**Ian Greenquist, PhD**

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Executive Summary

My dream is to help solve global climate change by improving the performance, economics, and environmental impact of the nuclear energy industry. I am an expert in the development and use of fuel performance models for UO2, metallic fuels, and advanced fuel concepts; sensitivity and uncertainty analysis; and code coupling. I am hardworking, passionate, driven, and reliable. I believe in honesty, in doing what is right, in trying new things, and in keeping my word. These attributes help me deliver quality results and give me a history of good relationships with employers and coworkers.

Skill Summary

* **Expertise:** fuel performance, nuclear materials, sensitivity and uncertainty analysis, multiphysics simulations
* **Programming Languages:** C++, Python, MATLAB
* **Modeling Techniques:** Finite Element, Phase Field, Monte Carlo
* **Modeling Software:** BISON, MARMOT, MOOSE, OpenMC, ANSYS, Aspen Plus, Simulink, ChemCAD
* **Languages:** English, Spanish

Education

* **Pennsylvania State University** State College, PA
Doctor of Philosophy: Nuclear Engineering 8/2019
GPA: 3.87
* **Brigham Young University** Provo, UT
Bachelor of Science: Chemical Engineering 4/2015
GPA: 3.42
* **Brigham Young University—Idaho** Rexburg, ID
Associate of Applied Science: Engineering Technology 4/2012
GPA: 3.41

Experience

**Oak Ridge National Laboratory** Oak Ridge, TN

**R&D Associate Staff Member** 1/2021–Present

 *Novel Nuclear Fuel*

* Developed a novel nuclear fuel concept
* Performed multiphysics scoping simulations of in-reactor, steady state fuel performance
* Enhanced simulations to include depletion analysis
* Awarded funding to continue development of fuel
* Oversaw experimental work of corrosion measurements
* Awarded a provisional patent

 *Ceramic Fuels*

* Evaluated risk of cladding burst and fuel release for very-high burnup UO2 fuel rods
* Performed sensitivity analysis of transient fission gas release models and their effects on cladding burst
* Modeled the effects of forensic taggants on fuel microstructure during manufacturing
* Modeled the effects of forensics taggants on irradiated minifuel experiments

 *Metallic Fuels*

* Analyzed the fuel performance of weapons-grade plutonium in metallic fast reactor fuel
* Fuel performance simulations predicting the behavior of uranium-molybdenum fuel in LWRs
* Completed the first comprehensive uncertainty quantification of BISON metallic fuel predictions

 *Reactor Shielding*

* Predicted irradiation damage of concrete shielding using machine learning
* Helped develop a code wrapper to couple python scripts to MOOSE-based codes
* Ran training simulations for a neural network machine learning algorithm

**Postdoctoral Research Associate** 7/2019–12/2020

* Fuel performance modeling of experimental reactors as part of Versatile Test Reactor project
* Developed 2 benchmark problems for testing and comparison of metallic fuel performance codes
* Implemented fuel performance models for U-Mo fuel and modeled the fuel in experimental conditions
* Collaborated with leaders in metallic fuels community to identify top research needs

**Pennsylvania State University** State College, PA

**Research Assistant** 8/2015–5/2019

* Developed a mechanistic mesoscale sintering model based on the phase field method
* First-of-kind comparison of mesoscale sintering model to experimental data
* First-of-kind quantification of kinetic effects of dopants using only simulations
* First-of-kind mesoscale model of irradiation-enhanced densification within UO2 nuclear fuel
* Created new techniques to generate initial conditions and measure density in simulations
* Contributed C++ code to MOOSE and MARMOT phase field application

**Idaho National Laboratory** Idaho Falls, ID

**Nuclear Engineering Intern** 5/2015–7/2015

* Developed benchmark phase-field simulation based on CALPHAD data
* Developed online phase field tutorial for new users of MOOSE framework
* Helped develop code to simulate grain-size effects on highly enriched nuclear fuels

**Chemical Engineering Intern** 5/2014–8/2014

* Competed 2 projects to improve profitability, cleanliness, and flexibility of coal-fired power plants
* Assessed the potential of running pretreated biomass pellets in existing coal-fired power plants
* Analyzed physical and chemical properties of 8 types of biomass pellets and coal
* Constructed an Aspen Plus model of a Coal-fired power plant with attached Steam Electrolysis plant

**Brigham Young University** Provo, UT

**Undergraduate Research Assistant** 6/2013–4/2014

* Evaluated potential strategies for hybrid nuclear energy systems with oil and gas production systems
* Developed MATLAB application for model-predictive control and optimization applications
* Attended an invited session at a national laboratory on Nuclear Hybrid Energy Systems
* Wrote grant proposals, presentations, and reports

**Upper-Division Math Tutor** 8/2012–4/2015

* Tutored students in college math classes in principles, applications, and problem-solving strategies
* Specialized in advanced subjects: Multivariable Calculus, Linear Algebra, and Ordinary Differential Equations
* Planned and taught exam-review sessions
* Assisted with other math courses: College Algebra, Trigonometry, Calculus 1 and 2, Business Calculus

Select Publications

* **Effects of transient fission gas release on rod balloon burst behavior during a** 2024 **loss-of-coolant accident**I. Greenquist, N. Capps
Annals of Nuclear Energy
* **Multiphysics analysis of fuel fragmentation, relocation, and dispersal susceptibility—Part 1:** 2023 **Overview and code coupling strategies**I. Greenquist, A. Wysocki, J. Hirschhorn, N. Capps
Annals of Nuclear Energy
* **Multiphysics analysis of fuel fragmentation, relocation, and dispersal susceptibility–Part 2:** 2023 **High-burnup steady-state operating and fuel performance conditions**J. Hirschhorn, I. Greenquist, A. Wysocki, N. Capps
Annals of Nuclear Energy
* **Multiphysics analysis of fuel fragmentation, relocation, and dispersal susceptibility–Part 3:** 2023 **Thermal hydraulic evaluation of large break LOCA under high-burnup conditions**A. Wysocki, J. Hirschhorn, I. Greenquist, N. Capps
Annals of Nuclear Energy
* **Accelerated fission rate irradiation design, pre-irradition characterization, and adaptation** 2023
**of conventional PIE methods for U-10Mo and U-17Mo**
P. Doyle, C. Massey, D. Richardson, I. Greenquist, R. Seibert, G. Helmreich, T. Ulrich,
R. Gallagher, K. Godsey, R. Fielding, A. T. Nelson, J. Harp
Frontiers in Nuclear Engineering
* **UO2-liquid metal suspension fuel concept for enhanced passive safety of LWRs: A heat** 2022
**pipe case study**
I. Greenquist
Nuclear Engineering and Design
* **Sensitivity and Uncertainty of the IFR-1 BISON Benchmark** 2022
I. Greenquist, J. J. Powers
Progress in Nuclear Energy
* **Metallic Fuel Performance Benchmarks for Versatile Test Reactor Applications (*Invited*)** 2022
J. Hirschhorn, J. J. Powers, I. Greenquist, R. T. Sweet, J. Hu, D. L. Porter, D. C. Crawford
Nuclear Science and Engineering
* **25 Pin BISON Fuel Performance Benchmark Case Based on the X430 Series of** 2021 **Experiments**
I. Greenquist, J. J. Powers
Journal of Nuclear Materials
* **Development of a U-19Pu-10Zr Fuel Performance Benchmark Problem Based on the** 2021 **IFR-1 Experiment**
I. Greenquist, K. M. Cunningham, J. Hu, J. J. Powers, D. C. Crawford
Journal of Nuclear Materials
* **Analysis of the Impact of Fuel Microstructure on Irradiation-Enhanced Densification** 2021 **Using Grand Potential Simulations**
I. Greenquist, M. Tonks, Y. Zhang
Annals of Nuclear Energy
* **Research Needs for Uranium-Zirconium-Based Metallic Fuels** 2020
A. Aitkaliyeva, M. Tonks, J. Hirschhorn, J. J. Powers, I. Greenquist, B. Beeler
INL Technical Memo
* **Grand Potential Sintering Simulations of Doped UO2 Accident-Tolerant Fuel Concepts** 2020
I. Greenquist, M. Tonks, M. Cooper, A. Andersson, Y. Zhang
Journal of Nuclear Materials
* **Development of a Microstructural Grand Potential-Based Sintering Model** 2020
I. Greenquist, M. Tonks, L. K. Aagesen, Y. Zhang
Computational Materials Science
* **Review of Sintering and Densification in Nuclear Fuels: Physical Mechanisms,** 2018 **Experimental Results, and Computational Models**
I. Greenquist, M. Tonks, Y. Zhang
Journal of Nuclear Materials

Select Presentations

* **UO2-liquid metal suspension fuel concept** 2023
I. Greenquist, M. Romedenne
Materials in Nuclear Energy Systems 2023
* **Very high burnup transient fission gas release: a sensitivity study in BISON** 2023
I. Greenquist, N. Capps

Materials in Nuclear Energy Systems 2023

* **Sensitivity of BISON modelt to Taggants / Phase Field Simulations of Tagged UO2 Sintering** 2023
I. Greenquist, A. Cheniour, R. T. Sweet, A. T. Nelson, B. A. Wilson, T. Ulrich, A. Kercher, A. Shields
Los Alamos National Laboratory
* **BISON Metallic Fuels Benchmark Simulations Based on the X430 Experiment** 2020
I. Greenquist, J. J. Powers
ANS Virtual Winter Meeting 2020
* **A Metallic Fuel Performance Benchmark Problem Based on the IFR-1 Experiment** 2020
I. Greenquist, K. Cunningham, J. Hu, J. J. Powers
Oak Ridge National Laboratory
* **Benchmarking BISON for VTR Driver Fuel** 2019
I. Greenquist, K. M. Cunningham, J. Hu, S. Morrison, J. J. Powers, D. C. Crawford
University of Florida
* **Initial Efforts to Benchmark Bison for VTR Driver Fuel Analysis** 2019

J. J. Powers, J. Hu, K. M. Cunningham, I. Greenquist, S. L. Morrison, S. R. Novascone,
A. Casagranda, D. C. Crawford
Materials in Nuclear Energy Systems biennial symposium

* **A New Phase Field Model of UO2 Sintering** 2018
I. Greenquist, M. Tonks, L. K. Aagesen, Y. Zhang
ANS Annual Meeting 2018
* **Mechanistic Mesoscale Simulation of UO2 Sintering and Densification *(Invited)*** 2018
M. Tonks, I. Greenquist, Y. Zhang
International Conference and Exposition on Advanced Ceramics and Composites
* **Phase Field Modeling of Uranium Dioxide Sintering** 2017
I. Greenquist, M. Tonks, Y. Zhang
TMS Annual Meeting and Exhibition
* **Phase Field Modeling of Uranium Dioxide Sintering** 2016
I. Greenquist, M. Tonks, Y. Zhang
MRS Fall Meeting and Exhibit