

# CURRICULUM VITAE - BRIAN W. SHELDON

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## EDUCATION

S.B., Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA, 1981.

Sc.D., Materials Science & Engineering, Massachusetts Institute of Technology, Cambridge, MA, 1989.

Dissertation: "The Formation of Reaction Bonded Silicon Nitride from Silane Derived Silicon Powders"

## PROFESSIONAL APPOINTMENTS

1981-1984: Research Staff, Amoco Research Center, Naperville, IL.

1988-1991: Research Staff, Oak Ridge National Laboratory, Oak Ridge, TN.

1991-1996: Assistant Professor, Brown University, Providence, RI.

1996-2003: Associate Professor, Brown University, Providence, RI.

2003-present: Professor of Engineering, Brown University, Providence, RI.

## COMPLETED RESEARCH

### *Books (edited) and Book Chapters*

1. B.W. Sheldon and S.C. Danforth, editors, "Silicon Based Structural Ceramics", Ceramic Transactions, Vol. 42, (American Ceramic Society, 1994).
2. W.Y. Lee, R. Johnson, M.L. Pickering, and B.W. Sheldon, editors, "Properties and Processing of Vapor Deposited Coatings", *MRS Proceedings Volume 555* (Materials Research Society, 1999).
3. S. Bishop, N. Perry, D. Mariocchelli, B. Sheldon, editors, "Electro-Chemo-Mechanics of Solids" (Springer, 2017).
4. Truong Cai, Jung Hwi Cho, and Brian W. Sheldon, "Mechanical Behavior of Transition Metal Oxide Based Battery Materials", chapter in *Transition Metal Oxides for Electrochemical Energy Storage* edited by Veronica Augustyn and Jagjit Nanda (Wiley, 2022).

### *Refereed Journal Papers:*

5. B. Sheldon, A.G. Emslie, and J.S. Haggerty, "Exact computation of the reflectance of a surface layer of arbitrary refractive-index Profile and an Approximate Solution of the Inverse Problem", *J. Opt. Soc. Am.* **72**, 1049 (1982).
6. B.W. Sheldon, "The Control of Gas Phase Kinetics to Maximize Densification during Chemical Vapor Infiltration", *J. Mater. Res.* **5**, 2729-36 (1990).

7. T.M. Besmann, B.W. Sheldon, and M.D. Kaster, "Temperature and Concentration Dependence of SiC Deposition on Nicalon Fibers", *Surf. Coat. Tech.* **43/44**, 167-75 (1990).
8. B.W. Sheldon and J.S. Haggerty, "Nitrogen Adsorption onto Silane Derived Silicon Powders", *J. Am. Ceram. Soc.* **74**, 1417-24 (1991).
9. T.M. Besmann, B.W. Sheldon, R.A. Lowden, and D.P. Stinton, "Vapor Phase Fabrication and Properties of Continuous-Filament Ceramic Composites", *Science* **253**, 1104-9 (1991).
10. B.W. Sheldon and T.M. Besmann, "Reaction and Diffusion Kinetics during the Initial Stages of Isothermal Chemical Vapor Infiltration", *J. Am. Ceram. Soc.* **74**, 3046-53 (1991).
11. B.W. Sheldon, J. Szekely, and J.S. Haggerty, "The Formation of Reaction Bonded Silicon Nitride from Silane Derived Silicon Powders: Overall Kinetics and Related Transport Phenomena", *J. Am. Ceram. Soc.*, 677-85 (1992).
12. T.M. Besmann, B.W. Sheldon, T.S. Moss, and M.D. Kaster, "Depletion Effects of SiC Deposition from Methyltrichlorosilane", *J. Am. Ceram. Soc.* **75**, 2899-2903 (1992).
13. B.W. Sheldon, T.M. Besmann, K.L. More, and T.S. Moss, "Epitaxial Nucleation of Polycrystalline Silicon Carbide During Chemical Vapor Deposition", *J. Mater. Res.* **8**, 1086-92 (1993).
14. Y. Shigesato, R.E. Boekenhauer, and B.W. Sheldon, "Emission spectroscopy during direct-current-biased, microwave-plasma chemical vapor deposition of diamond", *Appl. Phys. Lett.* **63**, 314-16 (1993).
15. B.W. Sheldon, R. Csencsits, J. Rankin, R.E. Boekenhauer, and Y. Shigesato, "Bias-enhanced nucleation of diamond during microwave-assisted chemical vapor deposition", *J. Appl. Phys.*, **75**, 5001-8 (1994).
16. F.S. Lauten, Y. Shigesato, and B.W. Sheldon, "Diamond nucleation on unscratched substrates", *Appl Phys. Lett.*, **65**, 210-2 (1994).
17. J. Rankin, R.E. Boekenhauer, R. Csencsits, Y. Shigesato, M.W. Jacobson, and B.W. Sheldon, "Nucleation and growth during the chemical vapor deposition of diamond on SiO<sub>2</sub> substrates", *J. Mater. Res.*, **9**, 2164-2173 (1994).
18. H.-C. Chang, T.F. Morse, and B.W. Sheldon, "Minimizing Infiltration Times During the Initial Stage of Isothermal Chemical Vapor Infiltration", *J. Mater. Proc. Manuf. Sci.* **2**, 437-454 (1994).
19. J. Rankin, B.W. Sheldon, and L.A. Boatner, "The measurement and analysis of epitaxial recrystallization kinetics in ion-beam-amorphized SrTiO<sub>3</sub>", *J. Mater. Res.*, **9**, 3113-3120 (1994).
20. B.W. Sheldon, J. Rankin, and J.S. Haggerty, "The Formation of Reaction-Bonded Silicon Nitride from Silane-Derived Silicon Powders: Nucleation and Growth Mechanisms", *J. Am. Ceram. Soc.*, **78**, 1624-32 (1995).

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30. R.S. Parikh, A. Lightfoot, J.S. Haggerty, and B.W. Sheldon, "The Effects of Trace O<sub>2</sub> Levels on the Nitriding Kinetics of High Purity Si Powders", *J. Am. Ceram. Soc.* **82**, 2626-32 (1999).
31. M.J. O'Brien and B.W. Sheldon, "Fracture at Alumina Interfaces with Controlled, Fine Scale Porosity", *J. Am. Ceram. Soc.* **82**, 3567-74 (1999).
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202. B.W. Sheldon, R.E. Boekenhauer, E.B. Chen, and F.S. Lauten, "The role of carbonaceous precursors during diamond nucleation on fused silica", in *Proceedings of the Fourth International Symposium on Diamond Materials*, edited by K.V. Ravi and J.P. Dismukes (Electrochemical Society, Pennington, N.J., 1995), pp. 649-55.
203. S. Nijhawan, S.M. Jankovsky, and B.W. Sheldon, "The Control of Intrinsic Stresses in CVD Diamond Films with Multistep Processing", in Diamond for Electronic Applications - MRS Sympo Proceedings, edited by P. Pehrsson et. al., (Materials Research Society, Pittsburgh, 1996).
204. R.E. Boekenhauer, F.S. Lauten, and B.W. Sheldon, "The Use of Disordered Interlayers to Enhance Si<sub>3</sub>N<sub>4</sub> Nucleation", in Polycrystalline Thin Films II - MRS Symposium Proceedings, edited by H.J. Frost, C.A. Ross, M.A. Parker, and E.A. Holm, (Materials Research Society, Pittsburgh, 1996).
205. S. Nijhawan, J. Rankin, B.L. Walden, and B.W. Sheldon, "Grain Impingement and Intrinsic Stress in CVD Diamond", in Thin Films - Stresses and Mechanical Properties VII - MRS Symposium Proceedings Vol. 505, eds. R. Cammarata, M. Nastasi, E. Busso, and W.C. Oliver (Materials Research Society, Pittsburgh, 1998), pp. 415-20.
206. B. W. Sheldon, "Kinetic Model for the Oxidation of BN Interface Layers in SiC/SiC Composites," in High Temperature Corrosion and Materials Chemistry, eds. P.Y. Hou, M. McNallan, R. Oltra, E.J. Opila, and D.A. Shores, The Electrochemical Society, Pennington, NJ, 1998), pp. 366-381.
207. B.W. Sheldon, S. Nijhawan, J. Rankin, and B.L. Walden, "Methane Effects on Grain Boundary Formation and Intrinsic Stress in CVD Diamond", in *Proceedings of the Sixth International Symposium on Diamond Materials*, eds. J. C. Angus, W. D. Brown, and A. Gicquel (Electrochemical Society, Pennington, N.J., 2000), pp. 175-184.
208. B.W. Sheldon, "Compositional Stresses and Diffusion in Nonstoichiometric Oxide Films", in *Coatings 2005 Symposium Proceedings, MST 2005 Conference*, pp. 39-45 (2005).
209. H. Li, A. Kothari, and B. W. Sheldon, "Synthesis of carbon nanotube and silicon carbide nanofibers as composite reinforcing materials", *Ceram Engin Science Proc* **27**, 41-48 (2006).
210. S. Sirivisoot, C. Yao, X. Xiao, B.W. Sheldon, and T.J. Webster, "Developing biosensors for monitoring orthopedic tissue growth", in Biosurfaces and Biointerfaces - MRS Symposium Proceedings Vol. 950, eds. M. Firestone, J. Schmidt, N. Malmstadt (Materials Research Society, Pittsburgh, 2007), p. 81-87.
211. S. Sirivisoot, C. Yao, X. Xiao, B.W. Sheldon, and T.J. Webster, "Developing biosensors for monitoring orthopedic tissue growth", *AICHe Annual Meeting Conference Proceedings, 2007 AICHe Annual Meeting*, 9 p (2006).

212. A. Bhandari, B.W. Sheldon, and S.J. Hearne, "Stress evolution due to island coalescence during film growth", *Materials Research Society Symposium Proceedings*, v 967, (Materials Research Society, Pittsburgh, 2006), p. 294-306.
213. L. Yang, T.J. Webster, and B.W. Sheldon, "Topographical effects of micro- and nano-crystalline diamond for controlling osteoblast adhesion", *AIChE Annual Meeting Conference Proceedings, 2007 AIChE Annual Meeting*, 11 p (2007).
214. S. Sirivsoot, C. Yao, X. Xiao, B.W. Sheldon, and T.J. Webster, "Carbon nanotubes-titanium electrode for detecting calcium deposition by osteoblasts", *Bioengineering, Proceedings of the 33<sup>rd</sup> Annual Northeast Bioengineering Conference*, 238-240 (2007).
215. L. Yang, B.W.Sheldon, and T.J. Webster, "Topographical Evolution of Nanocrystalline Diamond and Its Effect on Osteoblast Interactions", in Diamond Electronics—Fundamentals to Applications II - MRS Symposium Proceedings Vol. 1039, (MRS, Pittsburgh, 2008), 1039-P03-02
216. S.Mandowara and B.W. Sheldon, "Compositional Stresses in Polycrystalline Ceria Films", *Electrochemical Society Transactions* **11 (33)**, 191-196 (2008).
217. Sumit K. Soni, Diane Samelor, Brian W. Sheldon, Constantin Vahlas, and Alain N. Gleizes, "Residual Stress Mechanisms in Aluminium Oxide Films Grown by MOCVD", *Electrochemical Society Transactions* **25(8)**, 1309-1315 (2009).
218. J.D. Nicholas, S. Mandowara, Q. Yang, and B.W. Sheldon, "Effect of Sintering Aids on the Stress Evolution of Constrained Sintered Gadolinium-Doped Ceria Films", *Electrochemical Society Transactions* **45(1)**, 481-490 (2012).
219. K. Ryzewski, S. Herringer, H. Bilheux, L. Walker, B. Sheldon, S. Voisin, J.-C. Bilheux, V. Finocchiaro, "Neutron Imaging of Archaeological Bronzes at the Oak Ridge National Laboratory", *Physics Procedia*,**43**, 343-351 (2013).
220. S. R. Bishop, D. Chen, J. Sheth, S. Misture, B. Sheldon, J. J. Kim, and H. L. Tuller, "Impact of size scale on electro-chemo-mechanical coupling properties in MIECs: Bulk and thin film (Pr,Ce)O<sub>2-δ</sub>", *ECS Transactions* **61** (1), 31-36 (2014).
221. C. James, Y. Wu, B. Sheldon, and Y. Qi, "Computational Analysis of Coupled Anisotropic Chemical Expansion in Li<sub>2</sub>-XMnO<sub>3-δ</sub>", *MRS Advances*. 1 (15), 1037 (2016). doi:10.1557/adv.2016.48

**Book Review:**

222. Review of "Diamond Chemical Vapor Deposition: Nucleation and Early Growth Stages, by H. Liu and D.S. Dandy", *Materials Research Society Bulletin*, September 1997, p. 52.

***Invited Lectures / Presentations:***

“Microstructure Evolution During Vapor Phase Processing of Advanced Ceramics”, University of Connecticut, April 1993.

"Minimizing Densification Times During Isothermal Chemical Vapor Infiltration", presented at the 1993 PacRim Meeting of the American Ceramic Society, Honolulu, Hawaii, November 1993.

“Modeling the Oxidation of Boron Nitride Interface Layers in Ceramic Matrix Composites” presented at NASA Lewis Research Center, Cleveland, Ohio, November 1996.

“Analysis and Modeling of Infiltration Problems”, DOE Workshop on Mathematical Aspects of Materials Science Modeling, Gatlinburg, Tennessee, April 1998.

“Oxidation of Boron Nitride Interface Layers in Ceramic Matrix Composites”, 193rd Meeting of the Electrochemical Society, San Diego, California, May 1998.

“Complex Oxidation Kinetics in Nitride Ceramics”, presented at the Gordon Conference on High Temperature Materials, Plymouth, New Hampshire, July 1998.

“Control of Intrinsic Stress During the Growth of Polycrystalline Diamond”, Gordon Conference on Diamond Synthesis, Queen's College, Oxford, UK, August 1998.

“Intrinsic Stress in CVD Diamond”, Penn State University, November 1998.

“CVD Coatings and Intrinsic Stress”, ASM Symposium on Advanced Coating Technologies, Knoxville Tennessee, March 1999.

“Control of Intrinsic Stress in CVD Diamond”, Naval Research Laboratory, Washington, DC, April 1999.

“Chemical Effects on Intrinsic Stress in CVD Diamond”, 196<sup>th</sup> Meeting of the Electrochemical Society, Honolulu, Hawaii, October 1999.

“The Control of Intrinsic Stresses During Island Coalescence”, International Symposium on Adhesion Aspects of Thin Films”, Newark, New Jersey, October 1999.

“Intrinsic Stress in CVD Diamond”, Gordon Conference on Diamond Synthesis, Newport, RI, June 2000.

“Understanding and Controlling Intrinsic Stresses Caused by Grain Boundary Formation in Polycrystalline Films and Coatings”, St. Gobain Research and Development Center, Worcester, Massachusetts, October 2000.

“Materials Science Based Training for Middle and High School Science and Math Teachers”, Materials Research Society Spring Meeting, San Francisco, California, April 2001.

“Controlling Intrinsic Stress in Polycrystalline Thin Films and Coatings”, Stevens Institute of Technology, Hoboken, New Jersey, October 31, 2001.

“Controlling Intrinsic Stress in Ceramic Thin Films and Coatings”, Harvard University, March 14, 2002.

“Step Energy Barriers and Morphology Changes in Small Faceted Particles”, 103rd Annual Meeting of the American Ceramic Society, St. Louis, MO, April 2002.

“Understanding and Controlling Intrinsic Stresses in Polycrystalline Thin Films and Coatings”, Basic Science Meeting of the American Ceramic Society, Seattle, WA, October 4, 2002.

“Performance of Nanotube-Based Ceramic Composites”, presented at the High Temperature Materials Lab Forum, Knoxville, TN, Nov. 20, 2002.

“Fiber-Reinforced Ceramic Composites for Biomedical Applications”, Synthes Osteobiologics, Philadelphia, PA, Jan. 14, 2003.

“Mechanical Behavior of Ceramic Coatings Reinforced with Carbon Nanotubes”, International Conference on Nanomaterials and Nanotechnologies, Crete, Greece, September 2003.

“Successes in Using WebCT for a Large Engineering Class”, CIS Faculty Showcase, Brown University, January 15, 2004.

“Competition Between Tensile and Compressive Stress Mechanisms During the Volmer-Weber Growth of Polycrystalline Films”, AACGE Conference, Fallen Leaf Lake, CA, June 14, 2004.

“Fiber-Reinforced Ceramic Composites for Biomedical Applications”, Skeletal Kinetics Corp., Cupertino, CA, June 17, 2004.

“Toughening Mechanisms in Nanotube Reinforced Ceramic Composites”, Carbon 2004 Conference, Providence, RI, July 15, 2004.

“Brown University Outreach to K-12 Science and Math Teachers” (with Profs. J. Blume and G. Crawford), Workshop at Boston Museum of Science, in conjunction with the Materials Research Society Fall Meeting, November 28, 2004.

“Tough Nanocomposite Coatings using New Self-Organized Carbon Forms”, Nanoscale Science and Technology Conference, Arlington VA, Dec. 14, 2005.

“Grain Boundary Induced Stresses in Polycrystalline Films”, Annual Meeting of the American Ceramic Society (MST05), Pittsburgh, PA, September 27, 2005.

“Nanostructured Improvements in the Fracture Toughness of Brittle Films”, Institut National Polytechnique de Toulouse, Toulouse, France, Dec. 12, 2005.

“Stress Evolution During the Vapor Deposition of Thin Films”, Institut National Polytechnique de Toulouse, Toulouse, France, Dec. 13, 2005.

“Protective Coatings for Automotive Applications”, Institut National Polytechnique de Toulouse, Toulouse, France, Dec. 15, 2005.

“Toughening Mechanisms in Ceramic Composites Reinforced with Nanotubes and Nanofibers”, ASM / TMS Symposium on Multi-phase and Composite Materials, Niskayuna, NY, May 22, 2006.

“Grain Boundary Induced Stresses in Polycrystalline Coatings and Thin Films”, AACGE Conference, Fallen Leaf Lake, CA, June 7, 2006.

“Island Size Effects on Tensile Stress Evolution in Patterned, Electrodeposited Ni Films”, 212<sup>th</sup> Meeting of the Electrochemical Society, Washington DC, October 11, 2007.

“Grain Boundary Induced Stresses in Polycrystalline Coatings and Thin Films”, Third International Symposium on Adhesion Aspects of Thin Films, Orlando, FL, Nov. 8, 2007.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, IMNI Nanoscience Forum, Providence, RI, May 5-7, 2008.

“Carbon Nanotube Reinforced Ceramic Coatings Produced by Chemical Vapor Infiltration”, Mécanismes de dépôt par voie gazeuse sur des Surfaces de Géométrie Complexe (CNRS Workshop), Nouan Le Fuzelier, France, June 18, 2008.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, University of Iceland, Reykjavik, Iceland, August 13, 2008.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, University of Connecticut, Storrs, CT, October 29, 2008.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, University of Limerick, Limerick, Ireland, November 17, 2008.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, General Motors Technical Center, Warren, MI, May 27, 2009.

“Grain Boundary Induced Stresses in Nanocrystalline Ceramic Coatings and Thin Films”, 8<sup>th</sup> Pacific Rim Conference on Ceramic and Glass (American Ceramics Society), Vancouver, Canada, June 2, 2009.

“The Influence of Chemistry on Grain Boundary Induced Stresses in Polycrystalline Films”, AACGE Conference, Lake Geneva, WI, August 12, 2010.

“Archaeology and Engineering, an Academic Alloy or Haphazard Experiment?”, Wayland Collegium, Brown University, March 10, 2010.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, University of Glasgow, Glasgow, Scotland, June 14, 2010.

Panelist: “Frontiers in mechanics derived from applications in broad scales”, NSF Workshop and Symposium on Future Directions in Mechanics Research, Providence, RI, June 2, 2011.

“Electrochemically Induced Stresses in Energy Storage Materials”, Alfred University, Alfred, NY, December 6, 2012.

“Electrochemically Induced Stresses in Energy Storage Materials”, Medtronic Energy and Component Center, Brooklyn Center, MN, February 26, 2013.

“Using In Situ Thin Film Stress Measurements to Understand Fundamental Lithiation Mechanisms in Battery Electrode Materials”, TMS Annual Meeting, San Antonio, TX, March 4, 2013.

“Fracture and Delamination in Thin Film Si Electrodes”, TMS Annual Meeting, San Antonio, TX, March 6, 2013.

“Chemically Induced Stresses in Li Ion Battery Electrodes”, ACS Annual Meeting, New Orleans, LA, April 10, 2013.

“Lithiation Induced Stresses and Interfacial Phenomena in Li Ion Battery Electrodes”, Society of Engineering Science Annual Meeting, Providence, RI, July 29, 2013.

“Electrochemically Induced Stresses in Energy Storage Materials”, University of Wisconsin, Madison, WI, October 17, 2013.

“Lithiation Induced Stresses and Interfacial Phenomena in Li Ion Battery Electrodes”, TMS Annual Meeting, San Diego, CA, Feb 19, 2014.

“Electrochemically Induced Stresses in Energy Storage Materials”, University of Rhode Island, Kingston, RI, March 3, 2014.

“Electrochemically Induced Stresses in Energy Storage Materials”, 225<sup>th</sup> Electrochemical Society Meeting, Orlando, Florida, May 13, 2014.

“Methods for Improving the Failure Resistance of Coatings and Thin Films”, Université Toulouse III - Paul Sabatier, Toulouse, France, July 4, 2014.

“Interfaces and Chemo-Mechanical Phenomena in NanoCeramic Coatings and Thin Films”, Institut National Polytechnique de Toulouse, Toulouse, France, July 8, 2014.

“Electrochemically Induced Stresses in Ceramics for Energy Applications”, XII International Conference on Nanostructured Materials, Moscow, Russia, July 14, 2014.

“Electrochemically Induced Stresses in Energy Storage Materials”, Electrochemical Strain Microscopy Workshop, Oak Ridge National Lab, September 15, 2014.

“Electrochemically Induced Stresses in Energy Storage Materials”, Society of Engineering Science Annual Meeting, Purdue University, October 1 – 3, 2014.

“Stress Evolution and Degradation Mechanisms in the Solid Electrolyte Interphase”, TMS Annual Meeting, Orlando, FL, March 18, 2015.

“Stress Evolution and Degradation Mechanisms in Energy Storage Materials”, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, June 26, 2015.

“Stress Evolution and Degradation Mechanisms in Energy Storage Materials”, Society of Engineering Science Annual Meeting, Texas A&M University, October 27, 2015.

“*In situ* Fracture Investigations in Ceramic Nanocomposites”, Society of Engineering Science Annual Meeting, Texas A&M University, October 27, 2015.

“Stress Evolution and Degradation Mechanisms in Li Ion Battery Materials”, ICAER 2015: International Conference on Advances in Energy Research, Mumbai, India, December 16, 2015.

“Interfaces and Mechanical Properties in NanoCeramic Coatings and Thin Films”, Seminar at IIT Bombay, India, December 18, 2015.

“Stress Evolution and Degradation Mechanisms in Energy Materials”, Rice University, Houston, Texas, February 11, 2016.

“Mechanical Behavior and Degradation of SEI Films on Graphite and Silicon Electrodes”, Gordon Research Conference on Batteries, Ventura, California, February 23, 2016.

“AFM Studies of Mechanical Behavior and Degradation of SEI Films”, Bruker Nano, Goleta, California, February 24, 2016.

“Electrochemically Induced Stresses in Oxide Films”, 2nd Conference on Functional Oxide Thin Films for Advanced Energy and Information Technology, Cancun, Mexico, March 5, 2016.

“Stress Evolution and Degradation Mechanisms in Li Ion Battery Materials”, Army Research Laboratory, Adelphi, Maryland, March 30, 2016.

“Stress Evolution and Degradation Mechanisms in Energy Materials”, Iowa State University, Ames, Iowa, April 7, 2016.

“Mechanical Degradation and Optimization of Solid Electrolyte Interphases in Li Ion Batteries”, Society of Engineering Science Annual Meeting, University of Maryland, October 4, 2016.

“Stress Evolution and Degradation Mechanisms at Interfaces in Energy-Related Ceramics”, Electronic Materials and Applications 2017 (American Ceramic Society), Orlando, FL, January 20, 2017.

“Mechanical Degradation and Optimization of Solid Electrolyte Interphases in Li Ion Batteries”, TMS Annual Meeting, San Diego, CA, March 2, 2017.

“Electrochemically Induced Stress and Fracture in Ceramic Electrolytes”, 21<sup>st</sup> International Conference on Solid State Ionics, Padua, Italy, June 18, 2017.

“Electrochemically Induced Stress and Fracture in Ceramic Electrolytes”, Society of Engineering Science Annual Meeting, Northeastern University, July 27, 2017.

“Chemo-Mechanical Failure Mechanisms in Ceramic Nanocomposites”, Electronic and Advanced Materials (American Ceramic Society), Orlando, Florida, January 17, 2018.

“Mechanical Degradation and Optimization of Solid Electrolyte Interphases in Li Ion Batteries”, *Keynote* at 10<sup>th</sup> European Solid Mechanics Conference, Bologna, Italy, July 3, 2018.

“Mechanical Degradation and Optimization of Solid Electrolyte Interphases in Li Ion Batteries”, Thermec 2018, Paris, France, July 10, 2018.

“Toughening mechanisms in ceramic nanocomposites with one- and two-dimensional reinforcements”, International Conference on the Strength of Materials, Columbus, Ohio, July 16, 2018.

“Chemo-Mechanical Degradation and Optimization of Solid Electrolyte Interphases in Li Ion Batteries”, ACS National Meeting, Boston, Massachusetts, August 21, 2018.

“Chemo-Mechanical Degradation of Solid Electrolyte Interphases in Li Ion Batteries”, *Keynote* at Society of Engineering Science Annual Meeting, Madrid, Spain, October 10, 2018.

“Stress Evolution and Degradation Mechanisms in Li Ion Battery Materials”, A123 Systems, Waltham, Mass, February 7, 2019.

“Interface Stability and Related Chemo-Mechanical Phenomena During Lithium Metal Plating”, Society of Engineering Science Annual Meeting, October 1, 2020.

“Chemo-Mechanical Phenomena During Lithium Metal Plating”, Automotive and Battery Safety Conference, Sept 28, 2021.

"Rate-dependent mechanical properties of sulfide electrolytes", presentation to CTO and technical managers of SK Innovation, November 7, 2021.

“Interface Stability and Related Chemo-Mechanical Phenomena During Lithium Metal Plating”, Oklahoma State University, Stillwater, Oklahoma, April 25, 2022.

“Chemo-Mechanical Degradation of Energy Storage Materials”, CIRIMAT, Institut National Polytechnique de Toulouse, Toulouse, France, June 28, 2022.

“Chemo-Mechanical Phenomena in Solid Electrolytes”, Multiscale Mechanics, Multiphysics Modeling and Simulations for Energy Storage (Euromech Colloquium 617), Sirmione, Lake of Garda, Italy, August 30, 2022.

“Integrated Simulation, Machine Learning, and Experimental Approaches to Characterize Fracture”, DMMI Workshop on Autonomous Materials Discovery and Optimization, National Academies of Sciences, Engineering and Medicine, Washington DC, November 2, 2022.

### **SERVICE (active participation during 2022):**

Fall 2020 - present: Materials Group Representative, Committee for Graduate Studies

Freshman and Sophomore Advising (13 students)

2013 – present: Editorial Board, *Scientific Reports (Nature Publishing)*

2010 - present: Editorial Board, *Coatings*

Organizer, Symposium on Mechanics of Electrochemical Materials and Systems, at U.S. National Congress on Theoretical and Applied Mechanics (June 2022)

### **ACTIVE RESEARCH GRANTS:**

Sept. 2017 – Sept 2023, “Toughening Mechanisms in Ceramic Nanocomposites with One and Two Dimensional Reinforcements”, DOE-BES, \$1,431,877.

Sept. 2018 – August 2023, "GOALI: Chemically induced stresses and degradation mechanisms in ceramic materials for Li ion batteries." National Science Foundation, \$420,000.

Oct 2019 – May 2023, "Fundamental Understanding of Dynamic Interfacial Phenomena in Solid State Batteries", DOE-BMR, \$250,000.

September 2020 – November 2023, "Enabling Advanced Electrode Architecture Through Printing Technique" (Sept 2020 - Nov 2023), DOE-AMO, \$702,692.

August 2021 – July 2025, "Chemo-Mechanical Failure Mechanisms in Inorganic Solid Electrolytes", National Science Foundation, \$634,034.

December 2021 – November 2025, "Continuation of the GM/Brown Collaborative Research Laboratory", \$1,250,000.

December 2022 – January 2025, "Chemo-Mechanical Degradation of Sulfide Glass Electrolytes", SK On, \$364,073.