

A Tribute to Anthony G. Evans: Materials Scientist and Engineer December; 4, 1942–September 9, 2009

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This special issue of the Journal of the American Ceramics Society brings together papers written by some of the many colleagues who have worked with Tony Evans over his career. The issue itself reflects the extraordinary breadth of Evans' scientific interests. This brief Tribute is an attempt to capture in a few words Tony Evans' remarkable influence and contribution to materials science and more broadly to engineering science. The task would be more daunting were it not for the testimony to Tony Evans in celebration of his 65th birthday by A. Heuer (*Int. J. Mat. Res.* **98** (2007) 1168–1169) and an obituary by N. A. Fleck, which appeared in the November 29, 2009 issue of the Guardian newspaper.

Anthony G. Evans was one of the most influential materials scientists and materials engineers of his generation. He had no rival when it came to the grasp of the underlying fundamentals of material behavior coupled with an extraordinary ability to focus his attention and to inspire and lead collaborative efforts. Evans was born and raised in Porthcawl, Wales to William Glyn and Annie May Evans. He met his wife, Trisha, in their hometown and they were married in 1964. Trisha and their daughters and grandchildren survive Tony. After obtaining BSc (1964) and PhD (1967) degrees in metallurgy at Imperial College, London, Evans began work in 1967 as a ceramist at the Atomic Energy Research

Establishment, Harwell. Following a sabbatical period at UCLA, Evans worked at the National Bureau of Standards from 1971 to 1974 and then served as a group leader at the Rockwell International Science Center from 1974 to 1978. In 1978 he joined the faculty of the Department of Materials Science and Mineral Engineering, University of California, Berkeley, where he remained until 1985. During these years the emphasis of much of Evans' research was on ceramics and he began his long association with the American Ceramics Society. In 1985 he moved to the Santa Barbara campus of the University of California as the Alcoa Professor. Evans was the founding chair of the Materials Department at UCSB (1985–1991) which would become one of the leading materials departments in the world. Those of us who conducted research with Evans during this period were largely unaware of his efforts as department chair—he later attributed this to the fact that he allocated the period from 7:30 to 9 in the morning each day to his departmental duties, finishing before his colleagues had an opportunity to perturb the process. This was also the period that Evans established himself as a research leader par excellence heading major projects on ceramic matrix composites, toughening of ceramics, and thin films and multilayers. Evans made two more academic moves before completing a circle back to UCSB in 2002. From 1994 until 1998 Evans was the Gordon McKay Professor of Materials Engineering in the Division of Engineering and Applied Sciences at Harvard University and from 1998 to 2002 he served as the Gordon Wu Professor in the Department of Mechanical and Aerospace Engineering at Princeton University. The pull of Santa Barbara and UCSB remained strong, however, and he returned in 2002 to a joint appointment in the Departments of Materials and Mechanical Engineering where he focused primarily on teaching and research.

Any tribute to Tony Evans must begin with the impact of his work. Evans is the most highly cited materials scientist with almost 35 000 citations to over 650 published journal papers. His h-index will soon pass 100. A short list of subjects to which Evans has made major contributions includes micro-cracking and transformation toughening of ceramics, ceramic matrix composites and metal matrix composites, thin film mechanics, interface mechanics, thermal barrier coatings, metallic foams, morphing structures, aerospace materials with special thermo-mechanical properties, lightweight lattice materials, and superior blast and ballistic resistant structural materials. On each of these problem areas, Evans brought to bear a fundamental understanding of material behavior at all scales together with innovative experiments in the laboratory. The experimental work he and his collaborators performed more often than not focused on observation of micromechanical behavior and new phenomena rather than on refined measurement of material properties.

The synergy between Evans' grasp of theory and his insightful exploitation of experiment, combined with his love of subject and legendary ability to focus, would have been enough, by themselves, to establish his primacy. However, there is more. Evans' skills at assembling, inspiring and leading interdisciplinary teams of engineers and scientists to tackle challenging technological problems is the additional component of his approach which truly set him apart. Those who have had the experience of working with Tony Evans on one or more of the teams he put together will be aware that he had no match as a technology

leader in the arena of structural materials. These include his former students, post-doctoral fellows, and a large cadre of colleagues which he brought together from many academic, government and industrial institutions, here and abroad. Particularly notable for each major project that Evans led were the workshops where ongoing work was reviewed and new work was planned with criticism and input from experts from industry and government labs. These workshops, which were always enlivened by Evans' active participation in every detail of the research, were exceptional in identifying the challenges and moving the research forward. Skepticism about the effectiveness of shifting research funding from smaller projects to relatively fewer large projects, a trend that has taken place over the past several decades in the US and is now spreading around the world, would be far less warranted if more large projects were led by individuals with the abilities of an Evans.

Tony Evans provided leadership in the materials community throughout his career in other ways as well. As already noted, he provided critical leadership in founding the Materials Department at UCSB for nearly six years and then later for the Princeton Materials Institute for four years, in each case without appearing to break step in his own research activities. Starting his service in 1974, Evans became the longest serving member of the Defense Sciences Research Council (formerly the Materials Research Council) of DARPA which played a major role in setting the agenda for research in advanced materials in the US. Simultaneous with all his other activities, during his entire career, Evans was a highly engaged consultant to many companies, not only in the materials industry but also in aerospace and electronics. To those of us who worked closely with Evans,

it was clear that much of his research emphasis was motivated by problems that surfaced through his consulting activities. There is little wonder that his work has had, and will continue to have, such major impact.

In his testimony in celebration of Tony Evans' 65th birthday, Arthur Heuer noted that Evans' exceptional generosity to students and colleagues with his ideas and time was one of the keys to his success. Quoting Heuer directly: "It is his incredible ability to focus, his "nose" for important problems to work on, and his generosity in collaborative research, that have led to his revered status in our field." Throughout his career, Evans enjoyed working closely with his many students and post-docs who are now spread far and wide in academia, industry and government. These former junior colleagues, together with all his other collaborators, will keep Evans' legacy alive for years to come.

Tony Evans' contributions have been recognized in many ways—a few of them are listed below. He was a member of both the National Academy of Engineering and the National Academy of Sciences. He was also a Fellow of both the Royal Society (FRS) and the Royal Academy of Engineering in the UK. He was a Distinguished Life Member of the American Ceramics Society and received essentially every major award of this Society. He won the Henry Marion Howe Medal of ASM International, the Turnbull Award of the Materials Research Society, the Griffith Medal and Prize and Mellor Memorial Lectureship of the Institute of Materials, UK, and the Nadai Medal of ASME. He was an Alexander von Humboldt Senior Scientist. In 2008, Evans was especially pleased to receive the highest award granted by his alma mater, Fellow of Imperial College, London. □