NATIONAL ACADEMIES Sciences Engineering Medicine

CHEMICAL SCIENCES ROUNDTABLE

Chemistry 2050: A Roadmap to the Future

A Workshop Hosted by the Chemical Sciences Roundtable

DRAFT MEETING AGENDA
KECK CENTER – Room 100, 500 FIFTH STREET NW, Washington, DC
AUGUST 5-6, 2026

AUGUST 5

8:00AM – 9:00AM **Check-in and *Optional* Early Morning Coffee**
Provided by the National Academies for registered in-person attendees in the Keck 100 pre-function area.

Breakfast is available for purchase in the cafeteria on the 3rd floor.

9:00AM – 9:10AM **Welcome and Workshop Overview for Day 1**
***Daniel Crawford**, Virginia Tech and Planning Committee Chair*

9:10AM – 9:20AM **Scene Setting: Why the CSR wanted to discuss these important issues, and interesting questions they would pose**
***Martin Burke** (NAM), University of Illinois at Urbana-Champaign and recent co-chair of CSR, and*
***Nicola Pohl**, Indiana University and recent co-chair of CSR*

9:20AM – 9:30AM **Sponsor Introduction: What is the value of this workshop for the sponsors?**
***Lin He**, U.S. National Science Foundation*

9:30AM – 11:00AM **Technical Talks: What is the cutting edge of chemistry's interaction with energy, quantum computing, and materials and manufacturing?**

Speakers will give 25-minute talks describing the most recent advances in their research in the context of the field. Speakers will, also, include thoughts on implications for the future of chemistry and chemical engineering.

Materials Science for Fusion Energy
***Jean Paul Allain**, Pennsylvania State University*

Rethinking Chemicals and Fuels Processing: Cleaner, Intensified Pathways for Chemistry 2050
***Götz Veser**, University of Pittsburgh*

Electrification of Chemical Processes and Alternative Feedstocks: Carbon Capture and Conversion
***Jenny Yang**, University of California, Irvine*

11:00AM – 11:15AM **Break (15 minutes)**

11:15AM – 12:45PM **Resume Talks**

Science, Engineering, and Innovation Needs for the Energy Value Chain
***Nazeer Bhore**, Bhore Solutions LLC*

Quantum Computing and Chemistry: A history and a future
***James Daniel Whitfield**, Dartmouth College and AWS*

Low-loss Materials for Transmons with Millisecond-scale Coherence Times and Beyond
***Nathalie de Leon**, Department of Electrical and Computer Engineering, Princeton University*

12:45PM – 1:30PM **Lunch (45 minutes)**
Provided by the National Academies for registered in-person attendees in the Keck 100 pre-function area. Additional items are available for purchase in the cafeteria on the 3rd floor.

1:30PM – 3:30PM **Resume Talks**

Chemistry and Materials Science on Classical and Quantum Computers
***Laura Gagliardi** (NAS), University of Chicago* (virtual)

Power Up: The Future of Batteries and Modern Electrification is Here
***Feng Lin**, Brown University*

Challenges and Opportunities in Sustainable Feedstocks and Materials
***David Parrillo** (NAE), Dow Chemical*

Catalyzing the Future of Chemical Synthesis: From Fundamental Principles to Translational Opportunities
***Shannon Stahl** (NAS), University of Wisconsin-Madison*

3:30PM – 3:50PM **Break (20 minutes)**

3:50PM – 5:20PM **Panel Discussion: Experts reflect on the technical talks from the perspective of their own work, and then engage in moderated discussion.**

Proposed questions:

- How has chemistry enabled advances in energy, quantum, new materials/feedstocks, and new reactions/processes?
- What are the important challenges and opportunities for chemistry related to breakthroughs in these fields, including interactions amongst these areas?

- How do you envision the future of your field in 2050? What is required to achieve that future in terms of scientific discovery, technology, infrastructure, training/education, and other factors?

Moderator: ***Cathy L. Tway**, University Partnerships, bp (retired), and Northstar Legacy Group LLC*

Panelists: ***Danna Freedman**, Massachusetts Institute of Technology (MIT)*
***Daniel Steingart**, Columbia University*
***Anna Wenzel**, Pitzer, Scripps, and Claremont McKenna Colleges*

5:20PM **Adjourn Day 1**

AUGUST 6

8:00AM – 9:00AM **Check-in and *Optional* Early Morning Coffee (Keck 100 pre-function area)**
Provided by the National Academies for registered in-person attendees

Breakfast is available for purchase in the cafeteria on the 3rd floor.

9:00AM – 9:10AM **Welcome and Workshop Overview for Day 2**
Daniel Crawford

9:10AM – 10:50AM **Group Discussions on Themes: Energy, quantum computing, and materials/manufacturing**

Participants will engage in an open conversation in group breakout sessions to address and prioritize the following key questions:

- Are there important issues, concerns, or challenges that were not identified by the technical speakers, or that should be highlighted? Including are premises achievable?
- Based on the workshop content, how do we see the future impact of this science and technology on the chemical sciences and engineering?
- Identify stakeholders who should or must be involved before scale-up
- What steps could chemists and engineers take to take advantage of these new advances in 2050, and what investments do we need to make now to reach those possibilities?

10:50AM – 11:10AM **Break (20 minutes)**

11:10AM – 12:50PM **Panel Discussion: the breakout conclusions, and collaboratively prioritizing actions**
Planning committee member(s)

12:50PM – 1:00PM **Reflections on the Day and Connecting Back to Vision to the Future**
Daniel Crawford

1:00PM **Adjourn Public Workshop**

1:00PM – 2:00PM ***Optional* Lunch Available for In-person Attendees**
Provided by the National Academies for registered in-person attendees in the Keck 100 pre-function area. Additional items are available for purchase in the cafeteria on the 3rd floor.

STATEMENT OF TASK

A planning committee of the National Academies of Sciences, Engineering will organize a public workshop to examine fundamental questions that could help shape our understanding of chemistry's future and identify pathways toward new opportunities and capabilities: What will the chemical sciences landscape look like in 2050? How can the chemical sciences community identify important issues to begin addressing and what actions can be taken now and over the next decade to achieve success by 2050?

The workshop will focus on three conceivable inflection points where strategic investment today, and increased adaptive capacity to capitalize on breakthroughs, could yield transformative benefits for chemistry's competitiveness:

- Energy: With advances in energy generation and the prospect of nuclear fusion on the horizon, how will chemical industries capitalize on inexpensive abundant electricity? What new processes become viable when constraints related to the costs of energy are greatly reduced or removed?
- Quantum Computing: Will quantum computing compress molecular design and synthesis timelines? Could challenges in catalysis and circular resource systems be overcome, helping avoid dependence on scarce materials like rare earth and platinum group metals?
- Materials and Manufacturing: Can new materials and feedstocks be achieved through carbon capture? What opportunities could be unlocked from a fully circular chemical economy? Looking beyond Earth, might space-based manufacturing enable processes impossible under terrestrial conditions?

A workshop proceedings-in-brief, authored by a rapporteur, will be published after the workshop, synthesizing insights for the research priorities and collaboration needed that could ensure chemistry delivers breakthrough technologies for global competitiveness.

SPONSORS

National Science Foundation and Department of Energy Office of Science, through the National Academies Chemical Sciences Roundtable

PLANNING COMMITTEE

T. Daniel Crawford, *Chair, Virginia Polytechnic University*
Thao T. Tran Dominy, *Clemson University*
Carlos Alberto Gonzalez, *National Institute of Standards and Technology (NIST)*
Kaytlin Henderson, *Dow, Inc.*
Yiguang Ju, *Princeton University*
Laurel Royer, *Carinalis Consulting and Research*
Hye Kyung C. Timken (*NAE), Chevron Corporation (retired)*

NATIONAL ACADEMIES STAFF

Elizabeth "Beth" Zeitler*, Director of the Chemical Sciences Roundtable and the Board on Chemical Sciences and Technology*
Catherine Wise*, Senior Program Officer*
Darlene Gros*, Senior Program Assistant*

BIOGRAPHIES

Prof. **Jean Paul Allain** is Professor of Nuclear Engineering and Lloyd and Dorothy Foehr Huck Chair in Plasma Medicine at the Pennsylvania State University, affiliated with the departments of Materials Science and Engineering and Biomedical Engineering as well as several institutes including the Institute for Computational and Data Sciences. He served as the inaugural Department Head of the Ken and Mary Alice Lindquist Department of Nuclear Engineering from 2019 to 2026. From 2023 to 2026 Allain served the nation as the Fusion Energy Sciences Associate Director in the U.S. Department of Energy Office of Science with Congressionally approved budget authority while on leave from Penn State. Dr. Allain fostered the implementation of new and innovative DOE fusion initiatives including the Milestone-Based Fusion Development Program, the Fusion Innovation Research Engines (FIRE) Collaboratives, the Inertial Fusion Energy (IFE) hubs, the Fusion-AI digital convergence platform and U.S. participation in ITER, among others. Dr. Allain became the inaugural Director of the Office of Fusion after its formation under the direction of the Under Secretary for Science in the Department of Energy where he led the development of the U.S. Fusion Science and Technology Roadmap released in June 2026. Dr. Allain was Professor and Associate Head of Graduate Programs in the Department of Nuclear, Plasma and Radiological Engineering at the University of Illinois at Urbana-Champaign (UIUC) from 2013 until 2019. Prof. Allain is recipient of numerous awards and distinctions including Department of Energy Early Career Award in 2010, the Research Excellence Award in 2011, the Fulbright Scholar Award in 2015, Illinois Faculty Entrepreneurial Fellow in 2016, Illinois Dean's Excellence in Research Award in 2017, the American Nuclear Society Fusion Energy Division Technology Accomplishment Award in 2018, and the IEEE Fusion Technology Award in 2023, among others. Prof. Allain works in areas of fusion and nuclear energy policy, surface science, surface chemistry and plasma-material interactions with applications in fusion energy, plasma medicine and advanced nanomaterials.

Nazeer Bhore is the CEO of Bhore Solutions LLC, an advisory practice specializing in strategic innovation and angel investment in the energy and materials value chains. A retired ExxonMobil executive with 36 years of experience, he founded and led the company's Technology Scouting, Innovation, and Ventures organization, holding leadership roles spanning research (including breakthrough research), development, technical services, technology sales and licensing, supply chain, operations, capital projects, corporate strategy, and new business incubation. Over his career, he decommoditized technology portfolios, launched breakthrough products, and delivered multi-billion-dollar profit improvements across energy and materials businesses. Nazeer holds a PhD in Chemical Engineering from the University of Delaware and is a graduate of the Wharton Management Program.

Martin D. Burke (NAM), M.D., Ph.D., is the May and Ving Lee Professor for Chemical Innovation at the University of Illinois Urbana-Champaign (UIUC), Founding Director of the Molecule Maker Lab, and Co-Founder of the Molecule Maker Lab Institute. He also helped launch the Carle Illinois College of Medicine, serving as its inaugural Associate Dean for Research. Dr. Burke pioneered blocc chemistry— iterative carbon–carbon bond formation that is friendly to machines, AI, and anyone. His lab developed MIDA and TIDA boronates to reversibly control boronic acid reactivity, enabling iterative

carbon–carbon bond formation and universal catch-and-release purifcation. The discovery that TIDA boronates are over 1,000-fold more stable than MIDA counterparts expanded blocc chemistry to stereospecifc Csp^3–C bond formation and accelerated automated synthesis from days to hours. His team also integrated blocc chemistry with AI, achieving the first example of closed-loop learning in organic synthesis. More than 300 of his molecular bloccs are now commercially available and have been used by hundreds of labs worldwide to synthesize pharmaceuticals, agrochemicals, and advanced materials—yielding over 1,000 publications and 300 patents. In his own lab, Dr. Burke has applied blocc chemistry to develop molecular prosthetics, producing new therapeutic candidates for cystic fibrosis and anemia, to discover renal sparing antifungals, and to drive AI-guided discovery of novel organic materials. He has co-founded five biotechnology companies—including Revolution Medicines, Sfunga Therapeutics (now Elion Therapeutics), Excelsior Sciences, Kinesid Therapeutics (acquired by Cajal Therapeutics), and cystetic Medicines—advancing nine drug candidates into clinical trials. Dr. Burke is an elected member of the National Academy of Medicine and the American Society of Clinical Investigation and is a Fellow of the American Association for the Advancement of Science. He has also received numerous honors, including the Arthur C. Cope Scholar Award, Elias J. Corey Award for Outstanding Original Contribution in Organic Synthesis by a Young Investigator, Nobel Laureate Signature Award in Graduate Education in Chemistry, and Mukaiyama Award, and the Presidential Medallion from the University of Illinois, and has many times been recognized as a Teacher Ranked as Excellent at the University of Illinois. Dr. Burke earned his B.A. in Chemistry from Johns Hopkins University, Ph.D. in Chemistry from Harvard University, and M.D. from the Health Sciences and Technology Program at Harvard Medical School and Massachusetts Institute of Technology.

Professor **T. Daniel Crawford** is the University Distinguished Professor and Ethyl Chair of Chemistry at Virginia Polytechnic Institute and State University (Virginia Tech), as well as the Director of the Molecular Sciences Software Institute in Blacksburg, Virginia. He held joint postdoctoral positions at University of Georgia and University of Texas before joining the Virginia Tech faculty in 2000. Professor Crawford's research focuses on the development of accurate quantum mechanical models for simulating the optical and vibrational spectra of chiral molecules. He has given more than 250 lectures in 27 countries. Professor Crawford is the winner of 2010 Dirac Medal of the World Association of Theoretical and Computational Chemists (WATOC), winner of the 2023 Cottrell STAR Award from the Research Corporation for Science Advancement, and a Fellow of the American Chemical Society, as well as an elected member of the International Academy of Quantum Molecular Science and WATOC. He is a Fellow of the American Chemical Society and, from 2021-2026, the Deputy Editor of the Journal of Physical Chemistry A. He received his bachelor's degree in chemistry and mathematics in 1992 from Duke University and his Ph.D. in 1996 from the University of Georgia's Center for Computational Quantum Chemistry under the direction of Professor Henry F. Schaefer.

Nathalie de Leon is a professor of Electrical and Computer Engineering at Princeton, where she focuses on quantum sensing with NV centers in diamond, quantum networks with solid state defect systems and nanophotonics, and new material platforms for superconducting qubits. She received her BS from Stanford University in 2004 and PhD from Harvard University in 2011. She then worked as a CIQM and Element Six postdoctoral fellow at Harvard. Nathalie joined the faculty of Princeton University as an assistant professor in Electrical and Computer Engineering in 2016. She is the co-director of the Princeton Quantum Initiative, and she is a Visiting Faculty Researcher at Google Quantum AI. Her group works at the interface of quantum optics, atomic physics, condensed matter and device physics, materials science, surface spectroscopy, nanofabrication, and spin physics to uncover sources of noise and loss in quantum systems, and uses these insights to design new quantum platforms and new tools for measurement. She is currently the materials thrust leader of the Co-design Center for Quantum Advantage, a DOE National Quantum Information Science Center, and she is the Chair of the APS Division of Quantum Information. Nathalie received the Air Force Office for Scientific Research Young Investigator Award in 2016, the Sloan Research Fellowship in Physics in 2017, the NSF CAREER Award in 2018, the DARPA Young Faculty Award in 2018, and the DOE Early Career Award in 2018, the Gordon and Betty Moore Foundation Experimental Physics Investigator Award in 2023, and the APS Rolf Landauer and Charles H. Bennett Award in Quantum Computing in 2023.

Danna Freedman is the F. G. Keyes Professor of Chemistry at MIT and the inaugural director of QMIT. Her laboratory's research focuses on applying inorganic chemistry to address challenges in physics. Key areas of research in her lab include a molecular approach to quantum information science, and pressure as a vector for chemical transformation. Danna began her career at Northwestern University as an Assistant Professor. She moved to MIT in 2021 as the F. G. Keyes Professor of Chemistry. She received her undergraduate degree from Harvard University, and her Ph.D. from University of California, Berkeley where she studied magnetic anisotropy in molecules. As a postdoc at MIT she engendered spin frustration in kagomé lattices to create quantum spin liquids. Danna's laboratory's research has been recognized by a number of awards including the MacArthur Fellowship, the ACS award in Pure Chemistry, the Presidential Early Career Award for Scientists and Engineers (PECASE), Camille Dreyfus Teacher-Scholar Award, and an NSF CAREER award.

Born and raised in Italy, **Laura Gagliardi** pursued her undergraduate and graduate education there, obtaining her Ph.D. in theoretical chemistry from the University of Bologna in 1997. Following her doctoral studies, she embarked on a postdoctoral research associate position at the University of Cambridge UK. In 2002, Gagliardi began her academic career as an assistant professor at the University of Palermo. Subsequently, in 2005, she assumed the role of associate professor at the University of Geneva in Switzerland. In 2009, she joined the University of Minnesota as a professor of chemistry. In 2020, Gagliardi transitioned to the University of Chicago, assuming the Richard and Kathy Leventhal professorship in chemistry and molecular engineering. Gagliardi is a theoretical quantum chemist who has made significant contributions to the advancement of electronic structure methods and their application in elucidating complex chemical systems. Alongside her research group, she focuses on the development of theories and methods tailored for quantum computing. Her overarching research objectives revolve around the

utilization of cutting-edge theoretical approaches to investigate energy-related chemical systems and materials. Gagliardi has received numerous prestigious accolades and recognitions from the chemistry community. Some of her notable achievements include: ENI Energy Frontiers Award (2026), World Association of Theoretical and Computational Chemists Schrödinger Medal (2026), Solvay Chair in Chemistry (2025), and the Pauling Medal of the American Chemical Society (2023). Furthermore, Gagliardi holds memberships in esteemed scientific academies, including: Elected Member of the USA National Academy of Sciences (2021), Elected Member of the American Academy of Arts and Sciences (2020), and is an Elected Member of the German National Academy of Sciences Leopoldina (2022). Additionally, Gagliardi serves as the Editor-in-Chief for the ACS Journal of Chemical Theory and Computation, which is a leading journal in the field of theoretical chemistry.

Dr. **Carlos Gonzalez** is the Senior Strategic Advisor on Material Data, Machine Learning, and AI in the Material Measurement Laboratory, at the National Institute of Standards and Technology (NIST). He previously served as the Chief of the Chemical Sciences Division for over 15 years until February 2026. Prior to that tenure, he held the position of Chief of the Chemical and Biochemical Reference Data Division and was the founding Director of NIST's Center for Theoretical and Computational Nanosciences. His primary research expertise focuses on the development and implementation of modern ab initio quantum chemical methodologies, particularly their application to conceptual DFT, chemical Information Theory, chemical reactivity, nanotechnology, materials at the nano-scale, and data-driven AI for chemistry. A co-author of the Gaussian suite of programs, Dr. Gonzalez has published over 100 peer-reviewed papers in quantum chemistry. His professional honors include the 2024 Allen V. Astin Award , the 2013 HENAAC Professional Achievement Level II Award and the 2005 Department of Commerce Bronze Medal. He is an active member of the American Chemical Society and the American Physical Society. Dr. Gonzalez earned his Ph.D. in Theoretical Chemistry from Wayne State University in 1990. He subsequently completed a postdoctoral fellowship at Carnegie Mellon University under the supervision of Nobel Laureate Prof. John A. Pople.

Dr. **Lin He** serves as the Section Head for the Chemistry Section in the Directorate for Mathematical and Physical Sciences (MPS) at the National Science Foundation (NSF), overseeing the MPS-Chemistry's investment that supports fundamental discovery, invention and innovation conducted by a large and vibrant chemistry research community. Dr. He was a rotating Program Director at NSF from 2011-2013, and after a year returned to NSF in 2014. During this period she was highly regarded in her role as Program Officer in the Chemical Measurement and Imaging (CMI), Centers for Chemical Innovation (CCI), and Macromolecular, Supramolecular, and Nanochemistry (MSN) programs. In 2021, Dr. He was selected for the Senior Executive Service position and served as the Deputy Division Director (DDD) in NSF/CHE, where she worked with then-DD closely in managing a broad portfolio of investments in Chemistry. Sha also served as the acting Division Director between late May 2024- early January, 2025. During the NSF reorganization in late 2025, Dr. He was appointed as the Section Head to lead a team of program staff that supports research investment in chemistry within MPS.

Prior to joining NSF, Dr. He was a tenured faculty member of Chemistry at North Carolina State University, with an Adjunct Appointment from the Biomedical Engineering Department at UNC, Chapel Hill. Her research interests were at the interface of bioanalytical chemistry and nanotechnology. Dr. He received her bachelor's degree in Chemistry from Peking University, China, and her Ph.D. in Chemistry from Pennsylvania State University. She worked at two biotechnology startups in the Silicon Valley during 2000-2003, before joining the North Carolina State University chemistry faculty in 2003. Dr. He is committed to apply her diverse perspectives from having worked in academia, government and private sectors to build strong partnership and promote chemical research and STEM education.

Kaytlin Henderson is the Analytics and AI Leader in Enterprise Data and Analytics at Dow. In her 14 years at Dow, she has held leadership positions in data and analytics, Dow's digital manufacturing transformation, and roles in reaction engineering R&D and manufacturing operations. Her expertise bridges applied chemical engineering and AI, with deep experience in reactor optimization, predictive analytics for manufacturing reliability, digital tools deployment, and enterprise data strategy. She has led large-scale AI deployment programs across Dow's manufacturing footprint, including predictive maintenance, third-party data integration, and enterprise-wide AI adoption. She now shapes and implements Dow's enterprise AI strategy across areas including sustainability, energy, and materials, with strategic priorities in Responsible AI frameworks, generative AI, and emerging agentic AI capabilities. Dr. Henderson is an active member of the American Institute of Chemical Engineers (AIChE), recently serving as Chair of the Career and Education Operating Council and the Membership Committee. She chairs Dow's Insight Scientist Community, focused on data application in materials development and the process industries. She received a Frost and Sullivan Manufacturing Leadership Award (2014) for engineering and manufacturing innovation. Dr. Henderson holds a BS in Chemical Engineering from Lafayette College and a PhD in Chemical Engineering from Carnegie Mellon University.

Yiguang Ju is the Robert Porter Patterson Professor in Mechanical and Aerospace Engineering, Associated Faculty of Princeton Plasma Physics Laboratory, and is the Director of DOE Energy Earthshot Research Center (EERC) for plasma assisted hydrogen production. Dr. Ju's research interests include combustion, green fuels, plasma, and electrified manufacturing. Dr. Ju is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA), the American Society of Mechanical Engineers (ASME), and The Combustion Institute. He has received many awards such as the Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation, the AIAA propellant and combustion award, the Alfred C. Egerton Gold Medal from the Combustion Institute, and the 2025 R&D 100 Award. He is Co-founder of HiTNano Inc, Princeton NuEnergy Inc, Polymer-X Inc, and USPlasma Inc. to develop innovative technologies for electrified and plasma aided manufacturing for energy decarbonization. Dr. Ju received his BSE in 1986 and an MSE in 1988 in mechanical engineering from Tsinghua University and his PhD in 1994 in mechanical engineering from Tohoku University, respectively.

Prof. **Feng Lin** joined Brown's School of Engineering in July 2025 after nine years of teaching and research in the Department of Chemistry at Virginia Tech. His research interests include rechargeable batteries, low-temperature materials manufacturing, and interface characterization and optimization. His teaching interests span materials science, inorganic chemistry, battery technologies, and interdisciplinary topics in energy science.

Dave Parrillo is currently the Vice President of Research and Development (R&D) for Dow's Packaging and Specialty Plastics division. This $28 Billion revenue division of Dow is key to Dow's decarbonize and grow strategy and includes Dow's Hydrocarbons and Energy business. Dave joined Dow in 2007 and developed new business strategies for several business platforms for Dow's Technology Licensing and Catalyst Business. In 2008, Dave became the Sr. R&D Director for Ventures and Business Development and worked to evolve Dow's strategy in the lithium-ion battery market, leading to the formation of the Dow Kokam Joint Venture. In 2009, Dave became the Global Director for Dow Solar Solutions R&D. He assembled the team and created the reliability engineering strategy, which led to a UL certified, residential solar building product, and the commercial launch of the Dow POWERHOUSE™ Solar Shingle. The Dow POWERHOUSE™ team received numerous awards, for example: The 2010 Environmental Excellence Award in Emerging Technology, and the 2012 Edison Award for Global Best New Product. Dave championed several innovative Dow venture capital investments within the solar space leading to Dow's acquisition of a select company. In 2012, Dave joined Dow's Packaging and Specialty Plastics business managing R&D/TS&D. He led the team for six years to innovate with product launches focused on providing business value and driving sustainable solutions across the value chain: Agility™ Performance LDPE resins, Symbiex™ ultra-fast curing solvent-less packaging adhesives, INNATE™ precision packaging polyethylene resins, Recycle Ready™ Stand Up Pouch technology, and INNATE™ Tenter Frame Biaxially Oriented Polyethylene (TF-BOPE) resin. These innovations received numerous awards, including: 2015-2017 R&D 100 Awards, the 2015 German Packaging Award, and the 2015 Ringier Technology Innovation Awar. In 2018 Dave joined Industrial Intermediates and Infrastructure (II&I) managing R&D for the Dow businesses of Polyurethanes, Construction Chemicals, Oil and Gas, and Industrial Solutions. The II&I division has some $13 Billion in sales and provides solutions in the areas of: Consumer Comfort, Energy Efficiency, Oil & Gas Processing, Transportation, and Infrastructure. During Dave's leadership of II&I R&D, the team's new products received numerous awards such as: The 2021 Business Intelligence Award for The World's First Commercial Polyurethane-Carbon Fiber Spar Cap for a New Generation of Wind Blades, The 2021 FUTUREDGE50 Award for Predictive Intelligence, an Artificial Intelligence Chemical Formulation Capability, The 2020 Best Sustainable Product for its RENUVA™ Mattress Recycling Program in Chemical Week's Sustainability Awards, and The 2018 R&D 100 Award for the ECOFASTTM Pure Sustainable Textile Treatment. In 2022, Dave joined Dow's Core R&D and led a robust portfolio responsible for all of Dow's R&D University hiring, university and research partnerships, and long-term R&D growth investments. Dave led the team to create 1) ADISE, an advanced digital internship for dual domain digital + STEM skills intern program serving all Dow functions and 2) DAISE, a data analytics immersion experience for underrepresented minority STEM students. Previously, Dave held positions at General Electric and Air Products and Chemicals. Dave holds Chemical Engineering degrees from the University of Pennsylvania (PhD) and from the University of Rhode Island (BS). He is an elected member of the

National Academy of Engineering, and he has held positions in: The Board of the NuvoSun company, Board and Treasurer of the Materials Research Society, Board President of Midland Cancer Services, Board of American Institute of Chemical Engineering (AIChE) Institute of Learning and Innovation, and The Leadership Council of Manufacturing Foresight. He currently holds leadership positions in: External Advisory Board UC Santa Barbara and University of Pennsylvania for Chemical Engineering, Advisory Council for Engineering and Applied Science for the University of Colorado, Board President West Midland Family Center, Board of AIChE, AIChE Fellow, and Board of the Xycle Company. He holds fifteen U.S. patents, has authored twenty three publications, and is the recipient of: General Electric's Whitney Technical Achievement Award for polymer development, the American Chemical Society Barnes award for outstanding chemical research management, the AIChE's Management Award for substantial contributions in the leadership of engineers, and The Society of Women Engineer's Rodney D. Chipp Memorial Award for sponsoring women in engineering.

Nicola Pohl is professor of chemistry, the Joan and Marvin Carmack Chair in Bioorganic Chemistry, director of the STEALTHub for smart automated experiments, and former Associate Dean of Natural and Mathematical Sciences and Research for the College of Arts and Sciences at Indiana University Bloomington. She was a professor of chemistry and of chemical and biological engineering and held the Wilkinson Professor of Interdisciplinary Engineering at Iowa State University before moving to Indiana University. The Pohl research group works to find new ways to make and analyze sugars and glycopeptides to dissect their important roles in plant, animal, and human biology and to design therapeutics. Her research group created the first automated solution-phase method to synthesize oligosaccharides using fluorous tags, the first automated method to make building blocks to feed automated oligosaccharide synthesis machines, and the first method to distinguish all 24 isomers of glucose using mass spectrometry. Dr. Pohl received her AB from Harvard-Radcliffe Colleges, her PhD in chemistry from the University of Wisconsin-Madison, and an MS in Strategic Management from the Kelley School of Business. She completed a National Institutes of Health Postdoctoral Fellowship in the Department of Chemical Engineering at Stanford University. She currently consults for CEVG and Flagship. Her work has been recognized by numerous awards, including the US National Science Foundation CAREER Award, a Kavli Frontiers of Science Fellow, Alfred P. Sloan Foundation Research Fellow, a US Fulbright Fellowship, and election as an American Association for the Advancement of Science Fellow.

Laurel A. Royer, Ph.D., is Founder of Carinalis Consulting & Research, an interdisciplinary scientific advisory practice at the intersection of chemistry, environmental and human health, and community impact. With more than 15 years of experience spanning research, scientific advising, and technical consulting, she helps organizations and communities navigate complex chemical, regulatory, and exposure questions — from risk assessment through remediation strategy. Dr. Royer's work examines the full life cycle of chemicals and materials, from manufacturing and application through disposal, contamination, exposure, and remediation. She advises stakeholders across industry, government, legal, nonprofit, and community settings on both proactive risk management and response to emerging or legacy environmental challenges. Grounded in the chemical sciences and committed to the equitable application of science, she brings particular attention to the disproportionate

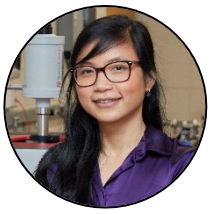
exposure burden faced by communities and currently evaluating frameworks for improving chemical hazard communication and emergency notification practice. Her work bridges technical rigor with clear communication, connecting scientific evidence, operational realities, and public-health and environmental outcomes. Dr. Royer holds a Ph.D. in Environmental Organic Chemistry and an M.S. in Medicinal Chemistry and Molecular Pharmacology from Purdue University, and a B.S. in Chemistry from the University of the Virgin Islands.

Shannon S. Stahl is the Steenbock Professor of Chemical Sciences in the Department of Chemistry at the University of Wisconsin-Madison. He obtained his B.S. in Chemistry from the University of Illinois at Urbana-Champaign in 1988. He earned his PhD in Chemistry from Caltech in 1997, working with Prof. John Bercaw, and he conducted postdoctoral research at MIT from 1997–1999, working with Prof. Stephen Lippard. At UW-Madison, Stahl and his research group have studying redox catalysis, with an emphasis on aerobic oxidation and electrochemical reactions. Applications include chemical synthesis, biomass conversion, and energy storage and conversion. He co-edited, with Dr. Paul L. Alsters (DSM), Liquid Phase Aerobic Oxidation Catalysis (Wiley-VCH), highlighting applications and opportunities for aerobic oxidation in industrial chemical synthesis, and he has developed an online short course on Organic Electrochemistry with Prof. Mohammad Rafiee. His work has been recognized by the ACS Award in Organometallic Chemistry, the Mitsui Chemicals Catalysis Science Award, the US EPA Presidential Green Chemistry Challenge Award and the ACS Award in Affordable Green Chemistry. He is a member of the American Academy of Arts and Sciences and the National Academy of Sciences.

Daniel Steingart is the co-director of the Columbia Electrochemical Energy Center. His group studies the systematic behaviors of material deposition, conversion, and dissolution in electrochemical reactors with a focus on energy storage devices. His current research looks to exploit traditional failure mechanisms and unwanted interactions in batteries, turning unwanted behaviors into beneficial mechanisms. Over the last decade, his efforts in this area have been adopted by various industries and have led directly or indirectly to five electrochemical energy-related startup companies, the latest being Feasible, an effort dedicated to exploiting the inherent acoustic responses of closed electrochemical systems. Steingart joined Columbia Engineering in 2019 from Princeton University, where he was an associate professor in the Department of Mechanical and Aerospace Engineering and the Andlinger Center for Energy and the Environment. Earlier, he was an assistant professor in chemical engineering at the City College of the City University of New York. He received his PhD from the University of California, Berkeley, in 2006.

Dr. **Hye Kyung Timken** (NAE) retired from Chevron Corporation in October 2025 after 25 years, where she was a Principal Scientist and Chevron Fellow; before that she worked for Mobil Corporation for 13 years. Her roles spanned technical team leadership and R&D project management. Dr. Timken's expertise spans novel refining and petrochemical process development and catalyst innovation for petrochemicals, base oil, and fuels. Her work employed solid catalysts including zeolites and other adsorbents, as well as ionic liquids, for hydrocarbon conversion processes. Her current interests include

technologies supporting the energy transition toward a lower carbon future, particularly manufacturing technologies for new fuels and plastics recycling, and processes for efficient carbon capture. She received the University of Illinois LAS Alumni Award in 2020, National Academy of Sciences Award for Chemistry in Service to Society in 2023 for development of a safer fuel manufacturing process, and was inducted into the National Academy of Engineering in 2024. She holds 163 US patents and has published 20 scientific journal articles. Dr. Timken received a Ph.D. degree in Physical Chemistry from the University of Illinois, Urbana-Champaign, and MS and BS degrees in Chemistry from Yonsei University, Seoul, Korea.



Dr. **Thao T. Tran Dominy** is the Dean's Associate Professor in the Departments of Chemistry, Physics and Astronomy at Clemson University, South Carolina. She is deeply committed to shaping the chemical sciences to elevate people's lives. Her research team studies quantum and functional materials, with a particular focus on leveraging electronic structure and physical principles to address key challenges in quantum information science and energy technology. Her research program has been supported and recognized by the Beckman Foundation, the National Science Foundation, the Research Corporation for Science Advancement, the Dreyfus Foundation, the Kavli Foundation, and the US National Academy of Sciences. She serves as an executive member of the APS Quantum Materials Synthesis Topical Group, the Structural Science Panel at Argonne National Laboratory, and the Neutron User Group at Oak Ridge National Laboratory, and as an Editorial Board member of Nature-Communications Materials. With these functions, she brings strong connections, thoughtful insight, and a forward-looking perspective to contribute and shape the future direction of chemical sciences. Dr. Tran Dominy earned her Ph.D. from University of Houston and completed postdoctoral research at Johns Hopkins University. As noted above, she is also a US National Academy of Sciences Kavli Fellow.

Cathy L. Tway, Ph.D., is a retired industrial chemist with more than 30 years of leadership experience in catalysis, sustainable chemistry, R&D portfolio management, and university-industry partnerships. Most recently, she served as Chief Chemist and Vice President for University Partnerships at bp, where she drove strategic collaborations, innovation delivery for growth engines, and the advancement of chemistry-based technologies. Her expertise spans the full project life cycle from front-end opportunity identification and technology creation through catalyst and materials design, scale-up, commercialization, licensing, plant support, metal recovery, CO_2 utilization, and green chemistry. Prior to bp, Dr. Tway held senior R&D and leadership roles at Johnson Matthey, Dow, Celanese, Solutia, and Akzo Nobel. She has successfully commercialized two new inorganic materials and four catalyst technologies, with one still in use today. She has served on numerous high-level panels and committees, including as Vice Chair of the U.S. National Academies consensus study report on The Importance of Chemical Research to the U.S. Economy and as a member of the U.S. Department of Energy Basic Energy Sciences Advisory Committee. Dr. Tway earned her B.S. in Chemistry from Wichita State University and her Ph.D. in Physical Inorganic Chemistry from the University of Nebraska-Lincoln. Throughout her career, she has championed cross-disciplinary teamwork, data integrity, and the translation of fundamental science into impactful industrial solutions. In retirement, she continues mentoring, advisory work, and engagement in chemistry and catalysis networks through consulting entity, Northstar Legacy Group LLC.

Götz Veser is the Nickolas A. DeCecco Professor of Chemical Engineering at the University of Pittsburgh's Swanson School of Engineering, Leonard Peters Fellow in Sustainability at the Mascaro Center for Sustainable Innovation, and Director of the Covestro Circular Economy Program. He received his diploma (M.Sc.) in chemical engineering from the University of Karlsruhe and his Ph.D. in physical chemistry from the Fritz-Haber-Institute of the Max-Planck-Society (Berlin) under Gerhard Ertl. Following a Feodor-Lynen postdoctoral fellowship with Lanny D. Schmidt at the University of Minnesota, he held positions at the University of Stuttgart and the Max-Planck-Institute for Coal Research before joining Pitt in 2002. Veser's research focuses on process intensification and catalytic reaction engineering, with a long track record of industry-collaborative work spanning specialty chemicals manufacturing, natural gas utilization, hydrogen production, plastic waste recycling, and carbon management. He recently spun out Graphonos Materials, Inc., for which he also serves as CTO, to commercialize robust, energy- and cost-efficient liquid metal catalysis for the production of battery-grade graphite and close a strategic domestic supply-chain gap in this critical material for the energy transition. Veser serves as an Associate Editor of AIChE Journal and sits on the Governing Board of RAPID, the international advisory board of the School of Chemical Engineering at Dalian University of Technology (China), and the board of the North American Catalysis Society. He has trained more than 50 doctoral researchers to date, who now hold positions across the chemical, pharmaceutical, energy, environmental, and materials industries. In 2026, Veser was elected a Fellow of AIChE.

Dr. **James Daniel Whitfield** is an Associate Professor in the Department of Physics and Astronomy at Dartmouth College where he leads a research group focused on modeling electrons and other fermions, both in terms of quantum computers and advancing classical methods for describing quantum information. He earned his B.S. in Mathematics and Chemistry from Morehouse College (2006) and his Ph.D. in Chemical Physics from Harvard University (2011). Following postdoctoral positions at NEC Laboratories America, Columbia University, and the Vienna Center for Quantum Science and Technology (as a Ford Postdoctoral Fellow, 2014-2015), he joined Dartmouth in 2016. Dr. Whitfield has published over 45 peer-reviewed papers and secured over $4 million in research funding from the NSF, DOE, and ARO. Since 2021, he has served as an Amazon Visiting Academic with the Amazon Braket team. He sits on the IBM HBCU Quantum Center Research Advisory Board and the Scientific Advisory Board for Qubit by Qubit at The Coding School, reflecting his commitment to advancing quantum information science and future workforce development.

Dr. **Jenny Yang** is currently a Professor of Chemistry at the University of California, Irvine (UCI). Previously, she worked as a senior scientist at the Pacific Northwest National Laboratory and at the Joint Center for Artificial Photosynthesis at Caltech. She has been working in the area of CO2 capture and/or utilization for over 10 years, with a focus on electrochemical methods. Dr. Yang is the director of the DOE-funded Energy Frontier Research Center (EFRC) Closing the Carbon Cycle (4C). She has received the Presidential Early Career Award for Scientists and Engineers, Sloan Foundation Fellow, and Camille Dreyfus Teacher-Scholar Award. Dr. Yang received her PhD in

Chemistry from the Massachusetts Institute of Technology and her BS from the University of California, Berkeley.

Professor **Anna G. Wenzel** specializes in chemical catalysis. She earned her B.S. in chemistry summa cum laude from U.C. San Diego and completed her M.A. and Ph.D. in chemistry as a National Science Foundation Fellow and Pfizer Research Fellow at Harvard University before completing a UNCF-Pfizer and NIH-sponsored postdoctoral position at Caltech. She joined the faculty at Scripps, Pitzer, and Claremont McKenna Colleges in 2006 as an Assistant Professor. In 2012 and 2020, she was promoted to Associate and Full Professor at these three institutions, respectively. She has served as a visiting faculty member at Caltech (2009-2010) and City of Hope (2013-2014).