ANTHONY G. EVANS
1942–2009
Elected in 1997

“For contributions in the development and understanding of structural materials.”

BY ROBERT M. McMEEKING

ANTHONY G. EVANS, materials engineer and materials scientist, founding chair of the Materials Department at the University of California, Santa Barbara (UCSB), and the most highly cited materials scientist in the world, died on September 9, 2009, at the age of 66. He was one of the most influential materials engineers and materials scientists of his time.

Tony had no rivals when it came to grasping the fundamentals of materials behavior. Coupled with his extraordinary ability to generate, inspire, and lead collaborative efforts, he achieved tremendous advances in the understanding and exploitation of advanced materials. He was a leading contributor to the successful use of brittle materials in a wide variety of applications such as space shuttle tiles, jet engines, silicon chips, and vehicle armor. In addition to his work and the 650 or so papers he authored, his legacy lives on in the legion of colleagues, students, scientists, and research engineers whom he influenced and who will take forward his ideas, concepts, and collaborative way of doing research, ensuring that he will continue to have a great impact for years to come.

Tony was born in Porthcawl, Wales, on December 4, 1942, the younger son of William Glyn and Annie-May Evans. He was educated at nearby Bridgend Boys Grammar School, and from 1961 read metallurgy at Imperial College, London, where
he earned a BSc with first class honors in 1964, the year he also married Trisha Cross. He went on to complete his PhD in metallurgy in 1967 at Imperial, under the supervision of Peter Pratt, and won the Matthey Prize upon graduation. His graduate research concerned plastic deformation and dislocation activity in single crystal calcium fluoride, introducing him to the emerging field of modern structural ceramics.

His first position was at the Atomic Energy Research Establishment (near Harwell, Oxfordshire), at the time one of Europe’s most prestigious and best-equipped laboratories, focused on the emerging need for advanced materials for nuclear power. There he studied the mechanical behavior of engineering ceramics such as silicon nitride, then a recently developed high-tech material. He became a pioneer in the application of fracture mechanics to ceramics, developing concepts that are important in harnessing the brittle nature of such materials and enabling their reliable use.

After a sabbatical at UCLA, Tony immigrated to the United States in 1971 and joined the National Bureau of Standards (now the National Institute of Standards and Technology) in Gaithersburg, Maryland, where he worked on glass fracture. His outcomes had an enormous impact on the structural ceramics community; for example, his proof test for assessing the reliability of glass and ceramics was widely used in the US space program.

In 1974 he moved to the Rockwell International Science Center in Thousand Oaks, California, to establish a group devoted to structural ceramics. His research there encompassed indentation fracture mechanics for ceramics, associated with hardness measurements for materials that crack when loaded by an indenter. From this work his group developed an important standard indentation test for measuring the fracture properties of brittle ceramics and glasses.

Tony then committed himself to academia, taking a position in the Department of Materials Science and Mineral Engineering at UC Berkeley in 1978. He remained in academia for the rest of his career, but continued to have influence in
industry through consulting activity, mainly for the aerospace and electronics industries. These interactions yielded many of the important problems he studied throughout his life, and he in turn had a profound impact on the research and development efforts of the companies for which he consulted.

At Berkeley he continued research on brittle materials, focusing on the mechanisms of ceramics and processing to make them more durable, robust, and tough. Because mechanical stress plays such a large role in these questions, his efforts incorporated applied mechanics, an emphasis that grew over the years.

In the first of several moves in academia that were eventually to bring him full circle, Tony joined UC Santa Barbara in 1985 to establish and chair the Materials Department. Under his leadership the foundations were laid for the rapid development of the department, which experienced a spectacular rise to prominence to become one of the leading materials science and engineering departments in the world. The early directions he set—a focus on collaborative interdisciplinary research, interaction with industry, and open-mindedness about the disciplines and topics that can be important in materials research—remain today. In recognition of his achievements, he was appointed UCSB's first Alcoa Professor of Materials.

His research exhibited increasing attention to high-temperature composite materials, including ceramics and metals reinforced by ceramic fibers. His pioneering work in this area enabled the deployment of brittle composite materials in severe environments of stress and temperature, and is revolutionizing the design and performance of diverse systems, including aircraft and space vehicles.

This stage of Tony’s career also saw an evolution in his style to emphasize the leadership of large multi-investigator, multi-institutional research projects, mixing academic, industrial, and government engineers and scientists. His active participation in every aspect of the endeavor was integral to the high degree of success and impact of these programs, and his skill at assembling, inspiring, and leading such large interdisciplinary teams was legendary and awe inspiring. In addition, he actively
sought industrial and government input and criticism of the approach, direction, and outcomes of these research programs, efforts that further ensured their effectiveness and influence. It was entertaining and stimulating to watch Tony summarize and defend these programs and pronounce on their future directions in front of a critical but good-natured audience at the end of the famous weeklong annual UCSB study groups. These gatherings of about 100 researchers became a notable feature of the coordination, integration, planning, and socialization of the large collaborative, multiyear projects he led.

Tony’s work on ceramic- and metal-matrix composites included emphases on thin film and interface mechanics, and then evolved to include thermal barrier coatings, metallic foams, morphing structures, aerospace materials with tailored thermomechanical properties, lightweight lattice materials, and structural materials with superior blast and ballistic resistance. His reach was such that he also did successful work on biological materials, including bone, nacre, and the cell cytoskeleton.

He continued his research on these topics when he moved to Harvard to become the Gordon McKay Professor of Materials Engineering in 1994 (he retained a partial appointment at UCSB until 1997). An offer to become Gordon Wu Professor of Mechanical and Aerospace Engineering took him to Princeton University in 1998, where he became director of the Princeton Materials Institute. UCSB attracted him back in 2002 to become Alcoa Professor of Materials once more.

Tony’s professional activities were concentrated mainly on two organizations: the American Ceramic Society (ACerS), which he served for a term as vice president, and the Defense Sciences Research Council (DSRC, previously known as the Materials Research Council), which he chaired for four years and of which he was the longest-serving member (1974–2006). DSRC provides support to the Defense Advanced Research Projects Agency (DARPA) of the Department of Defense and thus has input into the most ambitious and important research projects sponsored by DOD, including those that led the
development of modern advanced materials in the years when Tony had great influence in DSRC and at DARPA.

Tony’s published work has been cited more than 35,000 times, giving him an h-factor of 101. He received numerous honors throughout his career, including all the major prizes awarded by ACerS, which made him a Distinguished Life Member in 2000. He won the Griffith Medal and Prize of the Institute of Materials in 1994, the 2000 David Turnbull Lectureship of the Materials Research Society, the American Society of Mechanical Engineers Nadai Medal in 2003, and, in 2006, the Gold Medal of the American Society for Metals. In addition to being a member of both the National Academy of Engineering and the National Academy of Sciences, he was a fellow of the American Academy of Arts and Sciences, the Royal Society of London, and the Royal Academy of Engineering. He was especially proud and pleased in 2008 to be made a fellow of Imperial College, the highest honor bestowed by his alma mater.

The synergy between Tony’s grasp of theory and his insightful exploitation of experiment, his ability to focus on the critical issues, his nose for important problems, and his evident love of his subject were enormous strengths in his approach to his work. That he was a masterful organizer and leader of people and a delightful and amusing colleague set him apart as a true materials phenomenon.

He is survived by his wife Trisha, who writes:

Tony had a tremendous joy for life, regarding each new day as an adventure. No matter how busy he was, he always found time for others. He was kind, loving, and generous.

On the weekends, he and [I] loved to coach daughters Pollyanna and Jemina in soccer, softball, and he even took up skiing with his daughters. One of the joys of returning to Santa Barbara was his love of nature and he would like to spend time hiking the Santa Barbara trails. Additionally he loved to run around the lagoon and beach at UCSB as it cleared his head and helped him solve problems. It was a great honor when his IT and PhD students arranged a 5K run in his memory.
He enjoyed going to the theatre and the museums whether at home or abroad and was an avid fan of Welsh Rugby and of Chelsea Football Club. His friends all knew of his love for good food and especially great wines! He is greatly missed.

He is survived by his wife, three daughters, and several grandchildren.