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Celebrating the 150th anniversary of Vanderbilt University

De-en Jiang, *[a,b,c] Janet E. Macdonald *[b,c] and Sharon M. Weiss *[c,d,e]

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An introduction to the *Nanoscale Horizons*, *Nanoscale* and *Nanoscale Advances* themed collection celebrating the 150th anniversary of Vanderbilt University, featuring work from researchers currently affiliated with Vanderbilt University, esteemed alumni, and researchers with strong connections and extensive collaborations with the university.

Vanderbilt University was founded in 1873 by a generous gift from Cornelius Vanderbilt who rode the first industrial revolution and built a railroad-and-shipping empire in America. Founded in the wake of the US civil war, Vanderbilt's goal was for the university to strengthen ties between all corners of the deeply divided country. As our university celebrates its sesquicentennial, it is our privilege 150 years later to reflect upon Vanderbilt's history and its goal of bringing people together. We wish to celebrate this milestone by presenting some of the remarkable tapestry of intellectual exploration and ground-breaking research in nanoscience and engineering which underpins the technological advances of today, from nanomaterials to microelectronics to nanomedicine.

An important vehicle of nano research at Vanderbilt University is the Vanderbilt Institute of Nanoscale Science and Engineering (VINSE). Founded in 2001, VINSE is a multi-disciplinary institute that supports research, education, and K-12 outreach across science, engineering, and medicine. This vibrant institute and its 55 faculty members from across the campus are the engine of breakthrough nanoscale research at Vanderbilt. Collaboration is often the key to successes and some of our latest work is featured in this collection. Here we highlight two examples: Macdonald, Caldwell and coworkers have revealed the important role played by oleate, a widely used capping agent, in controlling the phases of metal sulfide nanoparticles (**https://doi.org/10.1039/D3NH00227F**) by harnessing the synthetic skills of the Macdonald lab and spectroscopic abilities of the Caldwell lab; Pantelides and coworkers introduce the new concept of "phonon vortices" in two-dimensional materials by employing density functional theory proof-of-concept calculations (**https://doi.org/10.1039/D3NH00433C**), based on a collaboration between Vanderbilt and the University of the Chinese Academy of Sciences in Beijing, China.

A crown jewel of Vanderbilt University is its medical school and biomedical research. Both the university and medical center are tightly integrated within a central and small campus in midtown Nashville, Tennessee. This proximity greatly facilitates the cross-fertilization of nanoscience and engineering research with medicine. For example, the Wilson group and their collaborators at the Vanderbilt University Medical Center and other institutions have invented a novel approach to engineer polymer-based endosomolytic nanocarriers for delivery of molecular therapeutic cargo (**https://doi.org/10.1039/D3NR02874G**).

Nano research is a global enterprise. Vanderbilt alumni are part of these global endeavours and often take the spirit of collaboration with them. This collection also features some of their current work. Lawrie's group at Oak Ridge National Laboratory and their collaborator Jacob Ng at the Technical University of Denmark found substantial change in the photon bunching in cathodoluminescence induced by indirect electron excitation; this observation is foundational to characterization of optical properties in beam-sensitive materials at the nanoscale (**https://doi.org/10.1039/D3NR00376K**). Carter and coworkers at U.S. Naval Research Laboratory showed that freestanding carbon nanofoam papers provide tunable porosity as cathodes for lithium–sulfur batteries (**https://doi.org/10.1039/D3NR02699J**). The Yang group at Tsinghua University in Beijing and their collaborators at City University of Hong Kong demonstrated efficient second- and higher-order harmonic generation from $LiNbO_3$ metasurfaces fabricated with ribs of 240 nm in height

[a]*Department of Chemical and Biomolecular Engineering, Vanderbilt University, Nashville, TN 37235, USA. E-mail: de-en.jiang@vanderbilt.edu*
[b]*Department of Chemistry, Vanderbilt University, Nashville, TN 37235, USA. E-mail: janet.macdonald@vanderbilt.edu*
[c]*Vanderbilt Institute of Nanoscale Science and Engineering, Vanderbilt University, Nashville, TN 37235, USA*
[d]*Department of Electrical and Computer Engineering, Vanderbilt University, Nashville, TN 37235, USA. E-mail: sharon.weiss@vanderbilt.edu*
[e]*Department of Physics and Astronomy, Vanderbilt University, Nashville, TN 37235, USA*

(**https://doi.org/10.1039/D3NR02430J**), indicating its great potential applications in non-linear optics.

As Vanderbilt looks forward to the next 150 years and continues to attract brilliant minds, we can be certain that it will continue to shape the landscape of research and education for generations to come. This collection serves as a snapshot of the nanoscale science and engineering research from Vanderbilt faculty, alumni, and collaborators in 2023–2024.

We thank all the contributors, *Nanoscale Horizons*, *Nanoscale* and *Nanoscale Advances* editors, and the RSC staff for making this collection a wonderful present in celebrating the 150th anniversary of Vanderbilt University.

De-en Jiang

De-en Jiang is a Professor in Department of Chemical and Biomolecular Engineering, with a secondary appointment in Department of Chemistry, at Vanderbilt University. He received his BS and MS degrees from Peking University and PhD degree from University of California Los Angeles, all in chemistry. He worked at Oak Ridge National Laboratory and University of California Riverside before joining Vanderbilt in 2022. His research focuses on computational materials and chemistry for energy and the environment. He received the DOE Early Career Award and the Presidential Early Career Awards for Scientists and Engineers. He was an elected Fellow of the American Association for the Advancement of Science in 2021 and a Highly Cited Researcher by Clarivate in 2023.

Janet E. Macdonald

Janet Macdonald is an Associate Professor of Chemistry at Vanderbilt University, where she has been since 2011. Before that time, she did her graduate work at the University of Alberta under the supervision of Jon Veinot and a post-doctoral fellowship with Uri Banin at the Hebrew University of Jerusalem. Her group primarily focuses on how crystalline phase is determined in colloidal nanocrystal synthesis. Her group regularly collaborates with physicists and physical chemists to examine fundamental charge transfer processes from quantum dots, and plasmon–plasmon coupled harmonic light generation using combinations of metal and plasmonic semiconducting nanoparticles. Dr Macdonald is an Associate Editor for Nanoscale *and* Nanoscale Advances.

Sharon M. Weiss

Sharon Weiss is a Cornelius Vanderbilt Chair in Engineering and Professor of Electrical and Computer Engineering, with a secondary appointment in Physics at Vanderbilt University. She also serves as Director of the Vanderbilt Institute of Nanoscale Science and Engineering. Dr Weiss received her PhD degree from the Institute of Optics at the University of Rochester. Her research group primarily focuses on silicon photonics for optical communication/datacom and optical biosensing. She is a Fellow of SPIE, Optica, and AAAS and has been awarded a Presidential Early Career Award for Scientists and Engineers, National Science Foundation CAREER award, Army Research Office Young Investigator Award, and IEEE Photonics Society Distinguished Lecturer award. Dr Weiss is also on the advisory board for Nanoscale Horizons *and is an associate editor for* Optica.