

Approved by the
Regents
May 21, 2015

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Nuclear Engineering and Radiological Sciences

John E. Foster, associate professor of nuclear engineering and radiological sciences, with tenure, Department of Nuclear Engineering and Radiological Sciences, College of Engineering, is recommended for promotion to professor of nuclear engineering and radiological Sciences, with tenure, Department of Nuclear Engineering and Radiological Sciences, College of Engineering.

Academic Degrees:

Ph.D.	1996	University of Michigan, Applied Physics, Ann Arbor, MI
B.S.	1991	Jackson State University, Physics, Jackson, MS

Professional Record:

2012-present	Associate Professor (with tenure), Department of Nuclear Engineering and Radiological Sciences, University of Michigan
2006 – 2012	Associate Professor (without tenure), Department of Nuclear Engineering and Radiological Sciences, University of Michigan
2005 – 2006	Senior Scientist, NASA
2003 – 2004	Principal Investigator, NASA
1998 – 2003	Research Scientist, NASA
1997 – 1998	Research Associate, University of Wisconsin, National Science Foundation Engineering Research Center for Plasma-Aided Manufacturing, Madison, WI

Summary of Evaluation:

Teaching: Professor Foster is a caring and effective teacher of undergraduate and graduate students. His experience at NASA enables him to present both fundamental and applied engineering aspects of plasma science. He initiated a new class (*NERS573, Plasma Engineering*) that addresses the important applications of plasmas in lighting, advanced spacecraft propulsion and semiconductor processing. He has also done an outstanding job of upgrading the plasma-teaching laboratory for NERS 575. After teaching a course more than once, his evaluation scores are in the range of 4.1 to 4.6 for Q1 (Excellent Course) and 4.2 to 5.0 for Q2 (Excellent Teacher).

Professor Foster spends an enormous amount of time working with students outside of class with his “open door policy.” Students truly appreciate his accessibility and caring nature. The best assessment of Professor Foster’s teaching comes from his students, who describe Professor Foster’s lecturing style as “passionate and knowledgeable.” One undergraduate student remarked: “His teaching is inspiring and is one of the reasons that I am choosing to focus my study within nuclear engineering on plasmas. ...His dedication to the education of his students is clear both inside and outside of the classroom.” Another undergraduate wrote, “Professor Foster, more than any other professor at the University of Michigan, has made the greatest impact on my academic life. ...I truly believe his extra effort really.... changed the direction of my career.” The impact John has had on students is apparent: “I feel that any student that is lucky enough to have Professor Foster as a teacher will have their lives changed like he has changed mine.”

In graduate education, Professor Foster has chaired or co-chaired the dissertations of seven Ph.D. graduates with another half-dozen Ph.D. students currently under his supervision. Professor Foster’s former graduate students have assumed positions at major U.S. laboratories. His graduate students

appreciate his compassionate supervision. He also devotes a huge effort to assisting students from other departments on their research as a member of their doctoral dissertation committees, serving as a member on 37 such committees. His mentoring commitment has extended to M.S. students (eight supervised) and undergraduate research projects (21).

Research: At the University of Michigan, Professor Foster has expanded his plasma propulsion research portfolio from NASA; he has also significantly and boldly pioneered new research programs at the university in basic low-temperature plasma science, water purification and plasma medicine. He developed a state-of-the-art plasma propulsion lab, the Plasma Science and Technology Laboratory. Professor Foster has pioneered microwave-powered plasma sources that have extended the lifetime and reliability of ion propulsion units for deep space missions, such as the development of a new, high-power annular ion thruster for NASA. His fundamental research has explored new laser diagnostics to measure the plasma parameters in electrical discharges. In recent years, he has greatly expanded his research portfolio to low-temperature plasma applications, including environmental plasma-aided water purification and plasma medicine — two areas that could have an enormous impact on world health, particularly in developing countries. Professor Foster's fundamental studies of low-temperature plasma discharges in bubbles have greatly extended the scientific capabilities in that field. He has demonstrated the capability to form underwater plasma jets, an innovative new technique for plasma generation in liquids. He has presented these exciting results in invited presentations and mini courses at international conferences. Professor Foster has been a prolific publisher with some 50 articles in archival journals and 115 refereed conference proceedings. Professor Foster has been very successful in garnering over \$3 million of external funding for research and education. He has six patents granted and another four applications filed.

Recent and Significant Publications:

- Sommers, B. and Foster, J.E., "Plasma Formation in underwater gas bubbles," *Plasma Sources Science and Technology*, 23, 015020, 2014.
- Hubble, A.A., Barnat, E.V., Weatherford, B.R., Foster, J.E., "The electron spatial distribution and leak width in a magnetic cusp," *Plasma Sources Science and Technology*, 23,022001, 2014.
- Foster, J.E., Sommers, B., Gucker, S. N., Blankson, I. M., and Adamovsky, G. "Perspectives on the Interaction of Plasmas with Liquid Water for Water Purification," *IEEE Trans. Plasma Science*, Vol. 40, no. 5, 1311, 2012.
- Sommers, B., Foster, J.E., and Kushner, M.J., "Observations of electric discharge streamer propagation and capillary oscillations on the surface of air bubbles in water," *J. Physics D: Appl. Phys.*, 44, 082001, 2011.
- Foster, J.E., Weatherford, B., and Gillman, E., "Underwater DBD Plasma Jet," *Plasma Sources Science and Technology*, 19, 025001, 2010.

Service: Professor Foster has made major contributions to service at the department, college, university and national levels. In his role as co-graduate chair and M.S. chair, Professor Foster has greatly enhanced graduate student recruiting in the Department of Nuclear Engineering and Radiological Sciences (NERS), particularly of women and underrepresented minorities. He has served as the NERS representative for UM's Alliance for Graduate Education and the Professoriate (AGEP) program. AGEP is an NSF funded program administered by the Rackham Graduate School that is directed toward increasing the number of underrepresented minorities obtaining graduate degrees in science and technology fields and entering into the professoriate. Professor Foster is playing a major national role as a member of prestigious committees, including the National Research Council Committee on Plasma Science, the DOE Fusion Energy Sciences Advisory Committee, IEEE Plasma Science and Applications Committee, and AIAA Electric Propulsion Technical Committee. Several of these committees are among the most powerful in setting the directions of plasma research for nuclear fusion science and space technology.

External Reviewers

Reviewer A: "His work is certainly very visible in the field and he has a good reputation among peer... Most definitely, he has met the requirements for promotion to full professor in a major research university...I recommend him strongly for the promotion."

Reviewer B: "I find that Prof. Foster is demonstrating all the research pieces looked for in making a recommendation for promotion to Professor...Collectively, Prof. Foster's research, teaching and service record meets the requires for promotion to Professor at a major research university."

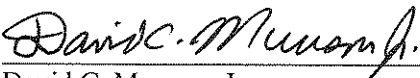
Reviewer C: "This *level* of publication productivity exceeds the threshold for promotion to full professor at comparable institutions...He is a member of the National Academies on Plasma Science, which is arguably one of the most influential committee appointments in plasma science...I believe that the candidate meets the requirements for someone being considered for promotion at a major research university."

Reviewer D: "He has a rather strong and well-funded externally research program. This attests to his strong leadership capacities, including the ability to stimulate and inspire others...The above clearly attests to quality of scientific activities, national and international visibility and recognition, scientific competence, autonomy, initiative, and leadership capacities...In my opinion Prof. Foster meets all requirements for someone to be promoted to a Full Professor at any major research university."

Reviewer E: "In terms of research productivity and quality, Dr. Foster has an excellent record that would be viewed exceptionally favorably at [my institution] with regard to promotion to full professor... Dr. Foster would compare very favorably with other colleagues in this field near the promotion to full professor, both here at [my institution] and at other institutions."

Reviewer F: "He has been quite visible on the national and international stages when it comes to professional service...In my opinion, Dr. Foster compares very favorably with engineering faculty members at the same stage of their academic careers and I am confident that were he a member of our department he would be promoted to full professor."

Summary of Recommendation: Professor Foster is an internationally recognized scholar and teacher in plasma science and engineering. He has made a major impact in the fields of plasma-electric propulsion, low temperature plasma science and applications to water purification. He has made major contributions to diversity in the department, college and university. It is with the support of the College of Engineering Executive Committee that I recommend John E. Foster for promotion to professor of nuclear engineering and radiological sciences, with tenure, Department of Nuclear Engineering and Radiological Sciences, College of Engineering.



David C. Munson, Jr.
Robert J. Vlasic Dean of Engineering
College of Engineering

May 2015