (rich) Glasses; 4) Processing and Performance of Materials Using Microwaves, Electric and Magnetic Fields, Ultrasound, Lasers, and Mechanical Work – Rustum Roy Symposium; 5) Thermodynamics of Materials in Extreme Environments — Thermodynamics of Molten Salts; 6) Controlled Synthesis, Processing, and Applications of Structural and Functional Nanomaterials — Nanostructure Synthesis & Mechanisms; and 7) Materials Informatics for Images and Multidimensional Datasets.

The BSD will also co-organized 9 poster sessions in MS&T 2022 on: 1) Additive Manufacturing of Ceramic-based Materials: Process Development, Materials, Process Optimization and Applications — Poster Session; 2) Controlled Synthesis, Processing, and Applications of Structural and Functional Nanomaterials — Poster Session; 3) Glasses and Optical Materials: Current Issues and Functional Applications — Poster Session; 4) Grain Boundaries, Interfaces, and Surfaces: Fundamental Structure-Property-Performance Relationships — Poster Session; 5) Materials Informatics for Images and Multidimensional Datasets — Poster Session; 6) Processing and Performance of Materials Using Microwaves, Electric and Magnetic Fields, Ultrasound, Lasers, and Mechanical Work – Rustum Roy Symposium — Poster Session; 7) Solid-state Optical Materials and Luminescence Properties — Poster Session; 8) Synthesis, Characterization, Modeling and Applications of Functional Porous Materials — Poster Session; and 9) Thermodynamics of Materials in Extreme Environments — Poster Session

2022 Sosman Lecture with symposium focusing on Advancing the Science of Materials for Extreme Environments – Bill Fahrenholtz from Missouri University of S&T. The 2022 Sosman lecture and symposium will be chaired by Yiquan Wu, Greg Hilmas, and Eric Wuchina.

The 2023 Sosman lecture will be Elizabeth Dickey of Carnegie Mellon University. The award committee was chaired by Wolfgang Rheinheimer.

BSD will provide \$5,000 support for the symposia tagged with BSD in MS&T'22. Additionally, BSD will provide \$1,350 to support 10 students for covering the registration costs of MS&T 22, teamed with ACerS' Ceramic and Glass Industry Foundation.

BSD is involved in EMA 2023. EMA 2023 will take place as an in-person event in Orlando, January 18–20, 2023. Amanda Krause and Ricardo Castro from BSD are co-organizing with Electronics Division. BSD plans to provide \$2,500 to support students for EMA 2023. BSD selected Jeffrey M. Rickman from Lehigh University as the plenary speaker of the EMA 2023. The title is Interfacial transitions at grain boundaries.

For EMA 2023, BSD will contribute 3 symposia on 1) Complex Oxide Thin Films and Heterostructures: From Synthesis to Strain/Interface-engineered Emergent Properties; 2) Mesoscale Phenomena in Ferriic Nanostructures: From Patterns to Functionalities; and 3) Evolution of Structure and Chemistry of Grain Boundaries and Their Networks as a Function of Material Processing, and will co-lead 6 symposia on 1) Characterization of Structure–Property Relationships in Functional Ceramics; 2) Advanced Electronic Materials: Processing Structures, Properties, and Applications; 3) Point Defects and Transport in Ceramics; 4) Agile Design of Electronic Materials: Aligned Computational and Experimental Approaches and Materials Informatics; and 5) Advanced Microelectronics; and 6) Frontiers in Ferriic Oxides: Synthesis, Structure, Properties, and Applications.

For the 2022 GEMS award in MS&T 2022, there were 38 applicants this year and 10 finalists were chosen. The awarding of the Diamond or Sapphire level will be determined by the oral presentation at MS&T 2022.

The Ceramographic contest and Snow award overseen by Klaus van Benthem of BSD will be held at the MS&T 2022. For MS&T 2022, 1st (\$75 award), 2nd place (\$50 award), and 3rd place (\$25) will be awarded in the SEM, TEM, and Scanning Probe individually, and a \$1,500 prize will be awarded for the Roland B. Snow Award.

Gordon Research Seminar and Conference in Solid State Studies in Ceramics support will continue with \$3,500/year for two years, the next meeting is chaired by Wayne D. Kaplan and Edwin Garcia in 2024.

New Initiatives/Opportunities:

1. BSD has an Executive Meeting on Sunday, October 9, 3:30-5:30 pm in Omni Pittsburgh, and BSD General Business Meeting on Tuesday, October 11, 12:00 – 1:00 pm in Convention Center.

2. BSD has established **BSD Early Discovery Award** and selected the first awardee (Yanhao Dong of Tsinghua University). Jürgen Rödel chaired the committee. The new award for early career (<10 years after the last degree) member of BSD who has demonstrated a contribution to basic science in

the field of glass or ceramics. The recipient will be awarded an award certificate and ACerS lifetime membership.

3. BSD officers reviewed the structures of committees and the rules of awards to refine the roles and responsibilities of each volunteer and officer to serve on the BSD committees.

4. BSD has considered Networking activity in MS&T 2022, but decided NOT to hold for 2022 due to the concerns on Covid and budget considerations.

5. BSD, Energy Materials & Systems Division, and ED have been working with Steve Tidrow to bring more students to become ACerS members by providing support for membership fees.

What action has the Division taken to address diversity and inclusion (award and officer nominations, invited speakers, etc.)?

- BSD officers refined the Sosman rules to add more structure and support D&I to the selection process, rules were presented at MS&T 2021 for approval.
- BSD has Victoria Blair as the BSD delegate as the ACerS Diversity and Inclusion Sub-Committee Member for 2023.

Action Items for ACerS Board Consideration at the October 2022 meeting:

Issues/Concerns:

BSD has organized several symposia in the MS&T 2022, and has a good number of participants, however, due to travel restrictions in other countries and concerns about COVID, some speakers will not be able to come for MS&T 2022. The MS&T 22 will not provide the virtual option this time, so the number of attendants will reduce, and some talks will be canceled. Some international officers may not be present for the in-person MS&T 2022 meeting.

Additional Items of Note:

BSD and Electronics Division have discussed a new location for 2024 EMA. Some BSD officers are considering BSD moving away from EMA in the near future.

Financial Statement: (Including year-end summary of expenditures from the Division's Funds)

Attached.

Submitted By: Yiquan Wu