2009 WILLIAM G. LOWRIE LECTURER

Gabor A. Somorjai
University Professor
University of California, Berkeley

Gabor A. Somorjai was born in Budapest, Hungary, on May 4, 1935. He was a fourth year student of Chemical Engineering at the Technical University in Budapest in 1956 at the outbreak of the Hungarian Revolution. He left Hungary and emigrated to the United States, where he received his Ph.D. degree in Chemistry from the University of California, Berkeley in 1960. He became a U.S. citizen in 1962.

After graduation, he joined the IBM research staff in Yorktown Heights, New York, where he remained until 1964. At that time, he was appointed Assistant Professor of Chemistry at the University of California, Berkeley. In 1967, he was named Associate Professor, and in 1972 promoted to Professor. Concurrent with his faculty appointment, he is also a Faculty Senior Scientist in the Materials Sciences Division, and Director of the Surface Science and Catalysis Program at the Center for Advanced Materials, at the Lawrence Berkeley National Laboratory. He was appointed University Professor by the UC Board of Regents in March of 2002.

Professor Somorjai has educated 125 Ph.D. students and more than 250 postdoctoral fellows; about 100 of them hold faculty positions and many more are leaders in industry. He is the author of more than 1000 scientific papers in the fields of surface chemistry, heterogeneous catalysis, and solid state chemistry. He has written three textbooks, *Principles of Surface Chemistry*, Prentice Hall, 1972; *Chemistry in Two Dimensions: Surfaces*, Cornell University Press, 1981; and *Introduction to Surface Chemistry and Catalysis*, Wiley-Interscience, 1994; and a monograph, *Adsorbed Monolayers on Solid Surfaces*, Springer-Verlag, 1979.

His major honors include: National Medal of Science, Election to membership of National Academy of Sciences and American Academy of Arts and Sciences, Priestly Medal, Adamson Award in Surface Chemistry, Colloid and Surface Chemistry Award active Research in Homogeneous or Heterogeneous Catalysis and Peter Debye Award in Physical Chemistry from ACS, Langmuir Prize in Chemistry, Senior Distinguished Scientist Award from Alexander von Humboldt Foundation, Emmett Award from North American Catalysis Society, Von Hippel Award from MRS, Henry Albert Palladium Medal, Docteur Honoris Causa from ETH, University of Manchester, Royal Institute of Technology, Stockholm, József Attila University, Università degli Studi di Ferrara, Université Libre de Bruxelles, Université Pierre et Marie Curie, Technical University, Budapest.

WILLIAM G. LOWRIE LECTURES
Chemical and Biomolecular Engineering
Lecturer: Dr. Gabor A. Somorjai

Lecture I: May 7, 2009 – 11:30 a.m.
Knowlton Hall, Room 250, 275 W. Woodruff Avenue

MOLECULAR FOUNDATIONS OF CATALYTIC SELECTIVITY BY METALS

Heterogeneous metal catalysts are nanoparticles that carry out reactions at high reactant gas pressures or in the liquid phase. Instruments developed in Berkeley for molecular studies under these conditions are sum frequency generation vibrational spectroscopy, high pressure scanning tunneling microscopy and ambient pressure X-ray photoelectron spectroscopy. Model surfaces were used to study heterogeneous catalytic reactions that permitted to control and monitor the atomic surface structure, composition and reaction intermediates and simultaneously measure reaction rates and selectivities. This way precise quantitative correlations could be obtained between catalytic reaction kinetics and the molecular factors that control reaction dynamics. Single crystal surfaces were used at first as model catalysts followed by the use of metal and bimetallic nanoparticles that were synthesized with precise size and shape using colloid techniques. Catalytic studies that produce a single molecule (ethylene hydrogenation, CO oxidation) were redirected to focus on reaction selectivity in multipath chemical processes. Reactions were found to induce restructuring of the metal surfaces and mobility of adsorbed molecules. Reaction selectivity and rates can be altered by changing the nanoparticle size in the 0.8 – 10 nm range and shape (surface structure). Transition metal catalysts that are nanosize achieve facile restructuring and rapid change in surface composition under reaction conditions as their low atom coordination permits rapid bond rearrangements. Exothermic surface reactions can cause the flow of hot electrons at oxide metal interfaces and the clustering of metal atoms at the interface, which dramatically increases the metal oxide interface area. Improvements of techniques for molecular studies of surfaces that provide better time resolution and spatial resolution will enhance our ability to study the dynamics of surfaces, which are key to both activity and selectivity during catalysis. The control of metal nanoparticle size and shape provides opportunities to achieve superior reaction selectivity. Combined studies of nanoparticle catalyst synthesis, characterization and reaction studies will accelerate developments of this important field of chemical sciences and chemical energy conversion.

Lecture II: May 8, 2009 – 10:30 a.m.
Physics Research Building, Room 1080, 191 W. Woodruff Avenue

SURFACE SCIENCE - CREATOR OF HEALTH, WEALTH AND NEW SOURCES OF ENERGY

The catalytic converter on automobiles greatly improved the air quality of Los Angeles. Air separation to oxygen and nitrogen is at the heart of water purification technologies. Chemical manufacturing to produce the desired product selectively without waste byproducts is the challenge of chemical process technologies and biotechnologies which are commonly called "green chemistry". The chemical, mechanical, optical, electrical and magnetic properties of surfaces studied on the molecular scale led to developments of new high technology industries that have enriched the United States.