Mildred S. Dresselhaus to receive 2013 Von Hippel Award for carbon science

The 2013 Von Hippel Award, the Materials Research Society's highest honor, will be presented to Mildred S. Dresselhaus, Emerita Institute Professor and Professor of Physics and Electrical Engineering at the Massachusetts Institute of Technology. Dresselhaus is being recognized for "her pioneering contributions to the fundamental science of carbon-based and other low electron density materials, her leadership in energy and science policy, and her exemplary mentoring of young scientists." Dresselhaus will present her award talk at the 2013 MRS Fall Meeting in Boston on Dec. 4, at 6:30 p.m. in the Grand Ballroom of the Sheraton Boston Hotel.

Dresselhaus has conducted research that covered a wide range of problems in the physics of solids with special attention to nanoscience, and carbon-based and other nanostructures of particular relevance to energy-related applications more recently. She made pioneering contributions to the study of semimetals and semiconductors, graphite and its intercalation compounds, fullerenes and carbon nanotubes, and nanostructured thermoelectrics. In the 1960s, she was among the first to use the newly invented laser in magneto-optics studies, an innovation that laid the groundwork for one of her signature accomplishments, the application of Raman spectroscopy to probe the electronic and vibrational response of carbon nanostructures. In her theoretical exploration of the electronic properties of graphene and single-walled carbon nanotubes, Dresselhaus developed an understanding of the unusual Raman spectra of these materials that arise from the interaction between electronic excitation and electron-phonon collisions. This understanding was used to make Raman spectroscopy of graphene and nanotubes the most used technique for determining the properties of individual samples.

In a landmark article co-authored with R. Saito, M. Fujita, and G. Dresselhaus (*Appl. Phys. Rev.* **60** [1992]; p. 2204), Mildred Dresselhaus predicted the electronic structure and density of states for all chiralities of carbon nanotubes (known at that time as graphene tubules) before they were measured and before many were discovered. This article and her work that followed are now the textbook formulation of carbon nanotubes that informs other studies in the field.

While elemental carbon has been the subject of much of her work, Dresselhaus has made significant contributions to the nanotechnology of other materials as well, in particular nonstoichiometric inorganic compounds. Her specific interest is in changes in the properties of materials induced by nanostructuring and how these altered properties may be used in practical applications.

Recognizing early on that meeting energy demand without damaging the environment is a major global challenge, Dresselhaus organized a special issue of *Nature* on energy that was the clarion call among scientists for new interdisciplinary science directions. In the early 2000s, she chaired a study on hydrogen for the Department of Energy's Office of Basic Energy Sciences, publishing the report *Basic Research Needs for the Hydrogen Economy*, which subsequently became the model for future government reports on energy. Dresselhaus has served in many scientific leadership roles, including director of the DOE Office of Science, president of the American Physical Society and the American Association for the Advancement of Science, and chair of the American Institute of Physics Governing Board, as well as co-chair of the most recent Decadal Study of Condensed Matter and Materials Physics.

The Von Hippel Award also recognizes the tremendous influence Dresselhaus has had on young scientists and in furthering the role of women in science. She helped establish the Committee on the Status of Women in Physics of the American Physical Society, which continues to be an influential committee, advising numerous laboratories and universities. In a recent interview with *MRS Bulletin* editorial board member Steve Yalisove, Dresselhaus said, "Mentoring is about listening to people … and not making decisions for them but having them make the decisions.…You have to not take over because it's their choice and they're going to have to face the consequences, so you have to have that in mind."

Dresselhaus received her AB degree from Hunter College, AM degree from Radcliffe College, and PhD degree from the University of Chicago. During this time, she also received a Fulbright Fellowship at Newnham College, Cambridge University, and a Bell Telephone Laboratory Fellowship. After serving as an NSF Postdoctoral Fellow at Cornell University from 1958 to 1960, Dresselhaus joined the staff at MIT Lincoln Laboratory (1960–1967), then the MIT faculty in 1968. Among her numerous honors are the National Medal of Science, the North American Laureate L'Oreal-UNESCO Award for Women in Science, the Vannevar Bush Award from the US National Science Board, and the Sōmiya Award for International Collaboration from the International Union of Materials Research Societies. She became an MRS Fellow in 2009. Last year, President Obama named Dresselhaus as one of the two recipients of the Enrico Fermi Award. During the ceremony, then-Secretary of Energy Steven Chu recognized Dresselhaus's "scientific leadership … that has strengthened America's energy and economic security." In 2012, Dresselhaus also received the Kavli Prize in Nanoscience, and the Materials and Society Award from *Acta Materialia*, which was presented at the 2012 MRS Fall Meeting.

The MRS Von Hippel Award includes a $10,000 cash prize, honorary lifetime

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membership in MRS, and a unique trophy—a mounted ruby laser crystal, symbolizing the many faceted nature of materials research. The award recognizes those qualities most prized by materials scientists and engineers—brilliance and originality of intellect, combined with vision that transcends the boundaries of conventional disciplines, as exemplified by the life of Arthur von Hippel (http://vonhippel.mrs.org).

Robert O. Ritchie selected for 2013 David Turnbull Lectureship

The Materials Research Society's David Turnbull Lectureship recognizes the career of a scientist who has made outstanding contributions to understanding materials phenomena and properties through research, writing, and lecturing, as exemplified by the late David Turnbull of Harvard University. This year Robert O. Ritchie, H.T. & Jessie Chua Distinguished Professor of Engineering in the Department of Materials Science and Engineering at the University of California (UC)–Berkeley, has been selected to give the 2013 Turnbull Lecture. Ritchie is cited for his "pioneering contributions to, and teaching us all how to think about, the mechanistic role of microstructure in governing fatigue and fracture in a variety of materials systems, and communicating his scientific insights to the world audience through eloquent lectures and seminal publications." Ritchie will be presented with the award at the 2013 MRS Fall Meeting in Boston.

Ritchie's ability to simplify and categorize very complex fracture and fatigue behavior into understandable and tractable regimes that can be modeled are a hallmark of his contributions. He brought a new understanding to the fundamental mechanisms of fatigue in a wide range of engineering materials, from metallic alloys (specifically aluminum, titanium, nickel, and especially steels), intermetallics (e.g., γ-TiAl), ceramics (PSZ, Al_2O_3, Si_3N_4, and SiC), and the interfaces between them. In particular, he helped elucidate the role of microstructure, loading parameters, and environment on fatigue crack growth behavior. His research led to a new understanding of both the intrinsic fatigue processes ahead of a growing crack and the extrinsic (shielding) processes acting behind the crack tip. These could then be separated, quantified, and modeled. This seminal work helped create a new framework for understanding the fracture and fatigue properties of a wide variety of materials. Furthermore, Ritchie has made very significant advances in applying this understanding to predicting fracture and fatigue in engineering structures and biomedical devices, including the structural integrity of cardiac valve prostheses.

About 10 years ago, Ritchie recognized the urgent need to better understand fracture mechanisms of bone and the potential of applying and adapting the knowledge acquired over many years of research on fatigue fracture of ceramics and ceramic composites. To approach this problem, Ritchie and his collaborators adapted the concept of R-curves to biological materials. In this work, crack ligament bridging was recognized as a major contribution to the toughness of (fibrous) bony materials. Ritchie postulated intrinsic and extrinsic contributions to toughness, where "intrinsic" refers to material behavior preventing the nucleation of a critical crack, while "extrinsic" contributions hinder the propagation of an already developed crack, such as by crack deviation or ligament bridging.

Ritchie established global leadership in the field of fracture and fatigue through dedicated service, the organization of international events, and co-editing 19 books on the subject resulting to a significant extent from conferences in which he was involved in a leadership role. He has furthermore been an inspirational teacher and mentor for a generation of students, first at the Massachusetts Institute of Technology, and subsequently at UC–Berkeley.

In addition to his professorship at UC–Berkeley, Ritchie is Senior Materials Scientist in the Materials Sciences Division of the associated Lawrence Berkeley National Laboratory, and a member of the University of California–San Francisco/University of California–Berkeley Bioengineering group. He is a member of the US National Academy of Engineering and a Fellow of the UK Royal Academy, among numerous other honors.

From Cambridge University, he received his BA degree in physics and metallurgy, MA and PhD degrees in materials science, and a Doctor of Science degree. He has served as a consultant for both government and industry, including for such companies as Allison, Boeing, Chevron, Exxon, Garrett Turbine, General Electric, General Motors, Grumman Aerospace, Instron, Rockwell, Rolls-Royce, Teledyne, Westinghouse, and numerous legal firms. Ritchie has also acted as a consultant in the medical field to Baxter Healthcare, Cordis, Carbomedics, Guidant, Edwards, Sorin, and St. Jude Medical on the mechanical integrity of prosthetic devices. In addition, he has served as a member of several National Research Council Committees including "Advanced Space Technology" and "Small Spacecraft Technology."

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