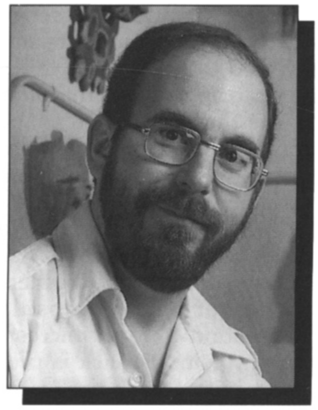
Legally, Suslick Selected as 1994 MRS Medalists

Max G. Lagally



Kenneth S. Suslick

The 1994 MRS Medal Awards, which recognize recent distinguished and innovative achievements or discoveries that are expected to have a major impact on the progress of any materials-related field, will go to Max G. Lagally (University of Wisconsin) and Kenneth S. Suslick (University of Illinois at Urbana-Champaign).

Max G. Lagally

Max G. Lagally received the MRS Medal "for pioneering and innovative development of scanning tunneling microscopy as a quantitative probe of the microscopic mechanisms of crystal growth and ordering at surfaces."

Lagally recognized the need for quantitative analysis of dynamic surfaces and the capability of STM to meet that need. He then explored and developed the technique, turning the field into a well-organized and studied body of facts and producing much of the underlying theory and basic concepts. The impact of his work has been enormous—stimulating theory and further experiments, and drawing fundamental connections to traditional surface science.

Lagally demonstrated the unique scientific power of STM for studying nonperiodic and dynamic surface features, and developed a methodology for using STM to quantitatively determine kinetic processes operative during film growth. In addition, he and his collaborators showed that the combination of real-space atomic-resolution images with statistical analysis is physically intuitive and easy to comprehend.

Lagally's approach allows clear separation of individual mechanisms operative in growth. Particularly focusing on silicon and germanium, he has used STM to study surface diffusion and diffusional anisotropy, nucleation of two-dimensional and three-dimensional structures, growth and coarsening during initial stages of film formation, interactions of atoms with steps and transport over steps, and the development of edge roughness and island shapes.

He directly measured and quantified surface diffusion, surface free energies, and island nucleation and growth. For example, surface-diffusion activation energies of Si measured by indirect methods had yielded diffusion activation energies ranging from 0.25 to 1.6 eV. Lagally's direct measurement gave a value of 0.67, settling that question and explaining other phenomena such as the occurrence of low-temperature epitaxy under appropriate conditions.

After receiving his BS degree in physics from Pennsylvania State University in 1963, Lagally attended the University of Wisconsin, where he received his MS degree in physics and PhD degree in solid-state physics in 1965 and 1968, respectively. In 1970, after being a guest scientist at Fritz-Haber Institut der Max-Planck-Gesellschaft in Berlin, he joined the University of Wisconsin-Madison as a research associate and instructor in the physics department.

Lagally is now the Erwin W. Mueller Professor of Materials Science and Physics at UWM. Since 1982 he has also been the director of the Thin-Film Deposition and Applications Center in the College of Engineering.

Lagally is a Fellow of the American Physical Society and the Australian Institute of Physics. He received the

Byron Bird Award for Excellence in Research at the University of Wisconsin in 1989, and the Medard W. Welch Award from the American Vacuum Society in 1991. He has written 180 papers and has edited or co-edited several books.

Kenneth S. Suslick

Kenneth S. Suslick received the MRS Medal "for incisive studies of the chemical effects of ultrasound on solids and surfaces, and the use of sonochemistry as a new synthetic approach to unusual inorganic materials."

A new research area, sonochemistry, has emerged much to the credit of Suslick, who recognized its potential and moved to provide a firm scientific basis for it. His work spans metal powders, amorphous metals, and biomaterials. His book, *Ultrasound: Its Chemical, Physical, and Biological Effects* is considered the definitive text in the field.

Suslick experimentally determined the conditions created during acoustic cavitation (the formation and implosive collapse of bubbles in an irradiated liquid). He used chemical reactions as kinetic thermometers to determine temperatures reached during acoustic cavitation. By doing so, he proved that transient hot spots of 5000 K exist, and that heating and cooling rates can exceed 10×10^9 K/s during acoustic cavitation.

The high transitory temperatures and pressures provided a basis for understanding the range of unusual reactions—from unexpected molecular processes to erosion of metals—that occur in a cavitating liquid. He demonstrated the compaction and fusion of metal particles into fine microcomposites, created protein microspheres for biomedical imaging, and demonstrated new solid-state reactions.

Suslick's research showed that the rapid heating and cooling provided by acoustic cavitation can produce amorphous metals in good yields by using simple equipment. He generalized his procedures to make amorphous Cr, Mo, Co, and Ni, and is now able to make mixed metal alloys as colloids stabilized in a polymer or on alumina. He examined the magnetic susceptibility of amorphous iron, answering a long-standing controversy concerning the magnetic moment of pure amorphous iron: Is the magnetic behavior of pure amorphous iron like that of normal crystalline α-iron or that of molten iron? His data showed a magnetic coupling of approximately 30% of that seen in crystalline iron.

Suslick's studies of the effects of ultrasound on metal powders and layered inorganic materials are an innovative combination of synthetic, mechanistic, and surface-characterization techniques. They revealed that ultrasonic irradiation of slurries can enhance chemical rates by 100,000. He then applied this surface-activation technique to catalyst preparation and activation, intercalation, and various dissolving metal reactions.

Suslick also used ultrasound for the synthesis of novel biomaterials. This led to the discovery and development of a new method of microencapsulation, using ultrasound to form microspheres from pure proteins. Suslick is presently developing biomedical applications of these microspheres as artificial erythrocytes for oxygen transport, drug delivery, and magnetic-resonance imaging.

Suslick received his BS degree in 1974 from the California Institute of Technology and his PhD degree on synthetic analogues of myoglobin and hemoglobin from Stanford University in 1978. He joined the University of Illinois at Urbana-Champaign in 1978 and now holds a joint appointment there in the Chemistry, and Materials Science and Engineering departments.

Suslick received the ACS Nobel Laureate Signature Award for Graduate Education together with his former graduate student Mark Grinstaff in 1994. He is a fellow of AAAS and has received an NSF Special Creativity Award. He is founding editor of the journal *Sonochemistry* and is on the boards of several other publications. He received the Excellence in Teaching Award in 1985 and 1993 from the University of Illinois at Urbana-Champaign. He has been a plenary lecturer at numerous international and national meetings and has given more than 180 invited seminars and presentations.

The Medal awards will be presented during the 1994 MRS Fall Meeting Awards Ceremony on Wednesday, November 30 at 6:00 p.m. in Salon E of the Boston Marriott. On Wednesday, November 30 at 10:45 a.m., Max Lagally will give a presentation on "Strange and Wonderful Two-Dimensional Structures in Epitaxial Growth" in a joint session of B1-6/D6/P5 in Salon F of the Boston Marriott Hotel. Also on Wednesday, Suslick will give a talk on "Applications of Ultrasound to Materials Chemistry" at 4:00 p.m. in Session Ja12, Constitution Room, Sheraton Hotel. MRS

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