

May 17, 2007

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

Wei Lu, assistant professor of mechanical engineering, Department of Mechanical Engineering, College of Engineering, is recommended for promotion to associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering, College of Engineering.

Academic Degrees:

Ph.D. 2001 Princeton University, Materials Science and Engineering, Princeton, NJ  
Ph.D. 1998 Tsinghua University, Solid Mechanics, Beijing, China  
MS. 1995 Tsinghua University, Solid Mechanics, Beijing, China  
B.S. 1994 Tsinghua University, Engineering Mechanics, Beijing, China

Professional Record:

2001 - present Assistant Professor (without tenure), Department of Mechanical Engineering,  
University of Michigan  
Summer 2005, 2006 Air Force Summer Faculty Fellow, Air Force

Summary of Evaluation:

Teaching: Professor Lu shows all the traits of an excellent teacher and advisor. He has taught a wide range of courses, including three undergraduate classes (ME 211, ME 311, ME 450), and two graduate classes, ME 511 and a new one he developed on "Nano/Micro Structure Evolution." His new course, which he has taught four times, has been received enthusiastically by the students (average Q1 and Q2 = 4.5). Professor Lu has also taught five times the senior elective course ME 311, where he invested a significant effort in developing and incorporating web-based technology to enhance the student experience (Q1=4.14, Q2=4.24). Students who have taken his classes praised Professor Lu's dedication and commitment to teaching, his approachability and his willingness to clarify the material outside the class. He has graduated one Ph.D. student and is presently advising three doctoral students. Letters from his Ph.D. students paint a picture of a caring advisor who strikes a good balance between nurturing research talents and encouraging individuality and creativity.

Research: Professor Lu's research activities address a critical challenge in nano-technology: the efficient and economical patterning of nano-scale structures of specific composition, feature size and spatial ordering. Professor Lu has a stellar archival publication record (40 published articles) in some of the premier journals in physics, mechanics and materials and a significant citation rate. In particular, since he has arrived at the University of Michigan, he has published 21 journal articles (all but one of which are with his students) in top quality journals, and several more papers at national and international conferences. He has also filed for one patent. His research agenda has been recognized by an NSF CAREER Award. He has been able to garner sufficient external research funding to establish a vibrant research group with truly impressive productivity. He has started some very promising collaborations with scientists within and outside the College of Engineering, including Chemistry and Physics, to complement his theoretical and modeling efforts. He has presented invited seminars at most of the top universities in the United States with several invited keynote talks, which is an indication of the esteem in which he is held by the scientific community. His research in the general field of the theoretical prediction of self-assembly and patterning at the nano-scale was praised by all the referees contacted. It is

clear that his careful and rigorous work is known and valued in the scientific community and that it is having a significant impact on experimentalists in this field.

#### Recent and Significant Publications:

- D. Salac and W. Lu, "Design Nanocrack Patterns in Heterogeneous Films," *Nanotechnology*, 17, 5185–5191, 2006.
- D. Kim and W. Lu, "Creep Flow, Diffusion, and Electromigration in Small Scale Interconnects," *Journal of the Mechanics and Physics of Solids*, 54, 2554-2568, 2006.
- W. Lu and D. Salac, "Interactions of Metallic Quantum Dots on a Semiconductor Substrate," *Physical Review B*, 74, Art. No. 073304, 2006.
- W. Lu and D. Kim, "Thin-Film Structures Induced by Electrostatic Field and Substrate Kinetic Constraint," *Applied Physics Letters*, 88, Art. No. 153116, 2006.
- D. Kim and W. Lu, "Three-dimensional Model of Electrostatically Induced Pattern Formation in Thin Polymer Films," *Physical Review B*, 73, Art. No. 035206, 2006.
- D. Salac and W. Lu, "Controlled Nanocrack Patterns for Nanowires", *Journal of Computational and Theoretical Nanoscience*, 3, 263-268, 2006.
- W. Lu and D. Salac, "Patterning Multilayers of Molecules via Self-Organization," *Physical Review Letters*, 94, Art. No. 146103, 2005
- W. Lu and Z. Suo, "Symmetry Breaking in Self-assembled Monolayers on Solid Surfaces: Anisotropic Surface Stress," *Physical Review B*, 65, Art. No. 085401, 2002.
- W. Lu and Z. Suo, "Dynamics of Nanoscale Pattern Formation of an Epitaxial Monolayer," *Journal of the Mechanics and Physics of Solids*, 49, 1937-1950, 2001.
- W. Lu, D.N. Fang, C. Q. Li, and K.C. Hwang, "Nonlinear Electric-Mechanical Behavior and Micromechanics Modeling of Ferroelectric Domain Evolution," *Acta Materialia*, 47, 2913-2926, 1999.

Service: Professor Lu's service record is in accordance with our expectations from junior faculty at this stage of their career. He has co-chaired the ME Seminar Series, and has served on several committees, including the ME Graduate Program Committee, the College of Engineering Library Advisory Committee, and the University of Michigan Senate Assembly Committee for a Multicultural University. He has also served on several Ph.D. committees within and outside the ME Department and as reviewer for major journals. He has played an active role in the professional community by organizing and chairing conference sessions in the American Society of Mechanical Engineers (ASME) and Materials Research Society. His peers have recognized his efforts by appointing him as a track-leader of Micro and Nano Mechanics for the ASME International Conference on Integration and Commercialization of Micro-Systems.

#### External Reviewers:

Reviewer A: "...Professor Lu has established a unique area through his innovative theoretical studies on the surface self-assembly processes that form nanostructures. The mechanisms that they have identified for controlling nanostructure morphologies are expansive, covering electrical (external electric field), molecular (dipole-dipole), chemical (chemical gradient), and physical (space-charge). These mechanisms provide experimentalists new tools in controlling their processes."

Reviewer B: "In a series of beautiful and elegant numerical simulations, he showed that the competition between the opposing thermodynamic forces leads to a very interesting dynamics in size selection and spatial ordering in various nanoscale multilayer systems."

Reviewer C: "The predictive nature of his work should help spawn a new area of manufacturing at very small scales."

Reviewer D: "His papers and his work reflect a precision of thought and a clarity that is not always found in current publications."

Reviewer E: "One of the impressive features of his work is the variety of driving forces (ranging from elastic stress to dipolar interaction among adsorbed molecules to electrostatic double layers) that he has recognized and quantified. While there is a huge amount of activity related to self-assembled structures, very few theorists have the ability to elucidate the physics as Wei Lu can."

Reviewer F: "In many ways, Wei has taken on some of his Ph.D. advisors [sic] best characteristics - a knack for choosing great problems, being able to develop and apply real physical intuition, a tendency for rigorous analysis, and the ability to present important results in a manner that is accessible to experts and non-experts alike."

Reviewer G: "The application of molecular dipoles opened up a new area to make three dimensional hierarchal nanoscale structures. Dr. Lu's work demonstrated that distributed electric fields can effectively direct the configuration and movement of domain patterns, which has led to an innovative molecular vehicle system. Molecules can be directed to specific positions by electric fields for various applications such as biosensors, nanolubrication or energy conversions."

Summary of Recommendation: In summary, Professor Lu's research activity in the field of nano-science, with emphasis on nano-scale self-assembly, has a bright future. He is making valuable contributions to the ME Department, the College and the University by bridging the gaps between design, fabrication and materials development for micro/nano-technology applications through his collaborations with physicists and chemists. His passion for and commitment to teaching is unquestionable, and his service contributions meet our expectations. It is with the support of the College of Engineering Executive Committee that I recommend Wei Lu for promotion to associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering, College of Engineering.



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

May 2007