2009 Robert Burwell Lecturer
Bruce C. Gates

This award is sponsored by Johnson Matthey Catalysts Company and administered by the Society. This award is given in recognition of substantial contributions to one or more areas in the field of catalysis with emphasis on discovery and understanding of catalytic phenomena, catalytic reaction mechanisms, and identification and description of catalytic sites and species.

The North American Catalysis Society is pleased to announce that Professor Bruce Gates is the recipient of the 2009 Robert Burwell Lectureship in Catalysis. Since 1992 Bruce has been on the faculty of the University of California at Davis, where he has the title of Distinguished Professor of Chemical Engineering. His interests include Catalysis, Catalytic Reactors, Chemical Reaction Engineering, Material Micro Structure, and Sol-Gel Processing.

For almost 40 years he has made significant contributions in three areas: the preparation and characterization of surface organometallic complexes, catalysis by strong solid acids, and the kinetics and reaction pathways of hydroprocessing catalysis. In the catalysis by strong solid acids, Bruce both expanded the applications and furthered understanding of underlying mechanisms. More recently, in a series of papers beginning in 1998, Bruce (with Bob Grasselli and Helmut Knözinger) explained the surface chemistry of tungstated zirconias with and without Pt, highlighting the role of surface reduction to W5+ and –OH in generating the active sites for alkane isomerization. Bruce's contributions to hydroprocessing catalysis are equally notable. His two review articles greatly assisted those requiring introduction to the field; each has been cited in excess of 375 times. The scientific contribution was his recognition (with James Katzer and George Schuit) that complex hydrodesulfurization and hydrogenation networks could be understood in terms of a small number of reactions whose rates could be quantified using model substrates. One supporter remarked that Bruce's work in metal clusters revolutionized the field of surface organometallic catalysis. Here also he has authored widely read reviews, and several influential, extensively cited papers. Much of this recent work has targeted catalysis by gold clusters or nanocrystals, work characterized by multi-technique correlation of catalytic activity to surface structure, careful interpretation of EXAFS data characterizing surface coordination, and proper consideration of how the catalysis alters the as-synthesized materials. Bruce was an early user and proponent of EXAFS and XANES in catalyst characterization. Many "nanoscience" papers in the literature today follow along paths he pioneered years ago.

Finally it should be noted that Bruce has educated two generations of catalytic scientists and industrial practitioners, through his widely used teaching texts ("Chemistry of Catalytic Processes" is a worldwide best seller), the many short courses he helped develop and teach (the one based on this book was taught for over 30 years at the University of Delaware, and at many industrial research centers) and not least through his mentoring of over 130 graduate students, postdocs and visiting scientists. Bruce has been a tireless cheerleader for the field of catalysis and in all his lectures strives for understanding, arousing curiosity, and getting down to the essentials of a problem. He has also been a very active member of the Board of the North American Catalysis Society.

2009 Eugene J. Houdry Awardee
Dr. Jeffrey S. Beck

The purpose of the Award is to recognize and encourage individual contributions in the field of catalysis with emphasis on the development of new and improved catalysts and processes representing outstanding advances in their useful application.

Dr. Jeffrey S. Beck of ExxonMobil Research and Engineering Company, Clinton, NJ (USA) is the 2009 Eugene J. Houdry Awardee. This award is sponsored by Süd Chemie and administered by The North American Catalysis Society.

Among his many accomplishments, Jeff was co-inventor of M41S, an entirely new class of mesoporous molecular sieves. M41S materials represent a breakthrough in ultra large pore molecular sieve technology. Utilizing strategies gleaned from surfactant chemistry, Jeff demonstrated how to manipulate the synthesis of these materials to tailor their pore size from 20 to 100 Å. He also demonstrated that the interactions between surfactant templates and reaction conditions in these systems could be manipulated to produce either zeolitic or mesoporous materials, thus illustrating the possibility of either molecular or supramolecular templating. Discovery of these materials is recognized as a major innovation throughout the scientific community. These silicates are applicable to a wide range of applications in catalysis, separations and as host/guest materials. This work was awarded the 1994 Donald W. Breck Award by the International Zeolite Association.

Another major achievement includes Jeff's seminal work on preparing ex-situ selectivated catalysts which laid the groundwork for the ExxonMobil PxMaxsm process (selective conversion of toluene to p-xylene, the precursor to terephathalic acid and polyesters), which was recently recognized with the ACS Heroes of Chemistry Award. His research in the "molecular engineering" of zeolites and the interplay between reaction pathways, kinetics, and mass transport in microporous materials led to several commercial processes for the selective production of para-xylene. Jeff's fundamental studies enabled him to tailor the diffusion properties of the catalyst by using novel nano-coating techniques. He carried out detailed kinetic and mechanistic studies to design catalysts for selective production of para-xylene in ExxonMobil processes such as PxMaxsm and XyMaxsm (awarded the 2003 Thomas Alva Edison Patent Award by the Research and Development Council of New Jersey), and his findings also played a key role in the commercial manufacture of these catalysts. These discoveries have been deployed worldwide in more than 20 commercial units for para-xylene production, with others planned, and have been recognized not just by their rather significant economic impact, but also for their environmental benefits by reducing the energy required to produce para-xylene and their societal benefit in enabling the lower cost production of the key component used in the production of polyethyleneterephthelate (PET), one of the world's most widely used polymers.

In addition, Jeff has authored or coauthored 47 scientific publications, 58 external presentations, and 59 patents, which demonstrate his creativity in the broad research area of catalysis. Jeff has also played a key role in bringing to ExxonMobil new research tools to further increase capabilities to efficiently carry out research and development of novel catalytic technologies. He was a key member of the team that established a broad ExxonMobil-Symyx alliance in High-Throughput R&D (HT R&D). With Jeff leading the effort, these new HT R&D tools, along with advanced modeling efforts, are successfully being implemented at ExxonMobil and have yielded innovations that have been commercialized in the refining and lubricant areas.

Jeff's current role at ExxonMobil is manager of Corporate Strategic Research of ExxonMobil Research and Engineering Company, with overarching responsibility for upstream, downstream, and chemicals long range research for the entire Corporation.

2009 Michel Boudart Award
Professor Avelino Corma Canos

The Award recognizes and encourages individual contributions to the elucidation of the mechanism and active sites involved in catalytic phenomena and to the development of new methods or concepts that advance the understanding and/or practice of heterogeneous catalysis. The Award is sponsored by the Haldor Topsøe Company and is administered jointly by the NACS and the EFCATS.

Professor Avelino Corma Canos has been selected for the 2009 Michel Boudart Award for the Advancement of Catalysis. Avelino Corma has been a research professor at the Universidad Politécnica de Valencia since 1990 where he founded and is director of the Instituto de Tecnologia Química (UPV-CSIC) at Valencia. He is a world class leader in structured nanomaterials and molecular sieves as catalysts, covering aspects of synthesis, characterization, and reactivity in acid-base and redox catalysis. He is recognized widely for his unique ability to combine state-of-the-art synthetic protocols with modern theoretical and characterization methods to design catalytic materials for specific functions. Avelino has become one of the most prolific and versatile contributors to the science and technology of heterogeneous catalysis. He has published nearly 700 scholarly manuscripts in the leading journals of chemistry and catalysis, and he has been recognized among the fifty most highly cited chemists for the last decade. Remarkably, he has combined these scholarly contributions with more than 100 patents covering inventions of far-reaching impact to the industrial practice of catalysis, many of them licensed to industry and some in commercial practice. In 2006 alone, he received four prestigious international awards in recognition of his many and broad fundamental and practical contributions to the field. As one nominator described, “Professor Avelino Corma’s … work illustrates the value of fundamental concepts in practical discoveries and the need to bring together experiment and theory, characterization of structure and function in complex inorganic solids, and industry and academia as we seek to advance the science of catalysis.” Another supporter remarked, he is “one of the internationally preeminent scholars in the field of catalysis today. His work has had immense impact on the science of this field and has also led to a number of significant technical applications, a very rare accomplishment for any academic investigator.”

Avelino’s grasp of concepts and of fundamental needs has been illustrated in his recent attempts to synthesize and use well defined-single-isolated sites to establish structure-function relations and to establish the connections among homogeneous, enzymatic and heterogeneous catalysis. In another example of his many contributions to catalysis, he and his research group have not only addressed the design of new zeolites materials for conventional reactions of hydrocarbons, but also discovered new chemistries and applications for these materials in the synthesis of petrochemicals, pharmaceuticals, and fine chemicals. The ITQ-type materials have become ubiquitous in the literature; they represent new catalyst compositions, currently numbering about 50 and consisting mostly of microporous solids, all discovered within the Corma research group. His novel catalysts for paraffin isomerization are widely used in practice because of their unprecedented sulfur resistance and high stability and selectivity.

In addition to his many outstanding research accomplishments, Avelino’s continued leadership in the field has been recognized by numerous awards, including the Francois Gault Award of the European Catalysis Society (2001), the Eugene Houdry Award of the North American Catalysis Society (2002), the Donald Breck Award of the International Zeolite Association (2004), and the Gabor A. Somorjai Award for Creative Research in Catalysis (2008).

2009 Paul H. Emmett Award in Fundamental Catalysis
Manos Mavrikakis

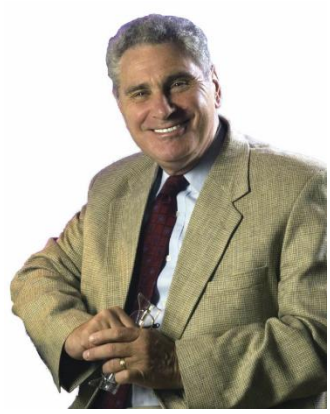
The purpose of the Award is to recognize and encourage individual contributions (under the age of 46) in the field of catalysis with emphasis on discovery and understanding of catalytic phenomena, proposal of catalytic reaction mechanisms and identification of and description of catalytic sites and species. The Paul H. Emmett Award in Fundamental Catalysis is sponsored by the Davison Chemical Division of W.R. Grace and Company. It is administered by The North American Catalysis Society and is awarded biennially in odd numbered years. Professor Manos Mavrikakis has been selected for the 2009 Paul H. Emmett Award in Fundamental Catalysis.

Since 1999 Manos has been with the Department of Chemical & Biological Engineering, University of Wisconsin - Madison. Manos is one of the world leaders in the area of computational chemistry in catalysis. He has also served as Visiting Professor, Department of Chemical Engineering, Technical University of Denmark, Lyngby, Denmark. The primary research focus of Manos' group is the fundamental understanding of surface reactivity, using state-of-the-art first-principles methods, and extensively collaborating with experimental experts. Manos has coauthored more than 80 original publications. He is a member of the editorial board of Surface Science and of the Annual Review of Chemical & Biomolecular Engineering. Dr. Mavrikakis has pioneered the use of Density Functional Theory (DFT) methods in the screening of pure and alloy metal catalysts to discover which metals or alloys have potential to yield catalysts of improved activity and/or selectivity. Manos has been unique in having used theoretical methods to find new, interesting classes of systems and site-nanostructures. Key to his success here was the use of fundamental principles concerning the relationships between the energetics of certain key intermediates and the activation barriers for the rate-controlling steps to make this screening procedure faster.

In particular, Manos demonstrated that possibility by identifying bimetallic alloys which bind atomic H as weakly as the noble metals (Cu, Au), but are able to break the H-H bond in H2 more easily than noble metals. Such Near-Surface-Alloy (NSA) materials are ideal for low temperature, highly selective, H-transfer reactions (e.g., in pharmaceutical production), and energy related catalytic applications. Also, Manos's group systematically studied Oxygen Reduction Reaction (ORR) on a number of late transition metals, including bimetallic and ternary alloys of Pt. The result of that work was the construction of stable, ternary NSAs, which contain much less Pt, and are up to a factor of four more active than pure Pt ORR electrocatalysts. Manos also has discovered many interesting aspects of catalytic reaction mechanisms that have inspired the field. In particular, very recently Manos' group has proposed a novel low-temperature reaction mechanism for the preferential oxidation of CO in the presence of H2, which explains the room-temperature reactivity of Ru-Pt core-shell nanoparticles. The specific nanoparticles were identified by Manos' group from first-principles as very active and selective PROX catalysts, and those predictions were confirmed upon synthesis and catalytic testing of the Ru-core Pt-shell nanoparticles. Manos also followed up his detailed gas-phase methanol decomposition DFT work with experiments and microkinetic modeling, to show that one can accurately predict experimental reaction rates directly from first principles. In the area of water gas shift catalysis, his efforts have led to a completely new water-gas shift reaction mechanism involving carboxyl species on Cu, Pt, and Au surfaces, which is quite general and may be applicable to other low temperature water-gas shift catalysts. Importantly, this mechanism is shown to be operational under realistic industrial water-gas shift conditions.

Manos will give a plenary lecture and be recognized at the 2009 North American Catalysis Society meeting in San Francisco.

F. G. Ciapetta Lecturer
Robert Farrauto



This award is sponsored by Grace Davison Catalysts and administered by The North American Catalysis Society. The award is given in recognition of substantial contributions to one or more areas in the field of catalysis with emphasis on industrially significant catalysts and catalytic processes and the discovery of new catalytic reactions and systems of potential industrial importance.

Dr. Robert Farrauto of BASF's Catalysis Research is the 2008 F. G. Ciapetta Lecturer. Bob has a long and distinguished record in industrial research. Among his important contributions to industrial catalysis has been the development of catalysts for the abatement of engine emissions, in particular, diesel engines. One gauge of the impact of his discoveries in this area is in the $300 million sales they generated for his company of 30 years, now BASF Catalysts (formerly Engelhard Corporation). Another important discovery was the use of a zeolite additive to trap the heavy molecular weight hydrocarbon emissions during cold start, which allowed the technology developed originally for heavy duty engines to be used for diesel engines for passenger cars. This technology created a new paradigm in emission cleanup catalysts. Bob has also contributed to many other successful commercial developments. One such example occurred in 1986 when, as a co-inventor at Engelhard, he developed a fast light off ammonia oxidation catalyst for the production of nitric acid. This technology, commercially known as HyliteTM, is still in practice today. It enhances the light off of the catalyst gauze in hours as opposed to days. He and his team also developed the fundamental mechanism of the deactivation of the Pt recovery gauze. This knowledge, coupled with the HyliteTM catalyst technology, virtually eliminated this mode of deactivation, adding increased lifetime and nitric acid yield to the process. This has resulted in over $10 million in revenues for Engelhard. Within the last 7 years Bob and his team have pioneered in the development of precious metal catalyzed monoliths and heat exchangers for distributed hydrogen for fuel cells and the hydrogen economy. The team has commercialized over 25 new catalysts.

Bob's innovations have spanned a wide range of areas involving reductants, oxidants, high and low temperature applications, liquid and gas phase reactants, and catalysts in pellet and monolithic forms. This broad patent portfolio is a strong testament to his creativity. His achievements have been recognized recently by the 2005 Catalysis and Reaction Engineering Division Practice Award from the American Institute of Chemical Engineers, the 2001 Henry Albert Award for excellence in precious metal catalysis by the International Precious Metals Institute, and the 2000 Cross-Canada Catalysis Lectureship Award.

Also, Bob Farrauto has made remarkable contributions to educating students and mentoring young industrial colleagues, contributing to the scientific literature, and providing service to the catalysis community. Bob has a passion for teaching. He taught courses in industrial catalysis after his regular working hours at Engelhard at the nearby New Jersey Institute of Technology from 1990 to 1997. The excellence of his lectures was recognized by a teaching award given to the best Adjunct Professor. He continues his academic affiliation with his current position as Adjunct Professor in the Earth and Environmental Engineering Department at Columbia University in the City of New York. There he started the BASF-Columbia program to fund research for graduate students and post docs. It links Columbia and BASF through programs of mutual interest in environmental and green chemistry. He also co-authored two textbooks describing Industrial Catalytic Processes, one in collaboration with his colleague Ron Heck, the other with Professor Cal Bartholomew, and both books are currently in their second editions. In addition, he has contributed over 75 papers to the scientific literature ranging from reviews to contributions in new fields. He is a co-inventor of 50 US patents. He is a gifted lecturer and has presented his various research findings to a wide international audience.