

## CURRICULUM VITAE FOR DAVID L. POERSCHKE

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### **Education and Training**

- 2014 Ph.D, Materials, University of California Santa Barbara, Santa Barbara, CA  
*NDSEG Fellow*  
*Dissertation: "Thermochemical Design of Robust Environmental Protection Systems for Ceramic Composites"*
- 2009 M.S. Materials Science and Eng., Case Western Reserve University, Cleveland, OH  
*Thesis: "Mechanical Properties of Oxide Dispersion Strengthened Molybdenum Alloys"*
- 2008 B.S. Materials Science and Eng., Case Western Reserve University, Cleveland, OH

### **Research and Professional Experience**

- 2017 – present *Assistant Professor (Macosko Professorship), Department of Chemical Engineering and Materials Science University of Minnesota, Minneapolis MN*
- 2014 – 2017 *Postdoctoral Scholar, Materials, University of California Santa Barbara*  
*Research Mentors: Profs. Carlos Levi, Frank Zok, Anton Van der Ven*  
*Reaction dynamics in thermal barrier coatings exposed to molten silicates, oxidation of SiC-based ceramic matrix composites (CMCs), implementation of robust matrix CMC concepts, first principles calculations of structural transitions in crystalline SiO<sub>2</sub>.*
- 2013 *Graduate R&D Intern, GE Global Research Center, Niskayuna, NY*  
*Mentors: Dr. Don Lipkin and Dr. Curt Johnson*  
*Durability and repair of environmental barrier coatings for SiC CMCs.*
- 2012 *ICMR International Research Fellow, Karlsruhe Institute of Technology*  
*Mentors: Prof. Hans Seifert and Dr. Damian Cupid*  
*Calorimetric measurements and CALPHAD thermodynamic database development for the yttrium-boron system.*
- 2007 – 2009 *Technical Writer, Technical Training Solutions, Ligonier, PA*  
*Developed course materials for use in Penn Foster workforce development programs.*

### **Awards and Honors**

- NSF Faculty Early Career Development Program Award: "CAREER: Oxygen Transport in Heterogeneous, Nonoxide Ceramics - Toward Durable New Composite Constituents" (2020)
- Outstanding Reviewer for 2017: Scripta Materialia, Journal of the American Ceramic Soc.
- Outstanding Reviewer for 2016: Journal of Thermal Spray Technology
- Best Poster Award: Thermal Barrier Coatings IV Conference, Irsee Germany (2014)
- International Center for Materials Research (ICMR) Research Fellowship (2012)
- International Center for Materials Research (ICMR) Emerging Regions Grant (2011)

- Outstanding Poster: Summer School on Materials/Structures for Hypersonic Flight (2011)
- National Defense Science and Engineering Graduate (NDSEG) Fellowship (2009 to 2012)
- Forging Industry Association Graduate Fellowship (2008-2009)
- P.G. ‘Jerry’ Lind Award, Jack Wallace Award: Case School of Engineering (2008)
- Patricia Kilpatrick Student Leadership Award: Case Western Reserve University (2008)

### ***Current Research Activities***

- ***Integrated modeling frameworks to design durable, multi-phase ceramic coatings for turbine engines*** Eeshani Godole (Graduate Student, GS), Scott Berens and Nikhil Karthikeyan (Undergraduate Students, UG), New TBC and EBC materials being developed in the Poerschke group rely on finely-dispersed secondary phases to tune thermal stability, toughness, and reactivity with model deposits. To support this long-term objective, the present research focuses on expanding existing computational thermodynamics models to include the stable extent of the garnet phase in the pseudo-senary  $\text{Al}_2\text{O}_3\text{-CaO-FeO}_x\text{-MgO-SiO}_2\text{-Y}_2\text{O}_3$ . The experimental effort at UMN is focused on developing phase equilibria and crystal chemistry data to support model development and experimental validation of the new models in higher-order systems. These new models will then be used in a high-throughput computational effort to design new multi-phase coating materials with enhanced performance. *Research at UMN was supported by an ONR STTR-funded collaboration between UMN, UCSB, Thermo-Calc Software, and QuesTek Innovations and through internal UROP undergraduate research fellowships for Scott Berens and Nikhil Karthikeyan. Ongoing industrial funding support is anticipated.*
- ***Oxidation in heterogeneous, non-oxide ceramics and composites*** Koen Verrijt (GS) The discovery of material solutions to address undesired oxidative embrittlement of structural ceramics is hindered by insufficient knowledge about how microstructural heterogeneity contributes to internal oxygen transport, the resultant spatial variations in the local oxidation activity and oxidation reaction sequence, and constituent property evolution. This research is developing new experimental tools to understand coupled internal and surface oxidation in amorphous, semi-crystalline, and crystalline ceramics containing multiple non-oxide phases, and varied porosity and grain size. The approach employs zirconia-based oxygen pumps and sensors arranged in series within a high temperature gradient transport rig to enable systematic control of the  $p_{\text{O}_2}$  and oxygen flux. This system will be employed to perform pump-probe experiments measuring the temporal variation in oxygen uptake reactions in these materials as scale growth seals surfaces that initially served as local pathways for internal oxygen ingress. *This research will be supported by an NSF CAREER award entitled “Oxygen Transport in Heterogeneous, Nonoxide Ceramics - Toward Durable New Composite Constituents”.*
- ***Discovery of new high melting point ( $T_m$ ), low thermal expansion (CTE) materials and composites for thermostructural applications*** Bengt Symstad (UG) To overcome limitations of thermomechanical instability ceramic composites and coatings, this research seeks to develop new low CTE materials capable of service to at least 1500°C. The approach involves rational substitution of high  $T_m$  oxides into crystal structures known to exhibit anomalously-low CTE. The preliminary effort is focused on understanding the stability limits of the low CTE phases and the thermochemical compatibility with conventional high temperature structural ceramics. *The initial research was supported by an internal UROP undergraduate research fellowship for Bengt Symstad.*
- ***Surface enhancement of multi principal element alloys and silicides for improved resistance to wear, erosion, and oxidation*** Yu-Hsuan Lin (GS), Brady Bresnahan(GS),

*Atharva Chikhalikar (GS)*

This research seeks to harness the expanded the added flexibility in alloy design afforded by the increased solid solution homogeneity ranges in transition metal and refractory multi-principal element (Re-MPEA) alloys to enable the development of alloys with exceptional high temperature oxidation resistance without sacrificing mechanical performance and thermal properties. The approach employs computational thermodynamics modeling to tune component chemical potentials to optimize the relative surface reactivity of individual constituents and combinatorial experiments to accelerate the exploration of the potential design space. Separate efforts focus on developing (i) alloys with high intrinsic oxidation resistance, (ii) processing for forming superhard nitride coatings for enhanced wear resistance, and (iii) approaches for in-situ synthesis of ultrahigh temperature ceramic (UHTC) coatings on refractory alloys. *The initial research in this area is focused on multi-element refractory metal silicides for enhanced oxidation resistance and was supported through a DOE STTR-funded collaboration between UMN and QuesTek Innovations.*

- ***Thermomechanically-robust nanocomposites via scalable mesoporous templating.***

This project seeks to develop strong, hard, and tough 3-D metal-ceramic nanocomposites exhibiting stable plastic deformation via controlled microstructures and atomic-level interfacial structures. The initial effort is focused on the W-SiC system, harnessing reactions between W and SiC to generate nanometer-scale silicide/carbide interlayers with graded mechanical contrast. *This research was initially supported by a MRSEC Seed award in collaboration with N. Mara, L. Penn, and A. Stein at UMN. D. Poerschke's contributions focus on high-temperature microstructure development and mechanical properties.*

### ***Peer Reviewed Publications***

18. Summers, W.D., *D.L. Poerschke*, A.A. Taylor, A.R. Erics, C.G. Levi, F.W. Zok. "Reactions of Molten Silicate Deposits with Yttrium Monosilicate". *J. Am. Cer. Soc.* In Press (2019).
17. Summers, W.D., *D.L. Poerschke*, D. Park, J.H. Shaw, F.W. Zok, C.G. Levi. "Roles of Temperature and Composition on Silicate Deposit Induced Recession of Yttrium Disilicate". *Acta Mater.* 160 34-46 (2018).
16. Abdul-Jabbar, N., *D.L. Poerschke*, C. Gabbett, C.G. Levi. "Phase Equilibria in the Zirconia-Yttria/Gadolinia-Silica Systems". *J. Eur. Cer. Soc.* 38 [9] 3286-3296 (2018).
15. *Poerschke, D.L.*, A. Braithwaite, D. Park, F. Lauten "Crystallization Behavior of Polymer-Derived Si-O-C for Ceramic Matrix Composite Processing". *Acta Mater.* 47 329-341 (2018).
14. *Poerschke, D.L.*, J.H. Shaw, N. Verma, F.W. Zok, C.G. Levi. "Interaction of Yttrium Disilicate Environmental Barrier Coatings with Calcium-Magnesium-Iron Alumino-Silicate Melts". *Acta Mater.* 145 451-461 (2018).
13. *Poerschke, D.L.*, R.W. Jackson, and C.G. Levi. "Silicate Deposit Degradation of Engineered Coatings in Gas Turbines: Progress Toward Models and Materials Solutions". *An. Rev. Mat. Res.* (2017). (**Invited Review**)
12. *Poerschke, D.L.*, M.N. Rossol and F.W. Zok. "Intermediate temperature oxidative strength degradation of a SiC/SiNC composite with a polymer-derived matrix" *J. Am. Cer. Soc.*, 100[4] 1606–1617 (2017).

11. *Poerschke, D.L., and C.G. Levi. "Phase equilibria in the calcia-gadolinia-silica system". J. Alloys Compd. 695 1397-1404 (2017).*
10. *Poerschke, D.L., T.L. Barth, and C.G. Levi. "Equilibrium Relationships Between Thermal Barrier Oxides and Silicate Melts". Acta Mater. 120 302-314 (2016).*
9. *Poerschke, D.L., M.D. Novak, N. Abdul-Jabbar, S. Kramer, C.G. Levi. "Selective Active Oxidation in Hafnium Boride-Silicon Carbide Composites above 2000°C," J. Eur. Cer. Soc. 36[15] 3697-3707 (2016).*
8. *Poerschke, D.L., M.N. Rossol and F.W. Zok. "Intermediate temperature internal oxidation of a SiC/SiCN composite with a polymer derived matrix" J. Am. Cer. Soc. 99[9] 3120-2128 (2016).*
7. *Poerschke, D.L., T.L. Barth, O. Fabrichnaya and C.G. Levi. "Phase Equilibria and Crystal Chemistry in the Calcia-Silica-Yttria System" J. Eur. Cer. Soc. 36[7] 1743-1754 (2016).*
6. *Poerschke, D.L., G.G.E Seward and C.G. Levi. "Influence of Yb:Hf ratio on ytterbium hafnate/molten silicate (CMAS) reactivity" J. Am. Cer. Soc. 99 651-659 (2016).*
5. *Jackson, R.W., E.M. Zaleski, D.L. Poerschke, B.T. Hazel, M.R. Begley, and C.G. Levi. "Interaction of molten silicates with thermal barrier coatings under temperature gradients" Acta Mater. 89 396-407 (2015).*
4. *Poerschke, D.L. and C.G. Levi. "Effects of cation substitution and temperature on the interaction between thermal barrier oxides and molten CMAS" J. Eur. Cer. Soc. 35 681-691 (2015).*
3. *Poerschke, D.L., D.D. Hass, S. Eustis, G.G.E Seward, J.S. Van Sluytman, and C.G. Levi. "Stability and CMAS Resistance of Ytterbium-Silicate/Hafnate TBC/EBCs for SiC Composites" J. Am. Cer. Soc. 98 [1] 278-286 (2015)*
2. *Poerschke, D.L., J.S. Van Sluytman, K.B. Wong and C.G. Levi. "Thermochemical Compatibility of Ytterbia-(Hafnia/Silica) Multilayers for Environmental Barrier Coatings" Acta Mater. 61 [18] 6743-6755 (2013)*
1. *Poerschke, D.L., and C.G. Levi. "Yttrium bearing silicon carbide matrices for robust ceramic composites" J. Am. Cer. Soc. 96 [4] 1300-1308 (2013)*

### ***Presentations***

#### ***Invited Presentations at Conferences, Workshops, Universities, and Industrial and Government Labs***

38. *Poerschke, D.L. "Materials Challenges for Next-Generation Turbine Engines" Minnesota ASM Chapter Meeting. (November 2019)*
37. *Poerschke, D.L. "Implications of Thermochemical Processes on the Mechanical Performance of Ceramic Coatings and Composites for Aero-propulsion Applications" University of Minnesota Aerospace Engineering and Mechanics Solids Seminar. (October 2019)*
36. *Poerschke, D.L. "Multiphase Thermal Barrier Coatings for Broad-base Resistance to Silicate Deposits" MS&T 2019. Portland, OR. (October 2019)*

35. *Poerschke, D.L. "New Strategies to Understand Oxidation Processes in Heterogeneous, Non-oxide Ceramic Composite"* 10<sup>th</sup> International Conference on High Temperature Ceramic Matrix Composites (HT-CMC10), Bordeaux, France. (September 2019) (**Keynote Presentation**)
34. *Poerschke, D.L. "Design of Multiphase and Multilayer Thermal and Environmental Barrier Coatings: Towards New Materials for Enhanced Multifunctional Performance"* Orton/OSU Workshop on High Temperature Materials for Extreme Environments. Columbus, OH. (June 2019)
33. *Poerschke, D.L. "Design of Multiphase Environmental Barrier Coatings: Toward Multifunctional Molten Deposit Resistance"* International Conference on Metallurgical Coatings and Thin Films. San Diego, CA. (May 2019)
32. *Poerschke, D.L. "Computationally-Guided Design of Multicomponent Thermal and Environmental Barrier Coatings for Improved Multifunctional Performance"* 43<sup>th</sup> International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2019)
31. *Poerschke, D.L. "Communicating your Science: How to Effectively (and Ethically) Engage Diverse Audiences"* American Ceramic Society Winter Workshop, Daytona Beach, FL. (January 2019)
30. *Poerschke, D.L. "Feeding the Virtual Test Pipeline: Developing Thermodynamic Descriptions of Deposit-Induced Degradation of Thermal and Environmental Barrier Coatings"* 12<sup>th</sup> International Conference on Ceramic Materials and Components for Energy and Environmental Applications. Singapore. (July 2018)
29. *Poerschke, D.L. "Coating Design for Improved Environmental Protection of Ceramic Matrix Composites"* Symposium on Advanced Materials for Aero-engines. Yanqi Lake, China. (July 2018)
28. *Poerschke, D.L. "Mitigating Environmental Degradation of Ceramic Composite: Integrated Frameworks to Accelerate Materials Design"* Beihang University, Beijing, China (July 2018)  
Host: Hongbo Guo
27. *Poerschke, D.L. "Application of phase equilibrium modeling to understand and mitigate the CMAS threat in thermal and environmental barrier coatings"* Engineering Conferences International: TBC V. Irsee, Germany. (June 2018)
26. *Poerschke, D.L. "Silicate Deposit Induced Degradation of Thermal and Environmental Barrier Coatings: Toward Integrated Models for Accelerated Coating Design"* 14<sup>th</sup> International Ceramics Conference, CIMTEC 2018. Perugia, Italy. (June 2018)
25. *Poerschke, D.L. "Evolution of Multiphase Systems in Complex Environments: Integrated Frameworks for Accelerated Propulsion Materials Design"* ONR Navy Propulsion and Cellular Materials Program Review. Williamsburg, VA. (May 2018)
24. *Poerschke, D.L. "Making the Faculty Leap: Adventure and Learning as a New Assistant Professor"* Global Young Investigator Forum Symposium on Young Researchers Funding, Mobility, and Networks. Daytona Beach, FL. (January 2018)
23. *Poerschke, D.L. "Silicate-Induced Degradation of Environmental Barrier Coatings: Developing an Integrated Design Framework"* Winter Study Group on High Performance Materials. Santa Barbara, CA. (January 2018)

22. *Poerschke, D.L. "Ionic Substitution in Apatite: From Biologic Structures to Non-stick Turbine Blades" University of Michigan, Materials Science and Engineering Seminar. Ann Arbor, MI. (April 2017) Host: Prof. Amit Misra*
21. *Poerschke, D.L. "Ionic Substitution in Apatite: From Biologic Structures to Non-stick Turbine Blades" Missouri University of Science and Technology, Materials Science and Engineering Seminar. Rolla, MO. (March 2017) Host: Prof. Greg Hilmas*
20. *Poerschke, D.L. "Optimizing High Temperature Materials Performance: Integrated Frameworks to Accelerate Design and Discovery" University of Virginia, Materials Science and Engineering Seminar. Charlottesville, VA. (March 2017) Host: Prof. Elizabeth Opila*
19. *Poerschke, D.L. "Ionic Substitution in Apatite: From Biologic Structures to Non-stick Turbine Blades" University of Minnesota, Chemical Engineering and Materials Science. Minneapolis, MN. (February 2017) Host: Prof. Kevin Dorfman*
18. *Poerschke, D.L. "Mitigating Environmental Degradation of Ceramic Coatings and Composites: Integrated Frameworks to Accelerate Design and Discovery" University of Wisconsin Madison, Department of Materials Science and Engineering Seminar. Madison, WI. (January 2017) Host: Prof. Chang-Beom Eom*
17. *Poerschke, D.L. "Ionic Substitution in Apatite: From Biologic Structures to Non-stick Turbine Blades" North Carolina State University, Materials Science and Engineering Seminar. Raleigh, NC. (January 2017) Host: Prof. Yara Yingling*
16. *Poerschke, D.L. "Ionic Substitution in Apatite: From Biologic Structures to Non-stick Turbine Blades" University of California Irvine, Chemical Engineering and Materials Science Seminar. Irvine, CA. (December 2016) Host: Prof. Daniel Mumm*
15. *Poerschke, D.L. "Ionic Substitution in Apatite: From Biologic Structures to Non-stick Turbine Blades" University of Virginia, Materials Science and Engineering Seminar. Charlottesville, VA. (September 2016) Host: Prof. Jerrold Floro*
14. *Poerschke, D.L. "Microstructure Evolution in Ceramic Matrix Composites: Influence of Geometry and Composition on Matrix Processing" Gordon Research Seminar: Solid State Studies in Ceramics. Mount Holyoke, MA. (July 2016)*
13. *Poerschke, D.L. "Environmental Degradation and Advanced Coating Design for Ceramic Matrix Composites" Teledyne Scientific & Imaging. Thousand Oaks, CA. (December 2015) Host: Dr. Olivier Sudre*
12. *Poerschke, D.L. "Coating Design for Improved Environmental Protection of Ceramic Matrix Composites" Indo-US Bilateral Workshop on Ceramic Coatings and Multilayers. Coorg, India. (February 2016)*
11. *Poerschke, D.L., "Phase Relationships and Composition Trends in Reactions Between Rare Earth Containing TBCs and Silicate Melts" 40th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2016)*
10. *Poerschke, D.L. "Application of Phase Relations to EBC Design and CMAS Degradation Modeling" Winter Study Group on High Temperature Materials. Santa Barbara, CA. (January 2016)*
9. *Poerschke, D.L. "Design Challenges for Multilayer Ceramic Coatings: Phase Stability, Thermochemical Compatibility, and Molten Silicate Attack" University of Wisconsin Madison,*

Department of Materials Science and Engineering Seminar. Madison, WI. (October 2015) *Host: Prof. John Perepezko*

8. *Poerschke, D.L. "Environmental Challenges to the Implementation of Ceramic Composites in Gas Turbines" NASA Glenn Research Center. Cleveland, OH. (August 2015) Host: Dr. Valerie Wiesner*
7. *Poerschke, D.L. "Thermochemical Design of Thermal/Environmental Barrier Coatings to Resist Molten Silicate Attack" TU Freiberg, Institute of Materials Science Seminar. Freiberg, Germany. (June 2014) Host: Dr. Olga Fabrichnaya*
6. *Poerschke, D.L. "Progress in understanding TBC-CMAS Interactions: Consequences of Cation Substitution in Rare Earth Zirconates and Hafnates" General Electric Global Research Center. Niskayuna, NY. (July 2013) Host: Dr. Don Lipkin*
5. *Poerschke, D.L. "Benefits of Rare Earth Oxides for Thermal and Environmental Protection of SiC-based Turbine Components" Solvay Rare Earth Systems R&I Centre. Paris, France. (April 2013) Host: Dr. Andrew Polli*
4. *Poerschke, D.L. "Strategies for Robust Environmental Protection of SiC-based Ceramic Matrix Composites" Air Force Research Laboratory, Composites Branch. Dayton, OH (October 2012) . Host: Dr. Michael Cinibulk*
3. *Poerschke, D.L. "Modified SiC-based Matrix for Improved Volatilization Resistance of Ceramic Matrix Composites" General Electric Global Research Center. Niskayuna, NY. (July 2012) Host: Dr. Don Lipkin*
2. *Poerschke, D.L. "Strategies for Robust Environmental Protection of SiC-based Ceramic Matrix Composites" TU Darmstadt Department of Chemistry. Darmstadt, Germany (March 2012) Host: Prof. Barbara Albert*
1. *Poerschke, D.L. "Environmental Protection Strategies for SiC-based Ceramic Matrix Composites" Max Plank Institute for Intelligent Systems. Stuttgart, Germany (March 2012) Host: Prof. Manfred Rühle*

#### ***Contributed Presentations at Conferences and Workshops (presenting author)***

19. *Godbole, E.P., Berens, S., Poerschke, D.L. "Understanding the Stability of the Garnet Phase in the Context of Reactions Between T/EBCs and Silicate Deposits" 43th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2019)*
18. *Holgate, C., Poerschke, D.L., Levi, C.G. "Dissolution and Diffusion of Thermal Barrier Oxides in Molten Silicates" 43th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2019)*
17. *Poerschke, D.L. "Development of an Integrated Framework to Design T/EBCs Resistant to Molten Silicate Degradation" 42th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2018)*
16. *Poerschke, D.L. "Implications of Coupled Crystallization and Decomposition Reactions for CMC Processing using Polymer Derived Ceramics" ECI Conference on Advanced Ceramic Matrix Composites. Santa Fe, NM (November 2017)*
15. *Poerschke, D.L., A. Braithwaite and F. Lauten, "Crystallization Behavior of Polymer-Derived Si-O-C during Ceramic Matrix Composite Processing" Pacific Rim Conference on Ceramic and Glass Technology Waikoloa, HI. (May 2017)*

14. Poerschke, D.L. and C.G. Levi “*Toward an Integrated Model for Molten Silicate Degradation of Thermal and Environmental Barrier Coatings: Phase Equilibria and Reaction Dynamics*” 41<sup>st</sup> International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2017)
13. Poerschke, D.L. and F. Lauten, “*Interplay of Temperature, Composition, and Geometry on the Crystallization of Polymer Derived Ceramics for CMC Manufacturing*” MS&T 2016. Salt Lake City, UT. (October 2016)
12. Poerschke, D.L., M.N. Rossol, F.W. Zok, “*Internal Oxidation of SiC<sub>f</sub>/SiCN<sub>m</sub> Ceramic Matrix Composite with Polymer Slurry Derived Matrix*” MS&T 2015. Columbus, OH. (October 2015)
11. Poerschke, D.L., T.L. Barth, C.G. Levi, “*Composition Effects on TBC/Silicate Melt (CMAS) Interaction Dynamics*” 227th Electrochemical Society Meeting. Chicago, IL. (May 2015)
10. Poerschke, D.L., T.L. Barth, C.G. Levi, “*Phase Equilibria in Thermal Barrier Coating/Silicate Melt Interactions*” 39th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2015)
9. Poerschke, D.L., T.L. Barth, C.G. Levi, “*Transient Reaction Processes During Thermal Barrier Oxide/Silicate Melt Interactions*” MS&T 2014. Pittsburgh, PA. (October 2014)
8. Poerschke, D.L. and C.G. Levi, “*Rare Earth Efficacy for CMAS Mitigation in T/EBC Systems*” ECI TBC IV. Irsee, Germany. (June 2014) *Poster Presentation – Best Poster Award*
7. Poerschke, D.L. and C.G. Levi, “*Limitations of Rare Earth Reactive Crystallization for CMAS Mitigation in T/EBCs*” 38th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2014)
6. Poerschke, D.L., S. Burk, C.G. Levi, “*Challenges in Multilayer EBCs for CMAS Resistance*” PRICM8. Waikoloa, HI. (August 2013)
5. Poerschke, D.L., J.S. Van Sluytman, C.G. Levi, “*Thermochemical Considerations in the Design of Multilayered EBCs*” MS&T 2012. Pittsburgh, PA. (October 2012)
4. Poerschke, D.L. and C.G. Levi, “*Modified SiC-based Matrix for Improved Volatilization Resistance of Ceramic Matrix Composites*” HTCPM’8. Les Embiez, France. (May 2012)
3. Poerschke, D.L. and C.G. Levi, “*Rare Earth Modified Matrices for SiC Matrix Composites*” MS&T 2011. Columbus, OH. (October 2011)
2. Poerschke, D.L., L. Merrill, C.G. Levi, “*Self-healing Matrices for SiC Matrix Ceramic Matrix Composites*” 35th International Congress on Advanced Ceramics and Composites. Daytona Beach, FL. (January 2011)
1. Poerschke, D.L. and D. Schwam, “*The Effect of Cooling Rate on the Microstructure, Mechanical Properties and Machinability of Compacted Graphite Iron*” Keith Millis Symposium on Ductile Iron. Las Vegas, NV. (October 2008)



## ***Teaching and Mentoring***

### Course Instruction

- MatS 4301W: Materials Processing, *UMN*. Co-instructor: Spring 2018; Lead Instructor: Spring 2019 and 2020
- MatS 3011: Intro. to Materials Science and Eng., *UMN*. Recitation Instructor: Fall 2017 and 2018; Lead Instructor: Fall 2019
- MatS 8004: Mech. Properties, *UMN*. Guest lecturer on composite mechanics. Spring 2018.
- MatS 2001: Intro. to the Science of Engineering Materials, *UMN*. Guest lecturer on materials challenges in turbine engines. Fall 2017.
- Matr1 186: Manufacturing and Materials, *UC Santa Barbara*. TA. Spring 2010.
- MATH 121/122: Engineering Calculus I and II, *Case Western Reserve University*. Supplemental Instructor. 2006, 2006, 2007
- ENGR 131: Elementary Computer Programming, *Case Western Reserve U.* TA. 2005.

### Doctoral Students Advised

- Eeshani Godbole, *UMN Chemical Engineering*, 2017 to present  
*Integrated modeling frameworks to design durable ceramic coatings for turbine engines*
- Koen Verrijt, *UMN Materials Science and Engineering*, 2018 to present  
*Oxidation in heterogeneous, non-oxide ceramics and composites*
- Yu-Hsuan Lin, *UMN Chemical Engineering*, 2018 to present  
*Nitride-based surface mechanical property enhancement of multi principal element silicides and alloys*
- Kevin Schmalach, *UMN Chemical Engineering*, 2018 to present (informal co-advisee; primary advisor: N Mara)  
*Mechanical response and thermal stability of W-SiC nanocomposites*
- Atharva Chikhalikar, *UMN Chemical Engineering*, 2019 to present  
*Oxidation resistance of refractory multi principal element alloys*
- Brady Bresnahan, *UMN Materials Science and Engineering*, 2019 to present  
*In situ synthesis of multi principal element boride and carbide coatings*

### Undergraduate and High School Student Research Projects Supervised

- Nikhil Karthikeyan, *UMN Undergraduate Research Opportunity Program (UROP)*. 2018  
*Modelling temperatures and composition effects for reactions with TBC materials*
- Mikayla Roth, *UMN Undergraduate Research Opportunity Program (UROP)*. 2018  
*Investigation of the cold sintering method for coprecipitated  $Y_3Al_5O_{12}$ ,  $YAlO_3$ , and  $Al_2O_3$*   
*Thermal properties of refractory silicides*
- Uma Venkata, *UMN Directed Research*. 2018  
*Phase equilibria determination in aluminosilicate garnets.*
- Bengt Symstad, *UMN Undergraduate Research Opportunity Program (UROP)*. 2018  
*Low thermal expansion composite coatings for ceramic matrix composites.*

- Scott Berens, UMN Undergraduate Research Opportunity Program (UROP) and research for credit. 2017-2019  
*Influence of Fe and Mg on garnet phase formation on thermal barrier coatings.*
- Angus Braithwaite, UCS CISEI Summer Research Student from University of Oxford. 2016  
*Crystallization of polymer-derived ceramics for processing of robust ceramic composites.*
- Sreekar Molakalappalli, UCSB College of Creative Studies Research Project, 2015  
*Phase equilibria in calcium–rare earth–silicate systems.*
- Audrey Velasco-Hogan, UCSB CAMP Academic Year and Summer Research Intern. 2015  
*Ionic substitution in yttrium–bearing garnets.*
- Talia Barth, UCSB CAMP Academic Year and Summer Research Intern. 2014-2015  
*Dynamics of TBC – silicate melt interactions.*
- Kimberley Wong, UCSB College of Creative Studies Research Project, 2012-2013  
*Phase equilibria in the  $HfO_2$ – $Yb_2O_3$ – $SiO_2$  system.*
- Alexander Pieman, UCSB; High School Summer Apprentice Researcher Program, 2011  
*Matrix powder preparation for modified SiC composite matrices.*
- Craig Patton, UCSB High School Summer Apprentice Researcher Program, 2011  
*Processing of SiC fiber CMCs with modified matrices.*
- Luke Merrill, UCSB INSET Summer Community College Research Intern, 2010  
*Compositional effects in the design of robust SiC matrices.*

### ***Service and Synergistic Activities***

#### *University Service*

- Materials Science Graduate Student Admissions Committee, 2017 to present
- Undergraduate Research Symposium Poster Judge, 2018, 2019
- Faculty Advisor to UMN CEMS Chapter of Materials Advantage, 2018 to present

#### *External Committee Service:*

- American Ceramic Society Committee on Publications  
*Chair, 2018 to present; Member, 2016 to 2018*
- American Ceramic Society Committee on Strategic Planning for Emerging Opportunities  
*Member, 2018 to present*
- Co-organizer for ACerS Young Professional Network symposium “Success in Materials Science and Engineering: Career Guidance for Young Professionals” at MS&T 2020
- Member of the organizing committee for the Symposium on Polymer Derived Ceramics and Composites and the Symposium on Advanced Thermal and Environmental Barrier Coatings at the 10th International Conference on HTCMCs (2019)
- Organizing committee for Symposium on Advanced Ceramic Coatings for Structural, Environmental, and Functional Applications at ICACC, American Ceramic Society Engineering Ceramics Division (2018, 2019)
- Member of the organizing committee for the 5th and 6th Global Young Investigator Forums at International Conference on Advanced Ceramics and Composites (2016, 2017)

#### *Journal Review and Editorships:*

*Reviewer:* Journal of the American Ceramic Society, Acta Materialia, Scripta Materialia, Journal of Materials Science, Journal of the European Ceramic Society, Ceramics International, International Journal of Fracture, Journal of Thermal Spray Technology, Surface and Coating Technology

*Contributing Editor:* NIST Standard Reference Database 31 (Phase Equilibria Diagrams)

*Education and Public Outreach:*

- Science Museum of Minnesota, Community Outreach Volunteer. (2018-2019)
- Co-Facilitator, American Ceramic Society Journal Publishing Workshop “*Writing Excellent Abstracts and Titles: A Hands-on Workshop for Improving Article Discovery and Readership*” at International Congress on Advanced Ceramics and Composites. Daytona Beach, FL (January 2019)
- Invited Speaker, “*Communicating your Science: How to Effectively (and Ethically) Engage Diverse Audiences*”, ACerS Winter Workshop. Daytona Beach, FL (January 2019)
- Panelist, Career Development Panel, ACerS Winter Workshop. Daytona Beach, FL (January 2019)
- Invited Speaker, “*Making the Faculty Leap: Adventure and Learning as a New Assistant Professor*”, GYIF Symposium on Young Researchers Funding, Mobility, and Networks at ICACC. Daytona Beach, FL (January 2018)
- Panelist, Science Communication Panel, GYIF Symposium on Young Researchers Funding, Mobility, and Networks at ICACC. Daytona Beach, FL (January 2018)
- Invited Speaker, Our Material World, Materials Research Lab Community Outreach Event Presentation “*The Dream of Hypersonic Flight: Our World Connected*” attended by approximately 100 members of the Santa Barbara community. (2015)
- Panelist at NSF-sponsored workshop on “*The Future of Graduate Education in Materials*”, Santa Barbara, CA (2015)
- Facilitator for “*Family Ultimate Science Exploration*” (FUSE) junior high school science education workshops, Center for Science and Engineering Partnerships (2013)
- Facilitator for “*It’s a Material World!*” elementary school science education workshops. Materials Research Laboratory (2012-2014)