Curriculum Vitae

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Education and Training

Beijing Normal University, China	Ph.D.	1999	Materials Science and Engineering
Lund University, Sweden	Ph.D.	1998	Nuclear Physics
Beijing Normal University, China	M.S.	1993	Materials Science and Engineering
Beijing Normal University, China	B.S.	1990	Solid State Physics

Professional Experience

2010-present Distinguished Research and Development (R&D) staff (since 2015), Materials Science and Technology Division, Oak Ridge National Laboratory (ORNL); Joint Faculty Associate Professor in Materials Science and Engineering, University of Tennessee (UT). PI and Co-PI on fundamental and applied research projects related to equilibrium and non-equilibrium defect dynamics and energy transfer processes. Research focuses on a broad range of topics on both theoretical and experimental aspects of interaction with materials (ions, neutrons, electrons and photons) and how these interactions can be applied to the analysis and modification of materials, as well as the detection and characterization of charged particles. Deputy Director of the UT-ORNL Ion Beam Materials Laboratory (http://ibml.utk.edu/), responsible for training students and postdocs and management of routine operations.

2003-2010 Staff Scientist/Senior Research Scientist, Pacific Northwest National Laboratory (PNNL). PI and Co-PI on fundamental and applied research projects in the fields of ion-beam physics and radiation physics with focus on radiation effects, ionization-induced recrystallization, electronic stopping in solids, radiation detection, and nanoscale defect/interface engineering. Duties also include working with users in the Ion Accelerator Laboratory at the Environmental Molecular Sciences Laboratory, a DOE user facility.

2000-2002 Assistant Professor, Division of Ion Physics, Uppsala University, Sweden. Research includes ion-beam modification and synthesis of materials, impurity diffusion in solids, environmental degradation of materials, and applications of ion-beam analysis techniques; development of automatic control programs for ion beam analysis techniques; responsible for the corresponding research activities at the Uppsala Tandem Accelerator Laboratory.

1999-2000 Postdoctoral researcher, Division of Ion Physics, Uppsala University, Sweden.

Selected Publications (over 375 refereed journal articles, lead on 75 and many as corresponding author, and an H-index of 39 and total citation over 6500 based on Web of Science; 7 books and book chapters)

1. F. Tuomisto, I. Makkonen, J. Heikinheimo, F. Granberg, F. Djurabekova, K. Nordlund, G. Velisa, H. Bei, H. Xue, W.J. Weber, **Y. Zhang**, Segregation of Ni at early stages of radiation damage in NiCoFeCr solid solution alloys, *Acta Materialia* **196**, (2020) 44–51
2. Y. Osetsky, A.V. Barashev, L.K. Béland, Z. Yao, K. Ferasat & **Y. Zhang**, Tunable chemical complexity to control atomic diffusion in alloys, *npj Computational Materials* **6**, 38 (2020).
3. **Y. Zhang**, T. Egami, W.J. Weber, Dissipation of radiation energy in concentrated alloys: Unique defect properties and microstructural evolution, *MRS Bulletin* **44**, 798 (2019). Citations: 6.

4. **Y. Zhang**, X. Wang, Y. Osetsky, Y. Tong, R. Harrison, S.E. Donnelly, D. Chen, Y. Wang, H. Bei, B.C. Sales, K.L. More, P. Xiu, L. Wang, and W.J. Weber, Effects of 3*d* electron configurations on helium bubble formation and void swelling in concentrated solid-solution alloys, *Acta Materialia* **181**, (2019) 519. Citations: 3.
5. **Y. Zhang**, M.A. Tunes, M.L. Crespillo, F. Zhang, W.L. Boldman, P.D. Rack, L. Jiang, C. Xu, G. Greaves, S.E. Donnelly, L. Wang, W.J. Weber, Thermal stability and irradiation response of nanocrystalline CoCrCuFeNi high-entropy alloy, *Nanotechnology* **30**, 294004 (2019). Citations: 8.
6. W.J. Weber and **Y. Zhang**, Predicting damage production in monoatomic and polyatomic targets using Stopping and Range of Ions in Matter code: Challenges and Recommendations, *Curr. Opin. Solid State Mater. Sci.* **23**, (2019) 100757. Citations: 18.
7. S. Zhao, Y. Osetsky, G. M. Stocks, and **Y. Zhang**, Local-environment dependence of stacking fault energy in concentrated solid–solution alloys, *npj Comput. Mater*. **5**, (2019) 13. Citations: 12.
8. Z. Fan, S. Zhao, K. Jin, D. Chen, Y. Osetskiy, Y. Wang, H. Bei, K. More and **Y. Zhang**, Helium irradiated cavity formation and defect energetics in Ni-based binary single-phase concentrated solid solution alloys, *Acta Materialia* **164**, (2019) 283-292. Citations: 10.
9. G. Velisa, E. Wendler, S. Zhao, K. Jin, H. Bei, W.J. Weber, and **Y. Zhang**, Delayed damage accumulation by athermal suppression of defect production in concentrated solid solution alloys, *Materials Research Letters* **6**, (2018) 136-141. Citations: 16.
10. S. Zhao, T. Egami, G. M. Stocks, and **Y. Zhang**, Effect of *d* electrons on defect properties in equiatomic NiCoCr and NiCoFeCr concentrated solid solution alloys, *Phys. Rev. Materials* **2**, (2018) 013602. Citations: 32.
11. Y. N. Osetskiy, L. Beland, A. Barashev, and Y. Zhang, On the existence and origin of sluggish diffusion in chemically disordered concentrated alloys, *Curr. Opin. Solid State Mater. Sci.* **22**, (2018) 65-74. Citations: 23.
12. **Y. Zhang**, S. Zhao, W.J. Weber, K. Nordlund, F. Granberg, and F. Durabekova, Atomic-level heterogeneity and defect dynamics in concentrated solid-solution alloys, *Curr. Opin. Solid State Mater. Sci.* **21,** (2017) 221. Citations: 63.
13. S. Zhao, G.M. Stocks, and **Y. Zhang**, Stacking fault energies of face-centered cubic concentrated solid solution alloys, *Acta Materialia* **134**, (2017) 334-345. Citations: 84.
14. S. Zhao, Y. Osetskiy, **Y. Zhang**, Preferable diffusion in concentrated solid solution alloys: NiFe, NiCo and NiCoCr, *Acta Materialia* **128**, (2017) 391-399. Citations: 46.
15. F.X. Zhang, S. Zhao, K. Jin, H. Xue, G. Velisa, H. Bei, R. Huang, J.Y.P. Ko, D.C. Pagan, J.C. Neuefeind, W.J. Weber, and **Y. Zhang**, Local Structure and Short-Range Order in a NiCoCr Solid Solution Alloy, *Phys. Rev. Lett.* **118**, 205501 (2017). Citations: 79.
16. C. Lu, T. Yang, K. Jin, N. Gao, P. Xiu, **Y. Zhang**, F. Gao, H. Bei, W. J. Weber, K. Sun, Y. Dong, and L. Wang, Radiation-induced segregation on defect clusters in single-phase concentrated solid-solution alloys, *Acta Materialia* **127**, 98-107 (2017). Citations: 61.
17. **Y. Zhang**, K. Jin, H. Xue, C. Lu, R. Olsen, L. Beland, M.W. Ullah, S. Zhao, H. Bei, D.S. Aidhy, G.D. Samolyuk, L. Wang, M. Caro, A. Caro, G.M. Stocks, B.C. Larson, I.M. Robertson, A.A. Correa, and W.J. Weber, Influence of Chemical Disorder on Energy Dissipation and Defect Evolution in Advanced Alloys, *J. Materials Research* **31**, (2016) 2363-2375. Citations: 49.
18. F. Granberg, K. Nordlund, M.W. Ullah, K. Jin, C. Lu, H. Bei, L. Wang, F. Djurabekova, W.J. Weber, and **Y. Zhang**, Mechanism of radiation damage reduction in equiatomic multicomponent single phase alloys, *Phys. Rev. Lett.* **116**, (2016) 135504. Citations: 149.
19. C. Lu, L. Niu, N. Chen, K. Jin, T. Yang, P. Xiu, **Y. Zhang**, F. Gao, H. Bei, S. Shi, M. He, I.M. Robertson, W.J. Weber, and L. Wang, Enhancing radiation tolerance by controlling defect mobility and migration pathways in multicomponent single-phase alloys, *Nat. Commun.* **7**, (2016) 13564. Citations: 178.
20. K. Jin, B.C. Sales, G.M. Stocks, G.D. Samolyuk, M. Daene, W.J. Weber, **Y. Zhang**, and H. Bei, Tailoring the physical properties of Ni-containing single-phase equiatomic alloys by modifying the chemical complexity, *Scientific Reports* **6**, (2016) 20159. Citations: 78.

21. C. Lu, K. Jin, L.K. Beland, F. Zhang, T.-n. Yang, L. Qiao, **Y. Zhang,** H. Bei, H.M. Christen, R.E. Stoller, L. Wang, Direct Observation of Defect Range and Evolution in Ion-Irradiated Single Crystalline Ni and Ni Binary Alloys, *Scientific Reports* **6**, (2016) 19994. Citations: 74.
22. K. Jin, C. Lu, L.M Wang, J. Qu, W.J. Weber, **Y. Zhang**, H. Bei, Effects of compositional complexity on the ion-irradiation induced swelling and hardening in Ni-containing equiatomic alloys, *Scr. Mater.*, **119**, (2016) 65. Citations: 70.
23. S. Zhao, G.M. Stocks, **Y. Zhang**, Defect energetics of concentrated solid-solution alloys from ab initio calculations: $Ni_{0.5}Co_{0.5}$, $Ni_{0.5}Fe_{0.5}$, $Ni_{0.8}Fe_{0.2}$ and $Ni_{0.8}Cr_{0.2}$, *Phys. Chem. Chem. Phys*., **18**, (2016) 24043. Citations: 50.
24. M.W. Ullah, D.S. Aidhy, **Y. Zhang,** and W.J. Weber, Damage accumulation in ion-irradiated Ni-based concentrated solid-solution alloys, *Acta Materialia* **109**, (2016) 17-22. Citations: 46.
25. **Y. Zhang**, G.M. Stocks, K. Jin, C. Lu, H. Bei, B.C. Sales, L. Wang, L.K. Beland, R.E. Stoller, G.D. Samolyuk, M. Caro, A. Caro, and W.J. Weber, Influence of chemical disorder on energy dissipation and defect evolution in concentrated solid-solution alloys, *Nat. Commun.* **6**, (2015) 8736. Citations: 180.
26. **Y. Zhang**, R. Sachan, O.H. Pakarinen, M.F. Chisholm, P. Liu, H. Xue, and W.J. Weber, Ionization-induced annealing of pre-existing defects in silicon carbide, *Nat. Commun.* **6**, (2015) 8049. Citations: 61.
27. W.J. Weber, D.M. Duffy, L. Thomé and **Y. Zhang**, The role of electronic energy loss in ion beam modification of materials, *Curr. Opin. Solid State Mater. Sci.* **19**, (2015) 1. Citations: 71.
28. W.J. Weber, E. Zarkadoula, O.H. Pakarinen, R. Sachan, M.F. Chisholm, P. Liu, H. Xue, K. Jin, and **Y. Zhang**, Synergy of elastic and inelastic energy loss on ion track formation in $SrTiO_3$, *Scientific Reports* **5**, (2015) 7726. Citations: 53.
29. D.S. Aidhy, C. Lu, K. Jin, H. Bei, **Y. Zhang**, L. Wang, W.J. Weber, Point defect evolution in Ni, NiFe and NiCr alloys from atomistic simulations and irradiation experiments, *Acta Materialia* **99**, (2015) 69–76. Citations: 54.
30. **Y. Zhang**, M.L. Crespillo, H. Xue, K. Jin, C.-H. Chen, C.L. Fontana, J.T. Graham, and W.J. Weber, New ion beam materials laboratory for materials modification and irradiation effects research, *Nucl. Instrum. & Meth*. B **338**, (2014) 19. Citations: 84.
31. K. Jin, **Y. Zhang**, Z. Zhu, D.A. Grove, H. Xue, J. Xue, and W.J. Weber, Electronic stopping powers for heavy ions in SiC and SiO_2, *J. Applied Physics* **115**, (2014) 044903. Citations: 39.
32. Z. Tang, M.C. Gao, H. Diao, T.Yang, J. Liu, T. Zuo, Y. Zhang, Z. Lu, Y. Cheng, **Y. Zhang**, K.A. Dahmen, P.K. Liaw, T. Egami, Aluminum Alloying Effects on Lattice Types, Microstructures and Mechanical Behavior of High-Entropy Alloys Systems, *JOM*, **65**, 1848 (2013). Citations: 125.
33. P.D. Edmondson, C.M. Parish, **Y. Zhang**, A. Hallen, and M.K. Miller, Helium bubble distributions in a nanostructured ferritic alloy, *Journal of Nuclear Materials* **434**, (2013) 210–216. Citations: 64.
34. **Y. Zhang**, M. Ishimaru, T. Varga, T. Oda, C. Hardiman, H. Xue, Y. Katoh, S. Shannon, and W.J. Weber, Nanoscale Engineering of Radiation Tolerant Silicon Carbide, *Phys. Chem. Chem Phys.* **14**, (2012) 13429. Citations: 67.
35. Y. Gao, T. Yang, J. Xue, S. Yan, S. Zhou, Y. Wang, D.T.K. Kwok, P.K. Chu and **Y. Zhang**, Radiation tolerance of Cu/W multilayered nanocomposites, *J. of Nucl. Mater.* **413**, (2011) 11-15. Citations: 72.
36. **Y. Zhang**, P.D. Edmondson, T. Varga, S. Moll, F. Namavar, C. Lan and W.J. Weber, Structural Modification of Nanocrystalline Ceria by Ion Beams, *Physical Chemistry Chemical Physics*, **13,** (2011) 11946–11950. Citations: 44.
37. M. Toulemonde, W.J. Weber, G. Li, V. Shutthanandan, P. Kluth, T. Yang, Y. Wang and **Y. Zhang**, Synergy of Nuclear and Electronic Energy Losses in Ion-irradiation Processes: the Case of Vitreous Silicon Dioxide, *Physical Review B* **83**, (2011) 054106. Citations: 105.
38. P.D. Edmondson, C.M. Parish, **Y. Zhang**, A. Hallén and M.K. Miller, Helium entrapment in a nanostructured ferritic alloy, *Scripta Materialia* **65**, (2011) 731–734. Citations: 58.

39. **Y. Zhang**, W. Jiang, C. Wang, F. Namavar, P. D. Edmondson, Z. Zhu, F. Gao, J. Lian, W.J. Weber, Grain growth and phase stability of nanocrystalline cubic zirconia under ion irradiation, *Physical Review B* **82**, (2010) 184105. Citations: 76.
40. W. Jiang, H. Wang, I. Kim, I.T. Bae, G. Li, P. Nachimuthu, Z. Zhu, **Y. Zhang**, and W.J. Weber. Response of Nanocrystalline Silicon Carbide to Heavy Ion Irradiation, *Physical Review B* **80** (**R**), (2009) 161301. Citations: 59.
41. **Y. Zhang**, I.-T. Bae, K. Sun, C. Wang, M. Ishimaru, Z. Zhu, W. Jiang, and W.J. Weber, Damage Profile and Ion Distribution of Slow Heavy Ions in Compounds, *J. Appl. Phys.* **105**, (2009) 104901. Citations: 70.
42. **Y. Zhang**, Z. Zhu, W.D. Bennett, L.V. Saraf, J.L. Rausch, C.A. Hendricks, W.J. Weber, J. Lian, and R.C. Ewing, Response of Strontium Titanate to Ion and Electron Irradiation, *J. of Nucl. Mater.* **389**, (2009) 303. Citations: 61.
43. J. Lian, J. Zhang, F. Namavar, **Y. Zhang**, F. Lu, H. Haider, K. Garvin, W.J. Weber and R.C. Ewing, Ion beam-induced amorphous-to-tetragonal phase transformation and grain growth of nanocrystalline zirconia, *Nanotechnology* **20**, (2009) 245303, 1-7. Citations: 41.
44. **Y. Zhang**, J. Lian, C.M. Wang, W. Jiang, R.C. Ewing, and W.J. Weber, Ion-induced Damage Accumulation and Electron-beam-enhanced Recrystallization in $SrTiO_3$, *Physical Review B* **72**, (2005) 094112. Citations: 95.
45. W. Jiang, **Y. Zhang** and W.J. Weber, Temperature Dependence of Disorder Accumulation and Amorphization in Au Ion Irradiated 6H-SiC, *Physical Review* B **70**, (2004) 165208. Citations: 74.
46. **Y. Zhang**, W.J. Weber, W. Jiang, C.M. Wang, V. Shutthanandan, and A. Hallén, Effects of Implantation Temperature on Damage Accumulation in Al-Implanted 4H-SiC, *J. Appl. Phys.* **95**, (2004) 4012. Citations: 75.
47. **Y. Zhang**, W.J. Weber, W. Jiang, C.M. Wang, A. Hallén and G. Possnert, Effects of Implantation Temperature and Ion Flux on Damage Accumulation in Al-Implanted 4H-SiC, *Journal of Applied Physics* **93**, (2003) 1954-1960. Citations: 43.
48. **Y. Zhang**, W.J. Weber, W. Jiang, A. Hallen, and G. Possnert, Damage evolution and recovery on both Si and C sublattices in Al-implanted 4H-SiC studied by Rutherford backscattering spectroscopy and nuclear reaction analysis, *J. Appl. Phys.* **91**, (2002) 6388-6395. Citations: 75.
49. A. Hallén, M.S. Janson, A. Yu.Kuznetsov, D. Åberg, M.K. Linnarsson, B.G. Svensson, P.O. Persson, F.H.C. Carlsson, L. Storasta, J.P. Bergman, S.G. Sridhara and **Y. Zhang**, Ion Implantation of Silicon Carbide, , *Nucl. Instrum. & Meth*. B **186**, (2002) 186. Citations: 42.
50. **Y. Zhang**, H.J. Whitlow, T. Winzell, I. F. Bubb, T. Sajavaara, K. Arstila and J. Keinonen, Detection Efficiency of Time of Flight Energy Elastic Recoil Detection Analysis Systems, *Nucl. Instrum. & Meth. B* **149,** (1999) 477. Citations: 120.

Presentations: Over 80 invited presentations and 60 other presentations at national and international scientific conferences, workshops, research institutions, and universities. Beside regular presentations, one keynote talk at the 2nd Global Forum on Advanced Materials and Technologies for Sustainable Development and one Plenary talk at the 2018 Nuclear Materials Conference were recently delivered.

Mentoring and Educational Activities

- Developed a new graduate course: Ion Beam Modification and Analysis (MSE 571 and NE 544) in the Department of Materials Science and Engineering and the Department of Nuclear Energy, University of Tennessee. The objective of this course is to present an overview of accelerator-based research and engineering, which is a growing and vibrant scientific area, and to give the training in the central aspects of modern ion beam techniques for the modification and analysis of materials.
- Established an iterative procedure to analyze ion beam channeling spectra (described in J. of Nuclear Materials 389 (2009) 303–310) and made this algorithm easy for students to use in their thesis work. This research tool has also been provided to and widely used by researchers in the field using ion beams to determine defects and disorders in crystals.

- Routinely hosted visiting scientists from U.S. and foreign universities, mentor graduate students, summer undergraduates and high school interns at PNNL, ORNL and UT. Provided 8 to 10 hours of lectures, 2-3 weeks of accelerator training and hands-on practice at the experimental workstations so students and some users can operate the instruments themselves for introductory measurements.
- Supervised students (PhD, MSC, summer interns and high school students).
- Served on the dissertation committee for students and PhD candidates in USA and some European countries, including being an external Faculty Opponent.

Professional Awards and Recognition

- Oak Ridge National Laboratory Significant Event Award (2014)
- Pacific Northwest National Laboratory - Scientific and Technical Achievement Recognition (2008).
- Environmental Molecular Science Laboratory - Director Award, PNNL (2006).
- Recipient of **Presidential Early Career Awards for Scientists and Engineers (PECASE)** (2005) for *innovative research at the frontiers of science and technology, and for exceptional potential to shape the future through intellectual and inspired leadership*, especially for her internationally recognized, seminal contributions to the fields of ion–beam physics and ion–solid interactions in materials, and for her commitment to education and outreach.
- Recipient of **DOE Office of Science Early Career Scientist and Engineer Award** (2005) for *internationally recognized, seminal contributions to the fields of ion-beam physics and ion-solid interactions in materials, especially development of a novel approach for measuring electronic stopping, and for her commitment to mentoring students at the high school, undergraduate, graduate and postdoctoral levels, lecturing within the Joint Institute with the University of Washington, providing Chinese translations to local middle schools, and for judging local science fairs.*
- Environmental Molecular Science Laboratory - Outstanding Performance Award, PNNL (2005).

Professional Activities

- Guest Editor, Focus Issue: Concentrated Solid Solution Alloys Perspective, *Current Opinion in Solid State and Materials Science* 21, issue 5 (2017). Guest Editor, Defect-induced Effects in Nanomaterials, *Physica Status Solidi b* (2016). Guest Editor, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 286 (2011).
- Editorial board, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* (2009 - 2015).
- Symposium and Session Organizer: International Conference on the Application of Accelerators in Research and Industry (CAARI) (2006, 2008, 2012, 2014, 2018, 2020). Symposium Organizer: NuMat2014: The Nuclear Materials Conference (2014). Symposium Organizer: Materials Research Society "Materials Research Needs to Advance Nuclear Energy" (2009), "Advances in Materials for Nuclear Energy" (2012), "Defects and Radiation Effects in Advanced Materials" (2014). Symposium Organizer: "Defect-induced Effects in Nanomaterials," European Materials Research Society, Lille, France (2016). Co-Chair, 16th International Conference on Radiation Effects in Insulators, Beijing, China (2011). Organizer, Summer School on Materials Challenges for Advanced Nuclear Energy Systems, Beijing, China (2011). Symposium Organizer: "Ion Beam Modification and Synthesis in Solids," Material Science & Technology Conference, Cincinnati, OH (2006).
- Member Advisory Committees: International Scientific Committee on NOMATEN (Centre of Excellence in Multifunctional Materials for Industrial and Medical Applications, http://nomaten.ncbj.gov.pl/, 2018 - present); Center for Integrated Nanotechnologies (CINT) External Proposal Review Committee (2018 - present).
- Journal Reviewer: Nature Materials, Nature Communications, Scientific Reports, Acta Materialia, Scripta Materialia, Materials Research Letters, APL Materials, J. of applied physics, Nuclear Instruments and Methods in Physics Research A, Nuclear Instruments and Methods in Physics Research B, J of Phys E, IEEE Transactions on Nuclear Science, J. of Materials Research, J. of

Nuclear Materials, Nanotechnology, J. of Microscopy, Canadian Journal of Physics, J. of Microscopy, IEEE Transactions on Nuclear Science, High Pressure Research, Surface and Interface Analysis.

Scientific Leadership and Key Research Accomplishments

- *Novel approach for determining electronic stopping powers*: Electronic energy loss of charged particles in carbides and oxides is a fundamental process that affects many applications related to advanced nuclear power, radiation detectors, ion-beam processing, ion-beam analysis, single event upsets, and advanced processing of microelectronic devices. Dr. Zhang developed and demonstrated a highly accurate method for measuring the electronic stopping power in materials over a wide continuous range of energies. Specifically, she developed a novel approach based on high-resolution time-of-flight spectroscopy that provides both improved experimental accuracy and measurements over a continuous range of ion energies. This approach has significant advantages over conventional approaches for single point measurement. Her application of this technique generated the first experimental data available on electronic stopping for some ions heavier than He in a large number of self-supporting thin film of Si, C, SiC, and binary metal oxides over a wide range of energies. These measurements directly impact DOE and DOD missions related to advanced nuclear power, nuclear nonproliferation, national security, environmental cleanup and development of energy efficient advanced electronic devices. Accurate stopping data acquired using Dr. Zhang's novel approach are critical to development of improved theories and models of energy loss processes in materials, and her data have been included in Report 73 of the Committee on Stopping of Heavy Ions (International Commission on Radiation Units and Measurements). Based in part upon this work, Dr. Zhang was a recipient of the 2005 Presidential Early Career Award for Scientists and Engineers. Moving forward, she led an effort supported by DOD to validate the necessary correction of effective nuclear energy loss that enable to determine the electronic stopping powers of very heavy ions in the intermediated energy region where both energy deposition processes are significant, and modify the stopping prediction code to provide reliable damage profile and ion range.
- *Radiation effects in silicon carbide and oxides*: Dr. Zhang's long-term research addresses defects and radiation effects in SiC and other complex ceramics. Her work on SiC has provided critical new understanding of defect configurations and defect recovery processes, as well as critical experimental validation of theoretical predictions on defect properties. Dr. Zhang's more recent research has shown that ion–electron collisions can heal material defects. Investigating this non-intuitive healing process, she and her colleagues have discovered that the high-energy ions locally heated the material and restored order to SiC. The substantial self-healing effect demonstrated in SiC has a far-reaching implication, as the healing process could lead to in-operando repair of radiation damage of SiC components in nuclear and space applications. Furthermore, the fundamental understanding of this energy transfer could allow for better prediction of materials performance after exposure to high-energy ions used in manufacturing of electronic devices and engineered nanostructures. The work on *Ion–Electron Collisions Can Heal Material Defects* is highlighted at a DOE/BES website. In her work on complex oxides, Dr. Zhang demonstrated the role of oxygen vacancy mobility on the critical temperature for amorphization in samarium titanate; provided the first determination of damage accumulation behavior in rare-earth titanates and rare-earth silicates; and provided the first quantitative measurement of electron-beam stimulated recrystallization processes and corresponding activation energy in strontium titanate. Her work provided new insights into the physical processes of irradiation-induced point defect production, defect mobility, and damage accumulation in ceramics. Analysis tools she developed for more accurate and efficient interpretation of ion-channeling data are now routinely used by her colleagues and her former students and postdocs nationally and internationally. Her contributions on non-equilibrium defect and radiation effects introduced by irradiation comprise the science base for understanding equilibrium defect properties, ionic transport and materials performance at extremes.
- *Rapid screening of radiation detector materials for accelerated materials discovery*: Dr. Zhang's scientific vision in addressing critical material challenges is further illustrated by her application of

high-resolution time-of-flight spectroscopy to study the response of new radiation detector materials to single-ion events. Stringent requirements of national security, medical physics, and high-energy nuclear physics applications have prompted urgent needs for gamma detectors with better energy resolution, higher yield and faster response. The field, however, has reached an impasse due to a general lack of understanding of nonproportionality and transport properties. Taking advantage of better-understood ion-solid interactions than gamma-solid interactions, Dr. Zhang utilizes her single ion technique to understand scintillation response to energy deposition and paves a way to accelerated materials discovery through quantitative study of the nonproportionality and energy transport properties. Avoiding the Edisonian approach, the research has the potential to lead to new materials discovery and radical changes in radiation detector research.

- *Pioneering role in revealing material response from coupled electronic and nuclear energy deposition*: Knowledge on defect dynamics and structural evolution far from equilibrium is critical to the development of radiation-resistant nuclear materials and new functional materials based on formation of novel defects states, a wide variety of nanostructures, as well as for electro-optical devices, wear/corrosion resistance, bio-compatibility, and other advanced technologies. Understanding the dynamic response of materials to energy deposition is essential to predict and control material properties. In recent years, the importance of ionization effects and the coupled processes has become increasingly recognized for materials with both ionic and covalent bonds. Dr. Zhang have shown the first distinctive evidences of the coupling processes that affect the dynamic response to irradiation, including synergistic effects in $SrTiO_3$, additive effects in nanocrystalline ZrO_2 and CeO_2, and competitive effects in SiC. Her groundbreaking work, shown by her highly cited publications, has anchored this emerging research field. Understanding the coupling of electronic and atomic processes in this intermediate energy regime is critically important; it is the energy regime used for 1) ion simulation of radiation effects in nuclear environments; 2) ion implantation, ion-beam modification and defect engineering by research institutions and industry; and 3) ion-beam analytical techniques. The significant implications include the use of ion beam techniques to eliminate damage from implantation doping in device fabrication process, and to functionalize films or surfaces.
- *Leading role in revealing chemical complexity in energy dissipation on defect devolution*: Ever-increasing demand for materials that provide safe and economical operation in harsh and aggressive in-service environments is a long-standing roadblock to future energy generation technologies. Dr. Zhang's research vision is not limited to ceramic materials; she had identified research gaps in structural alloys and pushed materials research forward. Inspired by properties of complex ceramics, e.g., pyrochlore—one specific ceramic for which similar-sized atoms in its ordered lattice structure can easily switch locations to absorb radiation energy, making it resistant to the radiation damage, Dr. Zhang has envisioned that concentrated alloys, include high-entropy alloys, with stable random atomic arrangement on their crystalline lattices should fall into that category and be radiation resistant. Dr. Zhang has led a large multi-institution effort to validate a hypothesis that modifying chemical complexity will alter defect dynamics at their early stages, and thus to ultimately reduce surviving defect concentrations and enhance radiation tolerance. The research has demonstrated that radiation energy dissipates via complex interactions among the energy carriers (electrons, phonons, and magnons). Modifying energy landscapes and tailoring atomic transport processes through tuning the chemical complexity at the level of both electrons and atoms can effectively impact both defect production during energy dissipation in the *fs* to *ps* time frame and damage evolution over much longer time scales. The knowledge of how the chemical complexity of concentrated alloys manifests and ultimately controls energy dissipation and defect evolution under extreme conditions will contribute to radical advances in radiation physics and yield new design principles for radiation-tolerant structural alloys aimed at applications in the nuclear energy field. Equally important, the knowledge learned from the complex concentrated alloys will also inspire further advances in fundamental research and industrial applications in complex ceramics, such as high-entropy borides, carbides nitrides and oxides.