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### **Education:**

Ph. D., Aerospace Engineering, University of Minnesota, Minneapolis, MN, July 2016.

M. S., Aerospace Engineering, University of Minnesota, Minneapolis, MN, May 2012.

B.S. (B. Tech.), Mechanical Engineering, National Institute of Technology, India, June 2010.

### **Professional Experience:**

2020-present: Assistant Professor, Mechanical Engineering, University of Kentucky.

2018-2019: Postdoctoral Research Fellow, Aerospace Engineering, University of Michigan.

2016-2018: Postdoctoral Research Associate, Chemistry, Montana State University.

2015-2016: Doctoral Dissertation Fellow, Aerospace Engineering, University of Minnesota.

2010-2015: Graduate Research Assistant, Aerospace Engineering, University of Minnesota.

### **Current Grants**

Computing In-Depth Radiative Properties of Carbon Composites, Agency: NASA Entry Systems Modeling Project. Period: 6/1/2020-5/31/2021, Amount: \$80,000.

Development of an Artificial Neural Network to Transfer Microstructural Information of Thermal Protection Systems (TPS) into Vehicle-Scale Simulations, Agency: NASA KY EPSCOR Graduate Fellowship. Period: 8/1/2020-7/31/2020, Amount: \$45,000.

Development of a Novel Computational Framework to Investigate Thermochemistry of Melt Flow in Aerothermal Entry Physics, Agency: NASA KY EPSCOR Graduate Fellowship, Period: 8/1/2020-7/31/2021, Amount: \$45,000.

Kentucky Re-entry Universal Payload System: Enhancing Instrumentation Suite, Agency: NASA KY EPSCOR Team Fellowship Proposal, Period: 8/1/2020-7/31/2021, Amount: \$15,000.

### **Journal Publications**

Poovathingal S.J., Xu C., Murray V.J., Pillinski M., Schwartzenruber T.E., Minton T.K., "DSMC simulations of a Concentrator for Mass Spectrometry of Tenuous Atmospheres," in preparation for *Physical Review Fluids*.

Poovathingal S.J., Qian M, Murray V.J., Minton T.K., "Scattering and Reactive Dynamics of Hyperthermal O and O<sub>2</sub> from a Carbon Fiber Network," in preparation for *The Journal of Physical Chemistry C*.

Poovathingal S.J., Minton T.K., Szilagyi R.K., "Systematic Evaluation of Density Functionals for Electronic and Geometric Structures: Chemical Speciation of Mononuclear Ru-Cl-H-PR<sub>3</sub> Complexes," *The Journal of Physical Chemistry A* 2019, 123 (1), 343-358.

Murray V.J., Xu C., Poovathingal S.J., Minton T.K., “Scattering Dynamics of Nitromethane and Methyl Formate on HOPG,” *The Journal of Physical Chemistry C* 2018, 122 (28), 16178–16188.

Swaminathan-Gopalan K., Borner A., Stephani K.A., Murray V.J., Poovathingal S.J., Minton T.K., Mansour N. N., “DSMC Analysis of Molecular Beam Experiments for Oxidation of Carbon Based Ablators,” *Carbon* 2018, 137, 313-332.

Poovathingal S.J., Stern E.C., Nompelis I., Candler G.V., “Nonequilibrium Flow through Porous Thermal Protection Materials, Part II: Oxidation and Pyrolysis,” *Journal of Computational Physics* 2019, 380, 427-441.

Stern E.C., Poovathingal S.J., Nompelis I., Schwartzentruber T.E., Candler G.V., “Nonequilibrium Flow through Porous Thermal Protection Materials, Part I: Numerical Methods,” *Journal of Computational Physics* 2019, 380, 408-426.

Poovathingal S.J., Schwartzentruber T.E., Murray V.J., Minton T.K., Candler, G.V., “Finite-Rate Oxidation Model for Carbon Surfaces from Molecular Beam Experiments,” *AIAA Journal* 2017, 55 (5), 1644-1658.

Poovathingal S.J., Schwartzentruber T.E., Murray V.J., Minton T.K., “Molecular Simulation of Carbon Ablation Using Beam Experiments and Resolved Microstructure,” *AIAA Journal* 2016, 54 (3), 999-1010.

Poovathingal S.J., Schwartzentruber T.E., Srinivasan S.G., van Duin A.C.T., “Large Scale Computational Chemistry Modeling of the Oxidation of Highly Oriented Pyrolytic Graphite,” *The Journal of Physical Chemistry A* 2013, 117 (13), 2692-2703.

Smoll E.J., Poovathingal S.J., Murray V.J., “Session Viewpoints on the 2017 Dynamics of Molecular Collisions Conference,” *The Journal of Physical Chemistry A* 2018, 122 (4), 882–889.

### **Full-Length Conference Publications**

Banerjee A., Poovathingal S.J., “Investigation of In-Depth penetration of Radiative Heating in Thermal Protection System (TPS),” AIAA 2021-1631.

Hansson K., Carroll A., Poovathingal S.J., Boyd I.D., “Analysis of Chemical Kinetic Parameters for Hydrogen Atmospheres,” AIAA SciTech 2021 Forum, AIAA 2021-0706.

Barrios-Lobelle A., Davuluri R., Fu, R., Martin A., Poovathingal S.J., “Surface Oxidation of Carbon/Carbon Composites in Hypersonic Environments,” AIAA SciTech 2021 Forum, AIAA 2021-1173.

Poovathingal S.J., Kruszelnicki, J., Boyd, I. D., Kushner, M. J., “NonEquilibrium Processes in Plasma Torches of Inductively Coupled Plasma Facilities,” *AIAA Aviation 2019 Forum*, AIAA 2019-3566.

Poovathingal S.J., Schwartzentruber T.E., Minton T.K., “Gas-Surface Model in DSMC for Molecules Passing Through a Funnel-Type Gas Concentrator,” *AIAA Aviation 2019 Forum*, AIAA 2019-1281.

Swaminathan-Gopalan K., Borner A., Stephani K.A., Murray V.J., Poovathingal S.J., Minton T.K., Mansour N.N., “DSMC Analysis of Molecular Beam Experiments for Oxidation of Carbon Based Ablators,” *55<sup>th</sup> AIAA Aerospace Sciences Meeting 2017*, AIAA 2017-1845.

Borner A., Swaminathan-Gopalan K., Stephani K.A., Murray V.J., Poovathingal S.J., Minton T.K., Panerai F., Mansour N.N., “DSMC Analysis of Molecular Beam Experiments on Light-Weight Carbon Preform Ablators,” *47<sup>th</sup> AIAA Thermophysics Conference 2017*, AIAA 2017-3687.

Singh N., Poovathingal S.J., Schwartzentruber T.E., “DSMC Acceleration Techniques Applied to Shock Heated and Recirculating Flows,” *55<sup>th</sup> AIAA Aerospace Sciences Meeting 2017*, AIAA 2017-1843.

Poovathingal S.J., Schwartzentruber T.E., Murray V.J., Minton T.K., Candler G.V., “Finite-Rate Oxidation Model for Carbon Surfaces from Molecular Beam Experiments,” *46<sup>th</sup> AIAA Thermophysics Conference 2017*, AIAA 2016-3842.

Schwartzentruber T.E., Poovathingal S.J., Stern E.C., “Molecular Simulation of Oxygen Reactions with Realistic Carbon and Silica Surfaces at High Temperature,” *20<sup>th</sup> AIAA International Space Planes and Hypersonic Systems and Technologies Conference 2015*, AIAA 2015-3567.

Schwartzentruber T.E., Poovathingal S.J., Stern E.C., “Molecular Simulation of Oxygen Reactions with Realistic Silica and Carbon Surfaces at High Temperature,” *8<sup>th</sup> European Conference on Aerothermodynamics for Space Vehicles 2015*.

Poovathingal S.J., Schwartzentruber T.E., Murray V.J., Minton T.K., “Molecular Simulations of Surface Ablation using Reaction Probabilities from Molecular Beam Experiments and Realistic Microstructure,” *53<sup>rd</sup> AIAA Aerospace Sciences Meeting 2015*, AIAA 2015-1449.

Poovathingal S.J., Schwartzentruber T.E., “Effect of Microstructure on Carbon-Based Surface Ablators using DSMC,” *52nd Aerospace Sciences Meeting, AIAA SciTech Forum 2014*, AIAA 2014-1210.

Poovathingal S.J., Schwartzentruber T.E., “Computational Chemistry Modeling of the Oxidation of Highly Oriented Pyrolytic Graphite,” *43<sup>rd</sup> AIAA Thermophysics Conference 2012*, AIAA 2012-3099.

### **Invited Seminars**

Understanding the Oxidation of Ablative Heat Shields, Thermal Protection Systems Branch, NASA Ames Research Center, California, November 15, 2017.

A Novel Approach for High-Fidelity Simulations: from Hypersonics to Carbon Capture, MDRCBB Seminar, University of Minnesota, April 2015.

### **Awards**

Doctoral Dissertation Fellowship, U. of Minnesota, 2015.

John and Jane Dunning Copper Fellowship, Aerospace Engineering, U. of Minnesota, 2011.

### **Technical Presentations**

Testing Ablation Chemistry Model Based on Molecular Beam Experiments, Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 2020.

Investigation of In-Depth Penetration of Radiative Heating in Thermal Protection System (TPS), 45<sup>th</sup> Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 2020.

Applying High-Performance Computing to Investigate Microscale and Atomistic Scale Processes, University of Kentucky Computational Sciences Seminar, Oct 2019, Lexington, KY.

Non-Equilibrium Processes in Inductively Coupled Plasma Torches, 11<sup>th</sup> Ablation Workshop, Minneapolis, MN, September 2019.

Dynamics of Carbon Oxidation at High Temperatures, 9<sup>th</sup> Ablation Workshop, Bozeman, MT, USA, August 2017.

Finite-Rate Oxidation Model for Carbon Surfaces, 8<sup>th</sup> Ablation Workshop, Tucson, AZ, USA, October 2016. Molecular Simulations of Surface Ablation through Real Microstructures, 7<sup>th</sup> Ablation Workshop, Tullahoma, TN, USA, October 2015.

Microscale Resolved Simulations of Real Microstructures using DSMC, DSMC Conference 2013, Santa Fe, NM, September 2013.

### **Poster Presentations**

Development of a Computational Framework to Investigate Thermochemistry of Melt Flow in Aerothermal Entry Physics, University of Kentucky Commonwealth Computational Summit, Lexington KY, October 2020. *3<sup>rd</sup> place*

Banerjee A., Poovathingal S.J., Investigation of In-Depth Penetration of Radiative Heating in Thermal Protection System (TPS), University of Kentucky Commonwealth Computational Summit, Lexington KY, October 2020.

Barrios-Lobelle A., Fu. R, Martin A., Poovathingal S.J., Solving Surface Chemistry Rates for Hypersonic Vehicle CFD Simulations, University of Kentucky Commonwealth Computational Summit, Lexington KY, October 2020.

Dynamics of FiberForm Oxidation, 15<sup>th</sup> *International Planetary Probe Workshop (IPPW-15)*, Boulder, CO, June 2018.

Simulations of a Gas Concentrator for Mass Spectrometry of Tenuous Atmospheres, *15<sup>th</sup> International Planetary Probe Workshop (IPPW-15)*, Boulder, CO, June 2018.

Scattering Dynamics of Oxygen Atoms from a Three-Dimensional Carbon Composite, *Gordon Research Conference (GRC): Dynamics at Surfaces*, Newport, RI, August 2017.

Comparison of Scattering Dynamics from Carbon Composites and Graphitic Carbon, *Dynamics of Molecular Collisions*, Lake Tahoe, CA, July 2017.

Microstructure-Resolved Simulations of the Oxidation of Carbon Composites, *12<sup>th</sup> International Planetary Probe Workshop (IPPW-12)*, Koln, Germany, June 2015.

DSMC simulations of Carbon Composites: Atoms to Aircrafts, *10<sup>th</sup> International Planetary Probe Workshop (IPPW-10)*, San Jose, CA, June 2013.

Reactive Molecular Dynamics of the Oxidation of Highly Oriented Pyrolytic Graphite (HOPG), *5<sup>th</sup> Ablation Workshop*, Lexington, KY, March 2012.

**Scientific, Management, and Technical Experience:**

Professor Poovathingal has worked in the area of gas-material interactions for 10 years specializing in developing computational tools to solve multi-scale problems in hypersonics focusing on heat shield materials. During his career, he has developed numerical approaches for direct simulation Monte Carlo and large-scale molecular dynamics calculations to investigate the response of heat shield materials during hypersonic flight. He has published 20 peer-reviewed journal and conference publications in diverse fields: chemistry (The Journal of Physical Chemistry), aerospace engineering (American Institute of Aerospace and Astronautics (AIAA) Journal), and computational development (Journal of Computational Physics). He is an active member of the aerothermodynamics and the ablation community and has delivered over 17 presentations and 10 posters in engineering conferences like the Aviation and SciTech conference hosted by AIAA, as well as basic science conferences like the Gordon Research Conference on gas-surface interactions. As an assistant professor, he advises 4 Ph.D. students and has received multiple grants from NASA (both federal and Space Grant Consortium) to support research on high-fidelity mesoscale and macroscale modeling of heat shield materials.