

May 17, 2007

**PROMOTION RECOMMENDATION**  
The University of Michigan  
College of Engineering

Margaret S. Wooldridge, associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering, and associate professor of aerospace engineering, without tenure, Department of Aerospace Engineering, College of Engineering, is recommended for promotion to professor of mechanical engineering, with tenure, Department of Mechanical Engineering, and professor of aerospace engineering, without tenure, Department of Aerospace Engineering, College of Engineering.

Academic Degrees:

Ph.D. 1995 Stanford University, Mechanical Engineering, Palo Alto, CA  
M.S. 1991 Stanford University, Mechanical Engineering, Palo Alto, CA  
B.S. 1989 University of Illinois, Mechanical Engineering, Urbana-Champaign, IL

Professional Record:

2005 - present Associate Professor (with tenure), Aerospace Engineering, University of Michigan  
2002 - present Associate Professor (without tenure), Mechanical Engineering, University of Michigan  
1998 - 2002 Assistant Professor, Mechanical Engineering, University of Michigan  
1995 - 1998 Assistant Professor, Mechanical Engineering, Texas A&M University

Summary of Evaluation:

Teaching: Professor Wooldridge's teaching record is very strong, and has been recognized by several awards including the College of Engineering Teaching Excellence Award. She has taught a wide range of courses (six undergraduate and two graduate), and has demonstrated her excellence as a teacher in every instance (average Q1= 4.06, Q2= 4.45). She revitalized Mechanical Engineering's core graduate level course in Advanced Heat Transfer and created a new college-wide undergraduate course in Energy. Without exception, students have enthusiastically praised her dedication and commitment to work with and educate them. She has advised or co-advised 10 Ph.D. students (five graduated, five in-progress) and eight M.S. students. Her advisees laude her effectiveness as a mentor, her strong technical insights, and her concern for student well-being, even beyond graduation. Finally, she has demonstrated a commendable commitment to diversity and outreach.

Research: Professor Wooldridge is well-known and highly regarded in the international combustion community. She works on combustion science and its intersection with materials science, with emphasis on experimental chemical kinetics, material synthesis and diagnostic techniques. She is a researcher who can initiate and direct her own independent work, and at the same time a valuable contributor in collaborative group projects. With her students, she has developed a state-of-the art combustion laboratory, and effectively utilized it in laser absorption measurements in multiphase combustion systems and in particle nucleation studies. She has made significant independent contributions in combustion synthesis of nano-size particles and nano-composites that are recognized internationally. In parallel, Professor Wooldridge has played a leadership role in the combustion kinetics thrust within a large multi-University (UM, MIT, Stanford, Berkeley) team of top notch combustion researchers who explore how to improve fuel economy and simultaneously reduce pollutant emissions in a HCCI engine. Overall, Professor Wooldridge's scholarly work, which includes 30 refereed journal papers, is consistently of high standard and appears in the best journals in her field. She has given invited presentations and plenary lectures at prestigious conferences. A testimony to the impact of her work is that it was highlighted in two of the keynote presentations at the 2006 International Combustion Symposium in Heidelberg.

#### Recent and Significant Publications:

- He, X., Zigler, B. T., Walton, S. M., Wooldridge, M. S., and Atreya, A., (2006) "A Rapid Compression Facility Study of OH Time Histories During Iso-octane Ignition," *Combustion and Flame*, **145**, 552-570.
- Miller, T. A., Bakrania, S. D., Perez, C., and Wooldridge, M. S., (2005) "A New Method for Direct Preparation of Tin-Dioxide Nanocomposite Materials," *Journal of Materials Research*, **20**, 2977-2987.
- He, X., Donovan, M. T., Zigler, B. T., Palmer, T. R., Walton, S. M., Wooldridge, M. S., and Atreya, A., (2005) "An Experimental Study of Isooctane Ignition Delay Times at HCCI Operating Conditions Using a Rapid Compression Facility," *Combustion and Flame*, **142**, 266-275.
- Donovan, M. T., He, X., Zigler, B. T., Palmer, T. R., Walton, S. M., and Wooldridge, M. S., (2005) "Experimental Investigation of Silane Combustion and Particle Nucleation Using a Rapid Compression Facility," *Combustion and Flame*, **141**, 360-370.
- Hong, S. J., Wooldridge, M.S., and Assanis, D. N., (2003) "Modeling of Chemical and Mixing Effects on Methane Autoignition under Direct Injection Stratified Charged Conditions," *Proceedings of the Combustion Institute*, **29**, pp. 711-718.
- Wooldridge, M. S., Torek, P. V., Hall, D. L., Palmer, T. R., Schrock, C. R., Miller, T. A., and Donovan, M. T., (2002) "An Experimental Investigation of Gas-Phase Combustion Synthesis of SiO<sub>2</sub> Particles Using A Multi-Element Diffusion Flame Burner" *Combustion and Flame*, **131**, pp. 98-109. ISI Citation Count: 9
- Sami, M., Annamalai, K., and Wooldridge, M., (2001) "Co-Firing of Coal and Biomass Fuel Blends," *Progress in Energy and Combustion Science*, **27**, pp. 171-214.
- Wooldridge, M. S. (1998) "Gas-Phase Combustion Synthesis of Particles," *Progress in Energy and Combustion Science*, **24**, pp. 63 - 87.

Service: Professor Wooldridge's record of service to the University and the community is exemplary. She has served in a variety of contexts within the University which have included faculty search committees, casebook committees, the Mechanical Engineering Advisory Committee, the CoE Automotive Council, and the CoE Strategic Planning Steering Committee. She has organized and chaired sessions at prestigious international conferences and is serving as associate editor for the American Society of Mechanical Engineers' *Journal of Engineering for Gas Turbines and Power*. Professor Wooldridge has also made significant contributions toward improving diversity. She has been a strong advocate for hiring women faculty in both the Mechanical and the Aerospace Departments of the University of Michigan. At the undergraduate and high school level, she has advised UROP, SWE, SUROP, NASA SAP and Marian Sarah Parker students in research activities in her laboratory. She has also participated in outreach activities to help introduce K-12 students to science and engineering.

#### External Reviewers:

Reviewer (A): "She developed fast sampling method [sic] to quench a sample of the Rapid Compression Machine content during the delay period so that the different hydrocarbon intermediates could be measured on a gas chromatograph...as a result, there is now definitive time-resolved species information to pin point [sic] the important fuel chemistries and rates in auto-ignition process [sic]. These data are invaluable for kinetics studies and Margaret is the first one to obtain that data. The technique also opens up a whole new generation of experiments."

Reviewer (B): "She has produced important publications in multiple areas, including combustion synthesis of novel materials, chemical kinetics, and laser diagnostics. ...the specific expertise required for each of these areas is substantially different, and her mastery of these disparate specialties is testimony to her intellectual horsepower."

Reviewer (C): "...the Wooldridge team has pioneered the application of laser based OH absorption to the high pressures and high temperatures encountered in the realistic conditions of the RCM. For a "tour de force" application of this laser technique...see paper 6..."

Reviewer (D): "Professor Wooldridge has been able to expand her horizons into several new areas including ignition chemistry, high temperature syntheses of nanoized crystal structures as well as significantly contributing to the improvement of experimental measurement instruments and systems."

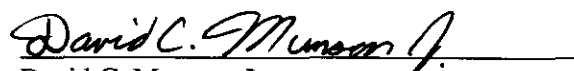
Reviewer (E): "Manufacturing nanoparticles is a challenge that can hinder the extensive applications of nanotechnology unless breakthroughs are made at the fundamental level, similar to what is being done by Dr. Wooldridge."

Reviewer (F): "I regard Margaret to be one of the top people in her [cohort] in the field of combustion. Margaret is well known and highly regarded in the international combustion community...Margaret was the one person from the whole international combustion community chosen to speak on the modeling of combustion synthesis systems..."

Reviewer (G): "Development of diagnostic techniques such as Margaret's quantitative diagnostics for hydroxyl radical and water molecules - at high pressures and temperatures- is the only hope we have. [H]er work to applying these techniques to complex multiphase systems is extremely important."

Reviewer (H): "Margaret and her students led the combustion community in development of a novel experimental technique for free-piston rapid compression studies of reactive mixtures. To date, these techniques have allowed first-ever isolation of the reaction kinetics critical to fuel ignition and particle nucleation under physically realistic conditions for combustion devices. The impact of her experiments and findings are clear."

Summary of Recommendation: In summary, Professor Wooldridge is an outstanding engineering educator, an accomplished researcher in the combustion community, and an exceptional leader on all of the diverse teams she serves. She has expanded the horizons and the visibility of the combustion research efforts at the University of Michigan and has received a number of prestigious society and professional awards in recognition of her work. It is with the support of the College of Engineering Executive Committee that I recommend Margaret S. Wooldridge for promotion to professor of mechanical engineering, with tenure, Department of Mechanical Engineering, and professor of aerospace engineering, without tenure, Department of Aerospace Engineering, College of Engineering.



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

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