

PROMOTION RECOMMENDATION

The University of Michigan
College of Engineering

Department of Nuclear Engineering and Radiological Sciences

Fei Gao, professor of nuclear engineering and radiological sciences, without tenure, Department of Nuclear and Radiological Sciences, College of Engineering, is recommended for the granting of tenure to be held with his title of professor of nuclear engineering and radiological sciences, Department of Nuclear Engineering and Radiological Sciences, College of Engineering [also professor of materials science and engineering, without tenure, Department of Materials Science and Engineering, College of Engineering].

Academic Degrees:

Ph.D. 1995 University of Liverpool, Materials Science and Engineering, Liverpool UK
M.Sc. 1987 Lanzhou University, Condensed Matter Physics, Lanzhou, China
B.S. 1983 Lanzhou University, Physics, Lanzhou, China

Professional Record:

2016-Present Professor (without tenure), Materials Science and Engineering, University of Michigan
2014-Present Professor (without tenure), Nuclear Engineering and Radiological Sciences, University of Michigan
2008-2014 Chief Scientist, Materials Science Division, Pacific Northwest National Laboratory, Richland, WA
2000-2008 Senior Research Scientist, Materials Science Division, Pacific Northwest National Laboratory, Richland, WA
2010-2014 Adjunct Professor, Materials Science and Engineering, Washington State University, Pullman, WA

Summary of Evaluation:

Teaching: Professor Gao has demonstrated excellence in teaching and student mentoring as evidenced by his student evaluations and letters. He has taught an undergraduate course (NERS 421) and graduate courses (NERS 522, NERS 524 and NERS 590) with an enthusiastic and engaging style. His student evaluations underscore his outstanding teaching. Students laud Professor Gao's meticulous preparation and delivery of lectures and commend the fact that he is passionate about their success, a factor that has drawn undergraduates into the graduate program and the field. He originated and developed a new class, Computational Nuclear Materials (NERS 590), which was highly successful in its first offering. This course focused on computational methods applied to nuclear materials, ranging from atomic-level simulations to mesoscale techniques to continuum modeling. Professor Gao has also devoted a great deal of time and effort to training and mentoring students. He is chair for five Ph.D. students, and thesis committee member for 15 Ph.D. students. In addition, he has advised four M.S. students and advises another two. He also has been active directing undergraduate research projects and mentoring post-doctoral scholars. In the last two years he published eight papers co-authored by students he is mentoring. Students have lauded Professor Gao for the time he spends with them

outside of the classroom and his helpful and encouraging style of teaching. His dedication to teaching is reflected in the outstanding performance of his students and their many awards.

Research: Professor Gao has built an extremely strong research program in computational radiation materials science. His work involves multi-scale computer simulations of materials performance under extreme conditions, including high temperature, high pressure, and intense radiation fields. Professor Gao's research is widely applicable to nuclear engineering topics and beyond. In the nuclear engineering field, he has tackled problems in structural materials, nuclear fuel, and new alloys such as high entropy alloys that offer extremely promising radiation resistant characteristics. His interests extend to other fields as evidenced by his work on electronic and optoelectronic devices. He simulates atomistic- and meso-scale behavior of defect evolution in compound semiconductors, including ultrafast displacement cascades, defect stabilization and cluster formation. This work has led to the improvement and optimization in performance of scintillator materials and has provided a science-driven search for new scintillator materials. Professor Gao's multi-scale computer simulations of nanoscale defect processes, ion solid interaction, and mechanical and electronic properties of nanostructures in ceramics was highlighted by the Office of Science-Decades of Discovery, DOE, as one of the top 101 discoveries during the previous 25 years. His research has resulted in four book chapters, over 350 peer reviewed journal articles, and over 50 proceedings, major reports, and book chapters. Professor Gao has published his research results in top journals including *Nature*, *Nature Journal of Physics*, *Acta Materialia*, and the *Journal of Nuclear Materials*. Professor Gao has been very successful in attracting federal research funding for his research. He has several active grants or contracts at UM totaling over \$5.5.M (\$1.8M as PI and over \$0.7M as co-PI).

Recent and Significant Publications:

- Lu, C.Y., Yang, T., Niu, L.L., Peng, Q., Jin, K., Crespillo, M.L., Velisa, G., Xue, H.Z., Zhang, F.F., Xiu, P.Y., Zhang, Y.W., Gao, F., Bei, H.B., Weber, W.J., Wang, L.M., "Interstitial Migration Behavior and Defect Evolution in Ion Irradiated Pure Nickel and Ni-xFe Binary Alloys," *J. Nucl. Mater.*, 2018; 509: 237.
- Tachopp, M.A., Gao, F., Solanski, K.N., "He-V Cluster Nucleation and Growth in α -Fe Grain Boundaries," *Acta Materialia*, 02/2017; 124: 544.
- Gao, N., Yang, L., Gao, F., Kurtz, R.J., West, D., Zhang, S., "Long-time atomistic dynamics through a new selfadaptive accelerated molecular dynamics method," *Journal of Physics: Condensed Matter*, 2017; 29: 145201.
- Gao, F., Chen, N.J., Hernandez-Rivera, E., Huang, D.H., Levan, P.D., "Displacement damage and predicted nonionizing energy loss in GaAs," *J. of Appl. Phys.*, 2017; 121: 095104.
- Lu, C.Y., Niu, L.L., Chen, N.J., Jin, K., Yang, T.N., Xiu, P.Y., Zhang, Y.W., Gao, F., Bei, H.B., Shi, S., He, M.R., Robertson, I.M., Weber, W.J., Wang, L.M., "Enhancing Radiation Tolerance by Controlling Defect Mobility and Migration Pathways in Multicomponent Single-Phase Alloys," *Nature Communication*, 2016; 7: 13564.

Service: Professor Gao has been active in service at all levels; department, college, university and profession. In his department, he has served on the Curriculum Review Committee and the Executive Committee. These are both substantial contributions to the department, the latter at a leadership level. In the college, he is a member of the Faculty IT Council. At the university

level, he is a member of the Committee for an Inclusive University, Senate Assembly, advising and consulting with the vice provost for equity and inclusion on policy and procedure issues related to the broad range of activities related to an inclusive university. Professionally, Professor Gao is or has served on numerous editorial boards. He currently serves as an editor for the American Institute of Physics Advances, and has served as member of several professional committees, as a chair, co-chair or session chair for many meetings, and as reviewer on numerous proposals and for many journals.

External reviewers:

Reviewer A: “Prof. Gao’s visibility is high. He has published extensively in archival journals and chapters in books, his work is very highly cited, and he is well known in the irradiation damage community.”

Reviewer B: “He is a world expert in materials simulations using ab initio methods, molecular dynamics, and Monte Carlo approaches. ... The qualities that Fei brings to his position are so important for keeping Michigan a lead institution.”

Reviewer C: “Dr. Gao’s work has greatly advanced the field of the microscopic mechanisms of radiation damage, and the development of nuclear fuels, fuel cladding and reactor internal materials.”

Reviewer D: “One of the remarkable attributes of Professor Gao’s work is its breadth and diversity: radiation effects, nuclear materials and fuels; batteries; catalysts; radiation detector and optically active semiconductors; and so on.”

Reviewer E: “He is highly respected in the nuclear materials computational community. ... The insights his atomistic calculations provide add substantially to the ability to understand the underlying physical mechanism which are observed in the experimental work”

Summary of Recommendation: Professor Gao is an internationally recognized scholar in the area of computational materials science. He has made a major impact in the fields of nuclear materials and semiconductor physics. He is a dedicated teacher and mentor to a number of undergraduate and graduate students. His service to department, college and the profession are exemplary. It is with the support of the College of Engineering Executive Committee that I recommend Fei Gao for the granting of tenure to be held with his title of professor of nuclear engineering and radiological sciences, Department of Nuclear Engineering and Radiological Sciences, College of Engineering.



Alec D. Gallimore, Ph.D.
Robert J. Vlasic Dean of Engineering
College of Engineering

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