Approved by the Regents
May 18, 2023

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Materials Science and Engineering

Robert M. Hovden, assistant professor of materials science and engineering, Department of Material Science and Engineering, College of Engineering, is recommended for promotion to associate professor of materials science and engineering, with tenure, Department of Materials Science and Engineering, College of Engineering.

Academic Degrees:

Ph.D.	2014	Cornell University, Applied Physics, Ithaca, NY
M.S.	2010	Cornell University, Applied and Engineering Physics, Ithaca, NY
B.S.	2007	Georgia Institute of Technology, Physics, Atlanta, GA

Professional Record:

2017 – present	Assistant Professor, Department of Materials Science and Engineering, University of Michigan
2014 – 2017	Post-Doctoral Fellow, Applied Physics, Cornell University, Ithaca, NY

Summary of Evaluation:

Teaching: Professor Hovden is an effective educator, both inside and outside of the classroom. He has rebuilt "MSE 562: Electron Microscopy I" into a uniquely original course focused on state-of-the-art theory and experiments in atomic resolution imaging not found in textbooks, such as electron tomography. He is redesigning the undergraduate course, "MSE 465: Structural and Chemical Characterization of Materials." The course will be renamed, "Nanocharacterization of Materials" to reflect the modern content and measurement techniques through hands-on lab tours and theory. Professor Hovden is an outstanding mentor. Since joining the MSE department, he has been directly responsible for the success of graduate, undergraduate, and high-school students within several departments (MSE, Physics, ME, EECS, Chemistry). In 2022, he received the Outstanding Research Mentor Award from UROP at the University of Michigan. He also works with the Office of Diversity, Equity, and Inclusion to mentor high-school students throughout the summer. His teaching scores are exemplary (averaging 4.5 and above in Q1 and Q2 for all terms of teaching). He has often received 4.9 scores in his graduate electron microscopy course. He has graduated one Ph.D. student, with another two expected to graduate this year.

Research: Professor Hovden is a nationally and internationally renowned leader in three areas of scientific research: Electron Microscopy and Tomography, Quantum Materials, and Biomineralization. He has made substantial scholarly contributions that shaped the fields of materials science, condensed matter physics, and electron microscopy. Professor Hovden has done an exemplary job of establishing a leading electron microscopy group, particularly in the areas of aberration-corrected transmission electron microscopy (TEM) that provides sub-Angstrom level resolution in structure and chemistry. He is the lead aberration-corrected TEM expert on campus and supports for the most advanced TEMs in (MC)2. Professor Hovden and

his mentees have received prestigious awards. His students have won the DOE SCGSR fellowship, the University of Michigan Rackham Predoctoral fellowship, the Best Physical Sciences Paper in Microscopy and Microanalysis (2018), multiple awards from the Microscopy Society of America (MSA), and two NSF graduate fellowships. Professor Hovden has published over 73 peer-reviewed articles with 7000+ citations and has an h-index of 36 (Google Scholar). This includes 20 manuscripts as the lead or a PI author. He has contributed to raising over $5.75M (~$1.1M to the Hovden lab) in project funding from external sources.

Recent and Significant Publications:

Gim, J., Schnitzer, N., Otter, L.M., Cui, Y., Motreuil, S., Marin, F., Wolf, S.W., Jacob, D.E., Misra, A., Hovden, R., "Nanoscale deformation mechanics reveal resilience in nacre of *Pinna nobilis* shell," *Nat Commun* 10, 4822 (2019).

Sung, S.H., Schnitzer, N., Brown, L., Park, J., Hovden, R., "Stacking, strain, and twist in 2D materials quantified by 3D electron diffraction," *Physical Review Materials*. 06/25/2019; 3(6).

Sung, S.H., Schnitzer, N., Novakov, S., El Baggari, I., Luo, X., Gim, J., Vu, N.M., Li, Z., Brintlinger, T.H., Liu, Y., Lu, W., Sun, Y., Deotare, P.B., Sun, K., Zhao, L., Kourkoutis, L.F., Heron, JT, Hovden, R., "Two-dimensional charge order stabilized in clean polytype heterostructures," *Nature Communications*.12/01/2022; 13(1).

Mannix, A.J., Ye, A., Sung, S.H., Ray, A., Mujid, F., Park, C., Lee, M., Kang, J.H., Shreiner, R., High, A.A., Muller, D.A., Hovden, R., Park, J., "Robotic four-dimensional pixel assembly of van der Waals solids," *Nature Nanotechnology*. 01/01/2022; 17(4): 361-366.

Yalisove, R., Sung, S.H., Ercius, P., Hovden, R., "Limits of Three-Dimensional Resolution and Dose for Aberration-Corrected Electron Tomography," *Physical Review Applied*. 01/05/2021; 15(1).

Service: Professor Hovden has served as an organizer for several organizations' annual symposiums. He serves on a review board at the National Center for Electron Microscopy at Lawrence Berkeley National Lab and conducts proposal reviews for Brookhaven National Lab. He also serves as a referee for journals in his field. Within the department, Professor Hovden is on the Graduate Student Committee, Graduate Admissions Committee, the Department Chair Selection Committee, and the Michigan Center for Materials Characterization advisory board. Professor Hovden has also proven to be an effective mentor of two high school students brought to his group as summer researchers by the University of Michigan Office of Diversity, Equity, and Inclusion. One of these female students was admitted to the UM undergraduate program, and her work led to the publication of two papers and a patent. Professor Hovden has had a significant impact in terms of external service to the research community by developing open-source software for processing and visualizing microscopy data and 3-D tomographic data. He made the software package available free of charge, and so far, the package has been downloaded more than 18,000 times.

External Reviewers:

Reviewer A: "I consider Dr. Hovden a motivated and bright scientist with high-impact contributions to the community. He is well-respected and his work is highly valued. He has brought significant resources and funds independently and through team efforts to establish a

successful and independent group at U Mich and I believe he continues to excel further with an even brighter career."

Reviewer B: "…Dr. Hovden has produced, both in quantity and quality, pioneering works in the development of electron tomography and in the studies of CWD phases in layered materials. It is abundantly clear that he is an excellent mentor and advisor, and he deeply cares about creating an inclusive environment to increase diversity in his group. In terms of teaching, his evaluations are excellent. He has also secured sufficient funding to carry out research in his group."

Reviewer C: "…I have no doubt that Dr. Hovden will be able to further increase his visibility in the community…His case broadly satisfies all of the criteria for promotion and tenure at the UM College of Engineering."

Reviewer D: "…I feel that Professor Hovden is succeeding in all of the aspects that are important for a tenured professor at a major research institution. He is leading publications, teaching at a high level, mentoring students, serving the community, leading individual research grants, and building a strong research presence in electron microscopy for Michigan."

Reviewer E: "His scholarly output in terms of quality and quantity is consistent with expectations for promotion to tenure at a top research institution such as Michigan… He has shown that he can produce insightful, high-quality scientific research, his framework open sourcing his work will lead to further sustained impact on our field, and his impressive teaching skills would meet the requirements here [at my institution]."

Summary of Recommendation: Professor Hovden is a very prominent and accomplished leader in atomic imaging using high-energy electron beams to discover exotic electronic or structural behavior in materials. It is with the support of the College of Engineering Executive Committee that I recommend Robert M. Hovden for promotion to associate professor of materials science and engineering, with tenure, Department of Material Science and Engineering, College of Engineering.

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

May 2023