

# Gyanender P. Singh

1412 Circle Dr., Knoxville, TN 37919

✉ [gsingh7 \(at\) utk \(dot\) edu](mailto:gsingh7@utk.edu)  
🌐 <https://ne.utk.edu/people/gyanender-singh/>

## Research Positions

---

**University of Tennessee Knoxville** **TN, USA**  
*Research Scientist, Department of Nuclear Engineering* *Mar 2018 – Present*

**Oak Ridge National Laboratory** **TN, USA**  
*Postdoctoral Research Associate, Materials Science and Technology Division* *Mar 2015–Mar 2018*

## Education

---

**University of Minnesota – Twin Cities** **MN, USA**  
*Ph.D., Mechanical Engineering* *2015*  
Dissertation: Explicit Crack Modeling based Approach for Structural Integrity Assessment of Brittle and Quasi-Brittle Structures  
Adviser: Dr. Alex Fok

**University of Minnesota – Twin Cities** **MN, USA**  
*M.S., Mechanical Engineering* *2012*  
Thesis: Durability of High Density Polyethylene for Potable Hot Water Applications: Crack Propagation  
Adviser: Dr. Susan Mantell

**Indian Institute of Technology – Roorkee** **UK, India**  
*B.Tech., Production & Industrial Engineering* *2009*

## Research Experience

---

**University of Tennessee Knoxville** **TN, USA**  
*Research Scientist, Department of Nuclear Engineering* *Mar 2018 – Present*

- Leading the thermo-mechanical-structural performance of SiC-SiC cladding and channel box for light water reactors applications.
- Performing multiphysics analysis of silicon carbide pellet sintering process with the goal of optimizing the die design and process parameters for manufacturing fully ceramic microencapsulated fuel pellets.

**Oak Ridge National Laboratory** **TN, USA**  
*Postdoctoral Research Associate, Materials Science and Technology Division* *Mar 2015–Mar 2018*

- Developed the SiC-SiC composite material model for fuel performance code BISON and commercial finite element software Abaqus.
- Evaluated thermo-mechanical-structural performance of SiC-SiC cladding and channel box through multiphysics modeling in BISON and Abaqus codes, which resulted in identification of critical issues with these core components.
- Managed and participated in interlaboratory mechanical testing of SiC-SiC composite that spanned across seven major organizations in USA including NASA and General Electric, thus establishing critical knowledge for ATF SiC cladding development.

- Led the setting up of resonance based non-destructive technique at ORNL to characterize the mechanical properties and evaluate structural flaws in nuclear materials such as SiC-SiC composites, graphite and metallic alloys.

**University of Minnesota – Twin Cities**

*Graduate Research Assistant, Department of Mechanical Engineering*

**MN, USA**

*Jan 2010–Aug 2014*

- Developed the graphite material model and implemented in Abaqus to evaluate the stresses and failure in Very High Temperature Reactor (VHTR) graphite bricks under complex in-reactor conditions.
- Conducted experiments to understand the effect of oxidization of High Density Polyethylene (HDPE) on its mechanical properties during potable water applications.
- Evaluated brittleness of degraded HDPE films through FTIR spectroscopy and tensile tests, and conducted fracture tests to understand the effect of oxidation on crack growth rate.

**University of Illinois Urbana-Champaign**

*Student Intern, Department of Mechanical Science & Engineering*

**IL, USA**

*Summer 2008*

- Conducted analytical study for modeling mechanical behavior of osteon in cortical bone through anisotropic linear elasticity.

## Journal Articles

---

1. **G. Singh**, J. Gorton, D. Schappel, B. S. Collins, N.R. Brown and B. Wirth, Impact of Control Blade Insertion on the Deformation Behavior of SiC-SiC Channel Boxes in BWRs, *Journal of Nuclear Materials* (submitted).
2. C. Ang, **G. Singh**, L. Snead, Y. Katoh, Preliminary study of sintering zero-rupture Fully Ceramic Microencapsulated (FCM) fuel, *International Journal of Applied Ceramic Technology*, 2019;00:1-9. ([link](#))
3. **G. Singh**, T. Koyanagi, C. Petrie, K. Terrani and Y. Katoh, Elastic Moduli Reduction in SiC-SiC Tubular Specimen after High Heat Neutron Flux Irradiation Measured by Resonant Ultrasound Spectroscopy, *Journal of Nuclear Material*, 523, 391-401, 2019 ([link](#)).
4. M. N. Cinbiz, T. Koyanagi, **G. Singh**, Y. Katoh, K. Terrani and N.R. Brown, Failure Behavior of SiC/SiC Composite Tubes Under Strain Rates Similar to the Pellet-Cladding Mechanical Interaction Phase of Reactivity-Initiated Accidents, *Journal of Nuclear Materials*, 514, 66-73, 2019 ([link](#)).
5. **G. Singh**, J. Gorton, D. Schappel, N.R. Brown, Y. Katoh, B. Wirth and K. Terrani, Deformation Analysis of SiC-SiC Channel Box for BWR Applications, *Journal of Nuclear Materials*, 513, 71-85, 2019 ([link](#)).
6. C. M. Donahue, M. C. Remillieux, **G. Singh**, T. J. Ulrich, R. J. Migliori and T. A. Saleh, Measuring the Elastic Tensor of a Monolithic SiC Hollow Cylinder with Resonant Ultrasound Spectroscopy, *NDT & E International*, 101, 29-33, 2019 ([link](#)).
7. **G. Singh**, T. Koyanagi, C. Petrie, K. Terrani and Y. Katoh, Evaluating the Irradiation Effects on the Elastic Properties of Miniature Monolithic SiC Tubular Specimens, *Journal of Nuclear Materials*, 499, 107-110, 2018 ([link](#)).
8. **G. Singh**, S. Gonczy, C. Deck, E. Lara-Curzio and Y. Katoh, Interlaboratory Round Robin Study on Axial Tensile Properties of SiC-SiC CMC Tubular Test Specimens, *International Journal of Applied Ceramics Technology*, 15, 1334-1349, 2018 ([link](#)).
9. **G. Singh**, R. Sweet, N. Brown, B. Wirth, Y. Katoh and K. Terrani, Parametric Evaluation of SiC/SiC Composite Cladding with UO<sub>2</sub> Fuel for LWR Applications: Fuel Rod Interactions and Impact of Nonuniform Power Profile in Fuel Rod, *Journal of Nuclear Materials*, 499, 155-167, 2018 ([link](#)).

10. **G. Singh**, K. Terrani and Y. Katoh, Thermo-Mechanical Assessment of SiC/SiC Composite Cladding for LWR Applications with Sensitivity Analysis, *Journal of Nuclear Materials*, 499, 126-143, 2018 ([link](#)).
11. **G. Singh**, A. Fok and S. Mantell, Failure Predictions for Graphite Reflector Bricks in the Very High Temperature Reactor with the Prismatic Core Design, *Journal of Nuclear Engineering and Design*, 317, 190-198, 2017 ([link](#)).
12. **G. Singh**, H. Li, A. Fok and S. Mantell, Size Effect on the Fracture Properties of Nuclear Graphite, *ASTM International*, 199-217, 2014 ([link](#)).
13. H. Li, J. Li, **G. Singh** and A. Fok, Fracture Behavior of Nuclear Graphite NBG-18, *Carbon*, 46-56, 2013 ([link](#)).
14. H. Ge, **G. Singh** and S. C. Mantell, Fracture Behavior of Degraded Polyethylene Thin Films for Solar Thermal Applications, *Energy Procedia*, 30, 783-792, 2012 ([link](#)).

## Conference Proceedings

---

1. T. Koyanagi, Y. Katoh, **G. Singh**, X. Hu, C. Petrie, K. Terrani, Evaluation of Irradiation-Induced Strain in SiC Tubes by a Combination of Experiment and Simulation, Transactions of the American Nuclear Society, Vol. 118, Philadelphia, Pennsylvania, June 17–21, 2018.
2. Y. Katoh, K. Terrani, T. Koyanagi, C. Petrie, **G. Singh**, L. Snead and C. Deck, Irradiation High Heat Flux Synergism in Silicon Carbide-based Fuel Claddings for Light Water Reactors, *Top Fuel 2016 - Light Water Reactor (LWR) Fuel Performance Meeting*, Boise, Idaho, USA, September 11-16, 2016.
3. Y. Katoh, C. Ang, T. Koyanagi, **G. Singh** and K. Terrani, Development of SiC-based Cladding for Accident Tolerant Fuels, *Transactions of the American Nuclear Society*, 114(1), 980, 2016
4. **G. Singh**, H. Li, A. Fok and S. Mantell, Failure Simulation of a VHTR Core Reflector Brick, *22<sup>nd</sup> International Conference on Structural Mechanics in Reactor Technology*, San Francisco, California, USA, August 18- 23, 2013.
5. H. Li, **G. Singh**, Y. Heo, L. Lin, A. Fok, Fracture Toughness of Nuclear Graphite NBG-18, *International Conference on Nuclear Engineering*, Anaheim, California, USA, July 30 – August 03, 2012.
6. **G. Singh**, S.C. Mantell and J.H. Davidson, Durability of polymers for solar thermal applications: Crack propagation in degraded polymers, *American Solar Energy Society (ASES) National Solar Conference*, Raleigh, North Carolina, USA, May 17-21, 2011.
7. **G. Singh**, S.C. Mantell and J.H. Davidson, Prediction of degradation of polymer tubes used in solar domestic hot water components, *Society of Plastics Engineers' ANTEC™ (Annual Technical Conference)*, Boston, Massachusetts, USA, May 1-5, 2011.
8. W. Camisa, S.C. Mantell, J.H. Davidson and **G. Singh**, Prediction of degradation of polyolefins used in solar domestic hot water components, *Proceedings of ASME 2010 4<sup>th</sup> International Conference on Energy Sustainability*, Phoenix, Arizona, USA, May 17-22, 2010. doi:10.1115/ES2010-90514

## Technical Reports

---

1. **G. Singh**, R. Sweet, D. Schappel, A. Nelson, J. Harp, B.D Wirth and Y. Katoh, *Preliminary Analysis on PCMI Behavior of SiC-SiC Cladding with U3Si2 and UO2 Fuel Systems*, ORNL/SPR-2019/1247.
2. **G. Singh**, J. Gorton, D. Schappel, N.R. Brown, K. Terrani, Y. Katoh and B. Wirth, *Preliminary Analysis of SiC BWR Channel Box Performance Under Normal Operation*, ORNL Report, June 2018.
3. **G. Singh**, R. Sweet, B. Wirth, K. Terrani and Y. Katoh, *Thermo-mechanical Analysis of SiC/SiC Cladding with BISON including Fuel Creep*, ORNL/SR-2017/435.

4. **G. Singh**, S. Gonczy, E. Lara-Curzio and Y. Katoh, *Interlaboratory Round Robin Study on Axial Tensile Properties of SiC/SiC Tubular Specimens*, ORNL/SR-2017/397.
5. X. Hu, K. T. Koyanagi, **G. Singh** and Y. Katoh, *Determination of He and D permeability of neutron-irradiated SiC tubes to examine the potential for release due to micro-cracking*, ORNL/TM-2017/362.
6. T. Koyanagi, Y. Katoh, **G. Singh** and M. Snead, *SiC/SiC Cladding Materials Properties Handbook*, ORNL/TM-2017/385.
7. X. Hu, C. Ang, **G. Singh** and Y. Katoh, *Technique development for modulus, microcracking, hermeticity, and coating evaluation capability characterization of SiC/SiC tubes*, ORNL/TM-2016/372.
8. **G. Singh**, R. Sweet, B. Wirth, K. Terrani and Y. Katoh, *BISON Modeling of SiC/SiC Cladding Including Fuel-Pellet Interaction*, ORNL/TM-2016/449.
9. **G. Singh**, S. Gonczy, E. Lara-Curzio and Y. Katoh, *Interlaboratory Round Robin Testing of SiC/SiC Composite Tubes*, ORNL/TM-2016/404.
10. **G. Singh**, *Explicit Crack Modeling based Approach for Structural Integrity Assessment of Brittle and Quasi-Brittle Structures*, PhD Dissertation, University of Minnesota, 2015.
11. **G. Singh**, *Durability of High Density Polyethylene for Potable Hot Water Applications: Crack Propagation*, M.S. Thesis, University of Minnesota, 2012.

## Technical Presentations at Conferences

---

1. **G. Singh**, D. Schappel, J. Gorton, N Brown, Y. Katoh, B.D. Wirth and K. Terrani, *Deformation Analysis of SiC-SiC Channel Box for BWR Applications*, *43rd International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 27-February 01, 2019.
2. **G. Singh**, C. Ang, Y. Katoh, L. Snead and B. Wirth, *Multiphysics modeling of SPS based manufacturing of SiC-matrix FCM pellet*, *43rd International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 27-February 01, 2019.
3. **G. Singh**, R. Sweet, N Brown, B.D. Wirth, K. Terrani and Y. Katoh, *Thermo-Mechanical Parametric Evaluation of SiC/SiC Cladding with Fuel Creep*, *42nd International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 21-26, 2018.
4. **G. Singh**, S. Gonczy, E. Lara-Curzio and Y. Katoh, *Interlaboratory Round Robin Study of Axial Tensile Properties of SiC-SiC CMC Tubular Test Specimens*, *ASTM Annual Meeting*, Daytona Beach, Florida, January 21, 2018.
5. T. Koyanagi\*, Y. Katoh, **G. Singh**, C. Petrie, C. Deck and K. Terrani, *Post Irradiation Examination of SiC Tube Neutron Irradiated under a Radial High Heat Flux*, *42nd International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 21-26, 2018 (\*presenter).
6. **G. Singh**, T. Koyanagi, C. Petrie, K. Terrani and Y. Katoh, *Evaluation of Elastic Properties of SiC/SiC Tubular Specimens using Resonant Ultrasound Spectroscopy*, *42nd International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 21-26, 2018.
7. N.R. Brown\*, J. Gorton, **G. Singh**, K. Terrani, Y. Katoh and B. Wirth, *Thermal-Hydraulic and Neutronic Analysis of a SiC/SiC Channel Box*, *42nd International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 21-26, 2018 (\*presenter).
8. T. Koyanagi\*, Y. Katoh, **G. Singh**, C. Petrie and K. Terrani, *Post Irradiation Examination of SiC Tube Subjected to Simultaneous Irradiation and Radial High Heat Flux*, *American Nuclear Society (ANS) Annual Meeting*, San Francisco, California, USA, June 11-15, 2017 (\*presenter).
9. **G. Singh**, K. Terrani and Y. Katoh, *Evaluation of Mechanical Properties of SiC Based Materials Through Non-Destructive Technique*, *41st International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 22-27, 2017.

10. **G. Singh**, B. Wirth, K. Terrani and Y. Katoh, Thermo-Mechanical Analysis of SiC/SiC Composite Cladding: Effect of Non-Uniform Axial and Circumferential Power Profile, *41st International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 22-27, 2017.
11. **G. Singh**, S. Gonczy, E. Lara-Curzio and Y. Katoh, Interlaboratory Round Robin Testing of SiC/SiC Ceramic Matrix Composite Tubes, *ASTM Annual Meeting*, Daytona Beach, Florida, January 22, 2017.
12. N. Cinbiz\*, N. Brown, K. Terrani, R. Lowden and **G. Singh**, Modified-Burst Test Development for Accident Tolerant Cladding of SiC-SiC Composites, *41st International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 22-27, 2017 (\*presenter).
13. **G. Singh**, Alex Fok\* and Sue Mantell, Failure Predictions For Graphite Reflector Bricks In The Very High Temperature Reactor With The Prismatic Core Design, *Carbon Conference*, State College, Pennsylvania, July 10-16, 2016 (\*presenter).
14. **G. Singh**, K. Terrani and Y. Katoh, Thermo-Mechanical Analysis of SiC/SiC Composite Cladding for LWR Applications, *145th TMS (TMS 2016) Conference*, Nashville, Tennessee, February 14-18, 2016.
15. **G. Singh**, K. Terrani and Y. Katoh, Performance Evaluation of SiC/SiC Cladding for LWR Applications, *40th International Conference and Exposition on Advanced Ceramics and Composites (ICACC)*, Daytona Beach, Florida, January 24-29, 2016.
16. **G. Singh**, Y. Katoh, E. Lara-Curzio, S. Gonczy and K. Terrani, Mechanical Properties of SiC/SiC Ceramic Matrix Composite Tubes for Accident-Tolerant Fuel Systems, *Materials Challenges in Alternative and Renewable Energy 2016*, Clearwater, Florida, April 17-21, 2016.
17. **G. Singh**, S. C. Mantell and J. H. Davidson, Durability of polymers for solar thermal applications, *The Midwest's Premier Energy, Economic and Environmental Conference (E3)*, St. Paul, Minnesota, December 1-2, 2010.

## Teaching Experience

---

<b>University of Minnesota – Twin Cities</b>	<b>MN, USA</b>
<i>Graduate Teaching Assistant, Department of Mechanical Engineering</i>	
<i>ME 3222 - Design &amp; Manufacturing - II</i>	<i>Fall 2010</i>
Delivered lectures and conducted recitations on various topics Guided student groups for their course projects.	
<i>ME 5241 - Computer-Aided Engineering</i>	<i>Spring 2011</i>
Conducted labs on case studies using CAD and finite element analysis software. Guided students for their CAD projects.	
<i>ME 3221 - Design &amp; Manufacturing – I</i>	<i>Spring, Fall 2014</i>
Delivered lectures and conducted recitations on various topics.	

## Technical Skills

---

<i>Software</i>	MOOSE, BISON, Pro/Engineer, SolidWorks, ANSYS, Abaqus, ParaView, CUBIT, Isight, ImageJ
<i>Languages</i>	C++, Python, Fortran, R (Statistical computing), MATLAB
<i>Instruments</i>	Resonant Ultrasound Spectroscopy, SEM, Digital Image Correlation, Micro-computed Tomography Fourier Transform Infrared Spectroscopy, Mechanical Testing

## Professional Service

---

- Reviewed articles for Journal of Nuclear Materials, Carbon, Annals of Nuclear Energy, International Journal of Applied Ceramic Technology, International Conference on Nuclear Engineering 2018.

- Member of American Ceramics Society (ACerS); involved with ASTM for development of ASTM C1773 test standard for testing ceramic matrix composite tubes, steering committee member of Young Professionals Network.
- Served as judge for 4<sup>th</sup> and 5<sup>th</sup> Annual Women in STEM Research Symposium, University of Tennessee, Knoxville, USA, March, 2018 – 2019 .

## Research Grants

---

- Significant contribution to successful grant proposal to Office of Nuclear Energy of U.S. Department of Energy for \$800K under Nuclear Energy University Program (2017).  
Project title: *Multiscale Degradation of SiC/SiC Composite Degradation in Helium Coolant Operating Environment.*