

# **Materials Science and Engineering in a Post-Pandemic World: A Workshop**

## **Committee**

### **Katherine T. Faber**

#### **Chair**

KATHERINE T. FABER is the Simon Ramo Professor of Materials Science at Caltech. She is interested in the fracture of brittle materials and mechanisms by which such materials can be toughened and strengthened through composite strategies such as gradients and designed topology, often using synchrotron radiation for internal stress measurement. Her studies comprise materials for energy-related applications including thermal and environmental barrier coatings for power generation components and porous solids for filters and flow. Her team is also developing an understanding of the solidification and the chemistry of freeze-casting systems, creating versatile pore topologies thereby expanding the use of porous materials for environmental and energy needs. Dr. Faber has also worked with the Art Institute of Chicago to establish the Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts where advanced materials characterization and analytical techniques are used in support of conservation science. She has served on the Scientific Advisory Committee of the Advanced Photon Source at Argonne National Lab from 2005 to 2007, is a fellow of ASM International and received the YWCA Achievement Award for Education in 1997. Her Ph.D. is in materials science from University of California at Berkeley, and her M.S. in ceramic science is from Penn State.

## **Dianne Chong**

### **Member**

DIANNE CHONG [NAE] is the retired vice president of Materials Assembly, Factory and Support Technology, an organization within Boeing Research and Technology which is the company's central research and development unit. Dr. Chong's team did provide materials and processes engineering and manufacturing support for Boeing, including the company's two major business units: Boeing Commercial Airplanes and Boeing Defense, Space and Security. Her team was responsible for providing non-destructive evaluation for programs such as the Boeing 787 Dreamliner. In addition, her organization researches and develops advanced assembly and integration concepts including materials development and additive manufacturing. Dr. Chong supports many professional societies and serves on several university boards and industry committees. She is a member of TMS, AIAA, ASM International, SME, SWE, Beta Gamma Sigma, and Tau Beta Pi and is the current 2020 president of the Accreditation Board for Engineering and Technology (ABET). In 2010, she was presented with the Asian-American Executive of the Year Award by the Chinese Institute of Engineers, USA. An expert in metallurgical engineering, she holds a Ph.D. and master's degree in metallurgical engineering, and bachelor's degrees in biology and psychology from the University of Illinois at Urbana-Champaign. She also holds of an executive master's degree in Manufacturing Management from Washington University.

## **Teresa Clement**

### **Member**

TERESA CLEMENT is a Senior Principal Systems Engineer at Raytheon. She earned her BSE in 2002, and her Ph.D in 2007, both from Arizona State University in Materials Science Engineering. She has also been the chair of the Governance Board and Executive Committee for America Makes (the National Additive Manufacturing Innovation Institute). Previously at Raytheon she has held the role as Corporate Technology Area Director for Mechanical, Materials, and Structures as well as Value Stream Manager. She has also been a Graduate Research Assistant at Arizona State University, a Graduate Intern at Sandia National Laboratories and a Undergraduate Intern at Motorola Semiconductor Corp. Dr. Clement has several patents to her name.

## **Robert Hull**

### **Member**

ROBERT HULL is the acting vice president for Research, Henry Burlage Jr. Professor of Engineering, and director of the Center for Materials, Devices, and Integrated Systems at Rensselaer Polytechnic Institute. Prior to that, he spent about a decade at Bell Laboratories in the Physics Research Division and twelve years at the University of Virginia, where he was the director of an NSF MRSEC Center and director of the UVA Institute for Nanoscale and Quantum Science. He received his Ph.D. in materials science from Oxford University in 1983. Dr. Hull is highly active in engineering and materials science societies and professional groups. He is a fellow of the American Physical Society and of the Materials Research Society, and in 1997, served as president of the Materials Research Society. He has also chaired a Gordon Research Conference on Thin Films, and chaired the Committee of Visitors for the National Science Foundation's Division of Materials Research. Within the realms of materials and nanoscience, Dr. Hull's research focuses on the relationships between structure and property in electronic materials, fundamental mechanisms of thin film growth, dataminig of large materials sets, and the self-assembly of nanoscale structures. Other areas of interest include degradation modes in electronic and optoelectronic devices, the properties of dislocations in semiconductors, nanoscale fabrication techniques, nanoscale tomographic reconstruction techniques, development of new nanoelectronic architectures, and the theory and application of electron and ion beams.

## **Lourdes Salamanca-Riba**

### **Member**

LOURDES SALAMANCA-RIBA is a professor of materials science and engineering at the University of Maryland's Energy Innovation Institute. She received her B.S. in physics from the Universidad Nacional Autonoma de Mexico and her Ph.D. in physics from Massachusetts Institute of Technology. Dr. Salamanca-Riba's research is in the areas of advanced manufacturing of 3D microstructures and their characterisation using computational methods and data analysis, self-assembly of semiconductor nanowires and liquid crystal nanocomposites for hybrid photovoltaic applications, DNA-based biosensors and radiation sensors on GaAs, and materials with high carbon content in the form of nanocarbon called "covetics," wide band gap semiconductors for high power, high temperature electronics. Dr. Salamanca-Riba's research involves the use of the transmission electron microscopes and the atomic force microscope at the Advanced Imaging and Microscopy (AIM) Laboratory. She is a member of the American Physical Society (APS), the Electron Microscopy Society of America, and the Materials Research Society (MRS).

## **Susan B. Sinnott**

### **Member**

SUSAN B. SINNOTT is a professor and department head of Materials Science and Engineering at Pennsylvania State University. She received her B.S. in chemistry from the University of Texas at Austin and her Ph.D. in physical chemistry from Iowa State University. She was a National Research Council Postdoctoral Associate at the Naval Research Laboratory and was on the faculty at the University of Kentucky prior to joining the University of Florida (UF) in 2000. Dr. Sinnott's research is focused on the use of electronic structure calculations and atomistic simulations to optimize the processing and properties of materials. Her research interests include: examining the chemical modification of polymer surfaces through mass-selected ion-beam deposition, exploring the dynamics associated with the growth of thin films, and developing new methodologies for the atomistic simulation of materials. Dr. Sinnott was the chair of the university materials council (UMC) in 2019, which is composed of department heads from academic programs in the materials field in North American universities. UMC's goal is to strengthen the educational content and the educational process in Materials Science and Engineering; and to increase the quality and quantity of students in the field. Dr. Sinnott is also the author of over 160 technical publications, including over 140 journal publications and eight book chapters; she has also delivered over 120 invited presentations. She is a member of the American Vacuum Society (AVS), American Ceramic Society (ACerS), American Chemical Society (ACS), American Physical Society (APS), Materials Research Society (MRS), and American Association for the Advancement of Science (AAAS), and was named a fellow of AVS in 2005. She was named a fellow of ACerS in 2011 and a fellow of the AAAS in 2010.

# Edwin L. Thomas

## Member

EDWIN L.THOMAS [NAE] is the TEES Eminent Professor of Engineering at TAMU College of Engineering. Previously he was the William and Stephanie Sick Dean of the George R. Brown School of Engineering at Rice University. He collaborates with scientists and engineers in the Richard E. Smalley Institute for Nanoscale Science and Technology at Rice. Dr. Thomas is a materials scientist and mechanical engineer and is passionate about promoting engineering leadership and student design competitions. His research is currently focused on using 2D and 3D lithography, direct-write and self-assembly techniques for creating metamaterials with unprecedented mechanical and thermal properties. Thomas is the former head of the department of materials science and engineering at the Massachusetts Institute of Technology, a position he held from 2006 until his appointment at Rice in July 2011. He was named Morris Cohen Professor of Materials Science and Engineering in 1989 and is the founder and former director of the MIT Institute for Soldier Nanotechnology (2002-2006). Before joining MIT, Thomas founded and served as co-director of the Institute for Interface Science and was head of the department of polymer science and engineering at the University of Massachusetts. He is a recipient of the 1991 High Polymer Physics Prize of the American Physical Society and the 1985 American Chemical Society Creative Polymer Chemist award. He was elected to the National Academy of Engineering and the American Academy of Arts and Sciences in 2009, Inaugural Fellow of the Materials Society in 2008, fellow of the American Association for the Advancement of Science in 2003 and fellow of the American Physical Society in 1986. He wrote the undergraduate textbook, The Structure of Materials, and has coauthored more than 420 papers and holds 16 patents. Thomas received his B.S. in mechanical engineering from the University of Massachusetts and his Ph.D. in materials science and engineering from Cornell University.

# Haydn N. Wadley

## Member

HAYDN WADLEY is the University Professor and the Edgar A. Starke Professor of Materials Science and Engineering at the University of Virginia in Charlottesville, Virginia. He has broad interests in materials science, mechanics, and thermal transport. His current research explores high temperature thermal protection systems (thermal barrier coatings, liquid metal heat plates for hypersonic vehicle leading edges, jet blast deflectors) and new materials for the mitigation of high intensity dynamic loads (ballistic and blast protection materials and structures). He has addressed many fundamental questions associated with the atomic assembly of nanoscopic materials from the vapor phase, the topological structuring of cellular materials and the processing of high performance composites. These fundamental studies have been used to develop models and numerical simulations that reveal the linkages between a materials composition/synthesis and its performance. Some of these models have been coupled with in-situ (ultrasonic and electromagnetic) sensors and nonlinear, feedback control algorithms to implement intelligent process control concepts. He has invented and commercialized several vapor deposition technologies that enable the growth of novel thin films and coatings, and numerous multifunctional cellular materials including those that support stress whilst also serving as impact energy absorbers, heat exchange media, electro-chemical power storage systems or shape morphing structures. His research group has spun out two companies: one that develops novel coatings and another that manufactures high performance cellular materials. He has served on the Defense Science Board's Summer Study, published 448 papers, co-authored a book on cellular materials, holds 21 U.S. patents, and is a fellow of the American Society for Materials.

## **Erik B. Svedberg**

### **Staff Officer**

ERIK B. SVEDBERG is a senior program officer of the National Materials and Manufacturing Board at the National Academies of Science, Engineering and Medicine a position he has held since 2008. In this role, he works with experts from across the nation to develop, negotiate, and oversee scientific and technical advisory studies for federal agencies related to questions of materials science, manufacturing and engineering design. His previous and current activities at the National Academies includes work as a Study Director for; Materials Needs and R&D Strategy for Future Aerospace Propulsion Systems; Corrosion Research Grand Challenges; Opportunities in Protection Materials; Optics and Photonics, Essential Technologies for Our Nation; Review of the National Nanotechnology Initiative; Airport Passenger Screening; Frontiers of Materials Research, A decadal Survey; Participation by DOD in its Manufacturing USA Institutes; and High Performance Bolting Technology for Offshore Oil and Gas Operations. As well as overseeing workshops such as: Big Data in Materials Research and Development; Limited Affordable Low-Volume Manufacturing; Materials and Manufacturing Capabilities for Sustaining Defense Systems; New and Novel Processes that are on the Verge of Industrial Modernization; and Emerging Needs in Quantum-Enabled Systems. Dr. Svedberg has a decade of industry experience with both small and large companies in the materials science area and has been a guest researcher at NIST for several years. He has been awarded and overseen five research grants and has published over 80 scientific articles, been granted two patents and is cited over 1,600 times with an h-index of 22. His Ph.D. and masters are in materials science and he is a fellow of the American Vacuum Society (AVS) and the Washington Academy of Science (WAS) including being their 2019 leadership in material science award recipient.