Division on Engineering and Physical Sciences
Army Research Laboratory Technical Assessment Board
Panel on Materials Science and Engineering at the Army Research Laboratory

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Biographical Sketches

Chair

MARK EBERHART is a professor in the Department of Chemistry and Geochemistry at the Colorado School of Mines, where he directs the Molecular Theory Group (MTG). At the MTG knowledge of bonding is obtained through detailed topological analyses of the spatial distribution of electrons in molecules and solids. Many subtle aspects of the distribution become obvious when viewed from a topological perspective. The accompanying topological formalism gives well-defined, unambiguous, meaningful and consistent definitions to previously indeterminate quantities such as atomic bonds and basins. His work is based primarily on first principles computations, which provide the electron charge densities, and topological analysis software developed at the MTG. He is also exploring the topological and geometric origins responsible for the stability of amorphous metallic alloys. In addition to his work on condensed phase systems, his group has active research programs exploring the relationships between charge density and the chemical properties of molecular systems, both organic and inorganic. Dr. Eberhart holds a B.S. degree in chemistry and applied mathematics from the University of Colorado, an M.S. degree in physical biochemistry from the University of Colorado, and a Ph.D. in materials science and engineering from the Massachusetts Institute of Technology.

Members

JUAN J. DE PABLO (NAE) is the Liew Family Professor in Molecular Engineering in the Institute for Molecular Engineering at the University of Chicago. His research interests are to develop multiscale models of complex fluids and materials for design of functional materials systems. The classes of materials studied in his laboratories range from amorphous solids or glasses, to polymers and liquid crystals. He also considers biological macromolecular systems, and their interactions with synthetic materials. The applications of his efforts encompass the design and characterization of glassy matrices for encapsulation of biological molecules or cells, the design of liquid-crystal based sensors for toxic molecules or for biological molecules and assemblies, and the design of self-assembling polymeric systems and processes for nanoscale patterning or for creation of three-dimensional functional structures.

ELIZABETH DICKEY is a professor and director of Graduate Studies of Materials Science and Engineering at North Carolina State University, where she is also the director of the Center for Dielectrics and Piezoelectrics, and director of the Science and Engineering of Atomic Structure Research Traineeship program. A primary focus of her research aims to develop processing-structure-property relationships for materials in which the macroscopic physical properties are governed by point defects, grain boundaries or internal interfaces. Particular emphasis is placed on understanding the role of these material defects on electrical and chemical transport in dielectric materials. Her research involves using an array of analytical techniques, in particular electron microscopy and spectroscopy, to understand the structure and chemistry of materials at the nanometer length scale. She has over 150 peer-reviewed journal publications in these areas, which have over eleven-thousand citations. Early in her career, she received the Presidential Early Career Award for Scientists and Engineers (PECASE) for her work on metal-ceramic interfaces. She is a fellow of the American Ceramic Society, has served on the society's Board of Directors, and was awarded the Fulrath Award by the society in recognition of her technical contributions related to the characterization of functional ceramics and composites. She is an

editor of the Journal of the American Ceramic Society and was a prior editor of Microscopy and Microanalysis. Dr. Dickey received her B.S. in materials engineering from the University of Kentucky in 1992, and her Ph.D.in materials science and engineering from Northwestern University in 1997.

OLIVIA A. GRAEVE joined the University of California, San Diego, in 2012, and is currently Professor in the Department of Mechanical and Aerospace Engineering, Director of the CaliBaja Center for Resilient Materials and Systems, and Faculty Director of the IDEA Engineering Student Center. Her area of research focuses on fundamental studies of the synthesis and processing of nanostructured materials, including ceramic and metallic nanomaterials and amorphous/nanocrystalline composites for both structural and functional applications, with a special emphasis on electromagnetic multifunctional materials for sensors and energy applications. Dr. Graeve has received research grants and contracts from federal agencies such as the National Science Foundation, the Department of Defense, the National Aeronautics and Space Administration, and the Department of Energy, as well as from industrial partners. Her publications include both research and pedagogy and curriculum development contributions, with publications that have appeared in Chemistry of Materials, the Journal of the American Ceramic Society, Langmuir, ACS Applied Materials and Interfaces, Biomaterials, the Journal of Physical Chemistry, the Journal of Materials Research, Scientific Reports, Nanotechnology, the Journal of Applied Physics, and Optical Materials, among others, and have been presented in over 200 invited, contributed, and poster presentations at local, national, and international meetings. Dr. Graeve has contributed to the development of human resources both as a research advisor and as an instructor, teaching courses in the general areas of structure and bonding, as well as the mechanical behavior of materials. She has served on numerous committees of her primary societies (American Ceramic Society, Materials Research Society, Society of Hispanic Professional Engineers, and Sociedad Mexicana de Materials, A.C.) in many different capacities and actively participates in organizing national and international conferences, as well as serving on various review boards and advisory panels. She has been involved in many activities related to the recruitment and retention of women and Hispanic students in science and engineering and has received several prestigious awards including the National Science Foundation CAREER award, the 2006 Hispanic Educator of the Year award by the Society of Hispanic Professional Engineers, the 2010 Karl Schwartzwalder Professional Achievement in Ceramic Engineering Award by the American Ceramic Society, the 2012 B.J. Harrington Lectureship by McGill University, the 2011 Society of Hispanic Professional Engineers “Jaime Oaxaca” Award, Outstanding Engineering Educator by the San Diego Chapter of the California Society of Professional Engineers (2015), and Alumna of the Year by Southwestern College (2015). More recently, she has been named into the Tijuana Walk of Fame (2014) and to the Mexican Academy of Engineering (2016). Dr. Graeve holds a Ph.D. in Materials Science and Engineering from the University of California, Davis, in 2001 and a Bachelor’s degree in Structural Engineering from the University of California, San Diego in 1995.

JOANNA R. GROZA is professor (emerita) of materials science and engineering at the University of California, Davis. Her research interests are in electrical field/current activated sintering – to understand the effects of electrical field application in powder sintering; control of field activated sintering technique process to achieve optimum final properties; sintering of nanocrystalline materials with emphasis on biomaterials; processing – microstructure – property relationships to improve the basic knowledge of materials behavior in high-temperature and fatigue conditions (e. g., in nanocomposites); and abnormal grain growth in polymorphic materials. Dr. Groza received an M.S. in metallurgy engineering and a Ph.D. in physical metallurgy from the University Politehnica of Bucharest, which she attended from 1968 to 1973.

RAINER HEBERT is a Castleman associate professor of Engineering Innovation and on the faculty of the Department of Materials Science and Engineering at the University of Connecticut (UConn). He is director of the Pratt & Whitney Additive Manufacturing Center at UConn and is the associate director of the Institute for Materials Science at UConn. His research interests are directed toward the melting and fusion behavior of powder beds interacting with laser beams and the phase selection during the solidification stages of rapid solidification processes. Dr. Hebert

graduated from the University of Saarbrücken, Germany, with a Diplom in physics in 1997 and from the University of Wisconsin-Madison with a Ph.D. in Materials Science and Engineering in 2003. Following post-doctoral time at the Research Center in Karlsruhe, Germany, from 2003-2005 and at the University of Wisconsin-Madison from 2005-2006 he joined UConn in 2006.

AGNES CHAU KLUCHA is the Senior Director, Engineering for the Sensors and Integrated Systems business unit at UTC Aerospace Systems, one of the world's largest suppliers of technologically advanced aerospace and defense products. She has responsibility for engineering leadership of the Inertial Control and Aircraft Management Systems (ICAMS) business segment. During her 21-year career at UTC, Agnes has held various engineering and management roles at UTC Aerospace Systems and Pratt and Whitney. Previous positions included Flight Test Engineer, Joint Strike Fighter Test Planning Manager, leadership of Tiger Teams to resolve top technical issues, and "intrapreneur" in the creation of the Engineering Innovation Center to pursue advanced manufacturing and design technologies, with a special focus on additive manufacturing. Agnes led the initiative to establish the University of Connecticut/Pratt and Whitney Additive Manufacturing Innovation Center. Ms. Klucha is the 2011 Connecticut Woman of Innovation winner in the Large Business Innovation and Leadership category, a 2015 STEP (Science, Technology, Engineering and Production) Award Honoree, a national event sponsored by The Manufacturing Institute, and a 2015 Society of Women Engineers' Advocating Women in Engineering Award winner. Ms. Klucha received a B.A. in engineering science – aerospace engineering – from the University of Toronto and an M.B.A. from the University of Massachusetts at Amherst.

SUBHASH MAHAJAN (NAE) is a distinguished professor in the Department of Materials Science and Engineering, University of California, Davis, and was a special adviser to the chancellor. Dr. Mahajan's research focuses on two thematic areas: functional materials and deformation behavior of solids. He has held positions at the University of Denver; The Atomic Energy Research Establishment, Harwell, England; Bell Telephone Laboratories, Murray Hill; Carnegie Mellon University; and Arizona State University (ASU). At ASU, he was chair of the Department of Chemical and Materials Engineering (2000 to 2006), and was the founding director of the School of Materials (2006 to 2009). In 2007, he became an ASU regent's professor. He was a senior adviser to the dean of engineering at ASU from 2009 to 2010. Dr. Mahajan has extensive experience in editorial work: he was an associate editor of *Metallurgical and Materials Transactions* (1984 to 1997); founded *Materials Science and Engineering B* in 1988 and managed it until 2000; has served as editor of *Acta Materialia* from 2000 to 2016; and the coordinating editor of Acta Journals from 2004 to 2016. He edited the *Handbook on Semiconductors* in 1994, and co-edited a number of encyclopedias*: Concise Encyclopedia of Semiconducting Materials and Related Technologies*; *The Encyclopedia of Advanced Materials*; and *The Encyclopedia of Materials*. He also co-authored an undergraduate text book,*Principles of Growth and Processing of Semiconductors*. Over the years, he has received numerous awards for excellence in research and education: fellow of ASM, TMS, and MRS; Albert Sauveur Achievement Award from ASM; ASM Gold Medal; and the John Bardeen and Educator Awards from TMS. In 2018, Dr. Mahajan was awarded the Acta Materialia Gold Medal. He delivered the Campbell Memorial and Lee Hsun Lectures, respectively, for ASM and the Chinese Academy of Sciences. He is a member of the National Academy of Engineering. Dr. Mahajan obtained his B.Sc. (physics, chemistry and mathematics) and B.E. (metallurgy), respectively, from Punjab University and the Indian Institute of Science with the highest honors. He received a Ph.D. in materials science and engineering from the University of California, Berkeley in 1965.

CHRISTIAN MAILHIOT is senior manager of Energy Materials Science at Sandia National Laboratories (SNL) in Livermore, CA. Prior to joining SNL in 2016, he held the position of professor in the College of Arts and Sciences at Washington State University (WSU) during the period 2013 – 2016. At WSU, he also held the positions of director for the Center for Institutional Research Computing (CIRC), and administrative director for the Joint Center for Deployment and Research in Earth-Abundant Materials (JCDREAM). Prior to joining WSU, Dr. Mailhiot was a senior technical manager at Lawrence Livermore National Laboratory (LLNL) during the period 1989 – 2013. He has worked in the areas of theoretical and computational condensed matter

physics, ab initio many-body calculations of materials, atomic and electronic structure of materials, electronic structure theory and optical properties of semiconductor superlattices and synthetically modulated quantum-confined structures, semiconductor physics, surface and interface science, and static and dynamic pressure-induced phase transformations. He received his B.Eng. in engineering physics in 1978 from L'École Polytechnique de Montréal in Canada. He obtained his M.S. (1980) and Ph.D. (1983) in applied physics from the California Institute of Technology, Pasadena, CA. From 1983 through 1989, he was a member of the technical staff at the Xerox Webster Research Center in Webster, NY, where he worked in the field of semiconductor and solid-state physics. In 2003, he was elected a fellow of the American Physical Society, Division of Materials Physics. He serves on numerous editorial boards and review and scientific advisory committees.

LAKSHMI S. NAIR is an associate professor in the Department of Orthopedic Surgery¸ Institute for Regenerative Engineering, Department of Material Science and Engineering, Institute of Material Science, and Department of Biomedical Engineering at the University of Connecticut Health. Her major research interests are in regenerative engineering, biomaterials, design and development of injectable hydrogels as regenerative biomaterials, nanostructured scaffolds for tissue regeneration, and post transcriptional regulation of cells using microRNA. She has more than 100 papers in the area of Biomaterial Design and Synthesis, Injectable Hydrogels; Protein and Small Molecule Delivery; Nanoparticles, Cell Instructive Polymer Matrices to Direct Regeneration; Platelet Rich Plasma Delivery; Gene Activated Matrices to Enhance Tissue Regeneration; and Biomaterial based Strategies for Pain Management. She currently serves as the managing editor of the journal of regenerative engineering and translational medicine as well as the secretary of the regenerative engineering society. Her awards and honors include Fellow of the United States National Academy of Inventors (2017), appointed to the Scientific Merit Review Board, Department of Veterans Affairs, (2011-2014), US-Chapter President, Society for Biomaterials and Artificial Organs India, (2012-2020), "Women of Innovation Finalist 2011" in the Entrepreneurial Innovation and Leadership.

KARIN M. RABE (NAS) is the Board of Governors Professor of Physics at Rutgers, The State University of New Jersey. Dr. Rabe's research interests center on the use of computation and theory in the design and discovery of new functional materials. Using computational methods to solve the quantum mechanics of crystalline solids from first principles, Dr. Rabe studies systems at or near structural, electronic and magnetic phase transitions, including ferroelectrics, antiferroelectrics, piezoelectrics, high-k dielectrics, multiferroics and shape-memory compounds. The high sensitivity of such materials to applied fields and stresses gives rise to functional behavior with a broad range of technological applications, including information and energy storage and conversion. Dr. Rabe has a particular interest in the properties of non-bulk structures stabilized in strained thin layers and the distinctive properties of interfaces in superlattices and other artificially structured systems, which are most efficiently explored by first-principles-based modeling. She has published more than 150 papers in the theoretical analysis and prediction of the structure and properties of materials, with successful application to the design of new functional materials. She was president of the Aspen Center for Physics from 2013-2016. Her professional recognitions include fellowship in the American Physical Society (2003), the David Adler Lectureship Award in Materials Physics from the American Physical Society (2008), fellowship in the American Association for the Advancement of Science (2011) and membership in the American Academy of Arts and Sciences (2013).

SUSAN SINNOTT is a professor and department head of Materials Science and Engineering and a professor of Chemistry at Pennsylvania State University. Dr. Sinnott received her B.S. degree in chemistry from the University of Texas in 1987 and her Ph.D. in physical chemistry from Iowa State University in 1993. From there, she joined the Naval Research Laboratory, Surface Chemical Branch, in Washington D.C. as a National Research Council Post-Doctoral Associate until 1995. Dr. Sinnott then became an assistant professor in the Department of Chemical and Materials Engineering at the University of Kentucky through 2000 when she began her tenure at the University of Florida. There she was an associate professor of materials science and engineering until her promotion in 2005 to the rank of professor of materials science and

engineering. In 2007, she became an Affiliate Professor in the Department of Mechanical and Aerospace engineering, and in 2012, she was named the Alumni Professor of Materials Science. Dr. Sinnott also became a member of the Quantum Theory Project in 2011 and the Director of the Cyberinfrastructure for Atomistic Simulation (CAMS) in 2012. In 2015, Dr. Sinnott joined the Pennsylvania State University. 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, developing new methodologies for the atomistic simulation of materials; using atomic-scale simulations to study the catalytic behavior of metal clusters; investigating the molecular origin of friction and wear at interfaces; and combining electronic structure and thermodynamic calculations to predict defect formation in metal oxides. Dr. Sinnott is the author of over 260 technical publications, including over 250 journal publications and eight book chapters; she has also delivered over 210 invited presentations. She is a member of AVS, ACerS ACS, APS, MRS, and AAAS, and was named a fellow of AVS in 2005. She was named a fellow of APS in 2013, a fellow of MRS in 2012, a fellow of ACerS in 2011, and a fellow of the AAAS in 2010.

EPHRAIM SUHIR is professor in the Departments of Mechanical and Materials Engineering and Electrical and Computer Engineering at the Portland State University, Portland, OR. He is also the chief operating officer of ERS Co., Los Altos, CA. His areas of expertise include applied mathematics, applied and mathematical physics, materials science and engineering, applied mechanics; applied probability, probabilistic analyses and probability-based physical designs of electron devices; probabilistic methods in reliability engineering, probabilistic risk assessment and management; analytical (mathematical) modeling in applied science and engineering; shock and vibration analyses and testing; and dynamic response of materials and structures to shocks and vibrations. He has a M.S. in naval architecture from the Polytechnic Institute Odessa, Ukraine; and a Ph.D. in mechanics and mathematics from the Moscow State University, Moscow, Russia.

NARESH N. THADHANI is professor and chair of the School of Materials Science and Engineering at the Georgia Institute of Technology. He is internationally recognized for his research in shock-compression and high-strain-rate deformation behavior of materials and for his services to the materials science and shock physics communities. His research has focused on studies of fundamental mechanisms of shock-induced physical, chemical, and mechanical changes in materials for processing of novel materials under extreme high-pressure conditions, and for probing the deformation, fracture, and ballistic response of metals, ceramics, polymers, and composites, subjected to impact and other high-strain-rate loading conditions. Dr. Thadhani has been recognized as fellow of ASM International based on his contributions in "materials effects of shock compression" and of the American Physical Society based on his "contributions in shock physics of materials." Dr. Thadhani received a B.E. in metallurgical engineering from the University of Rajasthan, India, in 1980; an M.S. in metallurgical engineering from South Dakota School of Mines and Technology in 1981; and a Ph.D. in physical metallurgy from New Mexico Institute of Mining and Technology in 1984.

EDWIN L. THOMAS (NAE) is the E.D. Butcher Chair of Engineering and Professor of Materials Science and NanoEngineering in the George R. Brown School of Engineering at Rice University. Professor Thomas carries out research on photonics, phononics, interference lithography and mechanical behavior of microtrusses, polymer physics and engineering of the mechanical and optical properties of block copolymers, liquid crystalline polymers, and hybrid organic-inorganic nanocomposites. One area of special interest is photonics and the fabrication of polymeric photonic crystals using self-assembly, especially with block copolymers, and holographic interference lithography. For these studies, large emphasis is placed on the understanding of complex relations between the lattice symmetry and optical properties of periodic structures. Another area of particular focus is phononics. His group is exploring the way light and sound propagate in quasicrystalline photonic and phononic structures. Other major topics in Professor Thomas' research are structured polymers. His structured materials research concentrates on enhancing our ability to fabricate complex structures with characteristic length in submicron and nanometer range in order to create materials with superior properties that can be tailored to a

particular application. Understanding the influence of composition and processing conditions on the resultant microstructure of polymers and how this determines the properties is the central part of his polymer morphology research. Professor Thomas is the 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 a fellow of the American Physical Society in 1986 and a fellow of the American Association for the Advancement of Science in 2003 and Inaugural Fellow of the Materials Society in 2008. In 2009, he was elected to both the National Academy of Engineering and the American Academy of Arts and Sciences. He coauthored the undergraduate textbook *The Structure of Materials* and a research monograph, *Periodic Materials: Photonics, Phononics and Mechanics*, and has published over 450 papers and holds 20 patents. Professor received a Ph.D. in materials science from Cornell University in 1974, and a B.S. in mechanical engineering and engineering science from the University of Massachusetts in 1969.

ARLTAB Chair

JENNIE S. HWANG (NAE) is CEO of H-Technologies Group, and board trustee and distinguished adj. professor at Case Western Reserve University. Her career encompasses corporate and entrepreneurial businesses, international collaboration, research management, technology transfer and global leadership positions, as well as corporate and university governance. Among her many honors and awards are U.S. Congressional Certificates of Recognition; induction into International Hall of Fame –Women in Technology and Ohio Women Hall of Fame; named the R&D-Stars-to-Watch; Distinguished Alumni Awards; Honorary Doctoral degree; and YWCA Achievement Award. She was the CEO of International Electronic Materials Corp. and has held senior executive positions with Lockheed Martin Corp., Hanson, PLC and Sherwin-Williams Co. and co-founded entrepreneurial businesses. She is internationally recognized as a pioneer and long-standing leader in the infrastructure development of electronics miniaturization and green manufacturing. She has served as Global President of the Surface Mount Technology Association and in other global leadership positions. An international speaker and author of 475+ publications including several internationally-used books, she has lectured to tens of thousands of managers, engineers and researchers on professional development courses. Her speeches range from university commencement addresses to keynote at DoD Federal Women's Program to tutorials at the U.S. Patent and Trademark Office. She is also a prolific author and speaker on education, workforce, and social and business issues. Additionally, Dr. Hwang has served as a board director for Fortune 500 NYSE-traded and private companies and various university and civic boards, and on the International Advisory Board of the Singapore Advanced Technology and Manufacturing Institute and a number of international industry boards. On serving the National Academies, she chairs the Technical Assessment Board of Army Research Laboratory, and has served as NAE Membership Search Executive (Materials Section), National Materials and Manufacturing Board, DoD R&D Globalization Board, Committee on Forecasting Future Disruptive Technologies and NAE Award Committee, among others. She also has served as a reviewer for National Academies Reports and other national/international publications. Her formal education include Harvard University Executive Program, Columbia University Business School Governance Program, and four academic degrees (Ph.D., M.A., M.S., B.S.) in Materials Science and Metallurgical Engineering, Chemistry, and Liquid Crystal Science. The Dr. Jennie S. Hwang Award for Faculty Excellence was established at her Alma Maters. The Dr. Jennie S. Hwang YWCA Award is established in her honor, now for 17 years running, to encourage and recognize outstanding women students in STEM, Further info: www.JennieHwang.com.