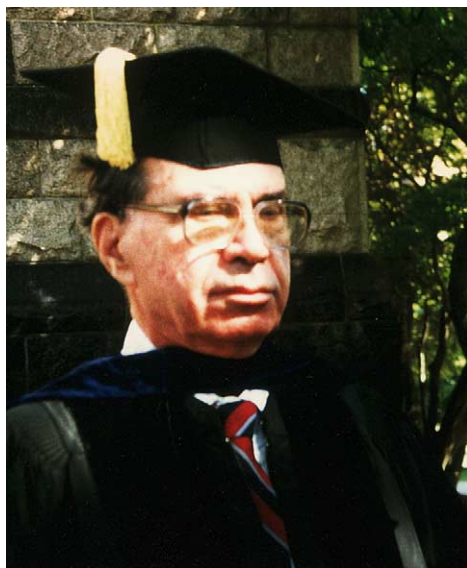


Personal Report
Obituary Prof. Dr. Joseph Gurland



On December 23, 2003 Joseph Gurland died at age 80, unexpectedly after having recovered well from a breakdown of health some years ago. The message of his death came as a shock to the scientific community, in particular to his friends and disciples from the many fields he has contributed to so much.

His life as well as his scientific career did not follow a simple pattern: Joseph (Joe) Gurland was born in Germany and as a boy had to leave Europe as his mother became a victim of the political situation. He studied at New York University, and after receiving the degrees of a Bachelor and a Master of Science he joined the Battelle Memorial Institute in Columbus in 1948. His first published contribution to science was on a truly innovative matter, i.e. “The Preparation and Properties of High-Purity Titanium”. The co-authors were R.I. Jaffee and J. Blocher who are now well known for the development of titanium sheet for supersonic airplanes and for the invention of chemical vapour deposition for metallurgical applications, respectively. Joe Gurland then joined the Metallurgy Department of the Massa-

chusetts Institute of Technology and, supervised by one of the best known metallurgists, J.T Norton, started to work in the field of tungsten carbide–cobalt alloys. For this group of technically important cutting materials little was known about the reasons for the unique synergism of hard and ductile phases. In only three years he finished the pioneering thesis “Role of the Binder Phase of Cemented Carbides” for which he received the Doctor of Science from MIT. Joe Gurland’s achievements opened this field and formed a basis for understanding the structure and properties of composite materials in general.

In 1951 Dr. Gurland joined one of the most prominent producers of cemented carbide, Firth Sterling at Pittsburgh, where he soon became head of the Basic Research Laboratory. He not only carried on research on production problems but also was involved in development, testing and standardisation of characterization methods for hardmetals in the CCPA (Cemented Carbide Producers Association of America) and ASTM (American Society for Testing and Materials). This

experience in an industrial environment was certainly important for his academic career. This started in 1955 at Brown University in Providence, Rhode Island, where D.C. Drucker and colleagues had established a leading Division of Engineering. Joe Gurland was appointed “Professor of Engineering” and educated a large number of students to pass the demanding requirements of the School of Engineering at this prestigious university, one of the schools of excellence in the “Ivy League” universities of Eastern United States.

Prof. Gurland invited young scientists to his research group, and in 1967/1968 I was fortunate to have been one of these privileged postdoctoral students. During the eight months I extended my scientific background and, as many others of Joe Gurland’s disciples, got a much deeper insight into the nature and physics of hard materials and cemented carbides, a field which I never fully left in the decades to come. Joe introduced me to his wife Dotty and his two daughters, invited me to his summer house and showed me how to sail and to fish (an absolute must with Prof. Ron Armstrong around). A lifelong friendship was established which brought him back to Germany for several months for joint research at the Max-Planck-Institute for Metals Research at Stuttgart. He also introduced me to some of the famous professors at Brown and at MIT. His calm and natural way of explaining the essence of scientific problems, his explorative mind, his belief in absolute human values and his inspiring way of discussing possible solutions had a great impact on me as well as on all other members of his group at that time as well as in the years before and those to come. We learned that fame and glory are secondary phenomena rather than goals of scientific work. Honours and awards came to him and, though welcomed, never changed anything in his conscientious and modest way of teaching and presenting the results of his research.

The wealth of Joe Gurland’s contributions to science is based on the quantitative relationships between the geometry of the microstructure and the properties of composite materials. Starting with investigating the W–C–Co phase diagrams for understanding liquid phase sintering and the formation of the brittle Eta-phase, he proceeded to modelling the toughness (transverse rupture strength) of cemented carbides. His approach to systematically collect data on the most important geometric features (volume fraction, size and distance) of the hard particles in composite materials led him to invent a new microstructural parameter which he called “contiguity”. This parameter is a quantitative measure for the degree to which the hard (and brittle) tungsten carbide grains form a continuous skeleton in the cobalt matrix separating them partially from each other. The concepts, equations and diagrams he derived early in his

career are now, about 50 years later, still valid and cited in most text books and reviews on cemented carbides and other composites.

Later, he improved the early approaches for predicting hardness from microstructural geometry by introducing the “continuous volume.” Another major contribution was to apply very early those concepts which later became ingredients of continuum mechanics, i.e. the effect of defects. The understanding of toughness and of brittle fracture was greatly enhanced by the idea that the differing distribution of defects causes the large scatter of toughness values for otherwise identical samples. Thus, toughness could be described quantitatively in statistical terms. He and his students tested the generalisation of these approaches by applying them not only to WC–Co alloys but also to steels and aluminium alloys. Another major achievement is due to a co-operation with French scientists during a sabbatical leave at IRSID, Paris, during which the sequence of processes occurring during ductile fractures (pore formation, growth, coalescence and catastrophic failure) was established. The experimental verification, extension and completion of these concepts were the basis of a complete theoretical foundation of fracture phenomena. Other sabbatical leaves were spent at the University of Newcastle-upon-Tyne and at the University of Strathclyde at Glasgow, both with Norman Petch, of Hall-Petch fame. At that time Joe Gurland succeeded in adding the element of grain size dependence into his description of the strength of polycrystalline composites.

The fascination of understanding the complex micro-mechanisms of two-phase materials continued beyond retirement in 1988. His work on the distribution of load between a brittle and a soft phase, the effect of redistribution during unloading and reverse loading, show Joe Gurland’s mastery in dealing with difficult problems of materials science. When, during the recent years, his creativity became focussed on other lines, he nevertheless followed new developments by his disciples and co-researchers with interest, and he actively contributed to progress by important advices and critical discussions.

Joe Gurland continued to edit the Alumni Review of Brown University, a most well-received newsletter, he organised the colloquium of the history of engineering during Brown’s Sesquicentennial Celebration in 1997. At this occasion he also presented a lecture exhibiting his profound knowledge of the evolution of the field which he also made available by published papers. He also kept his activities as a Fellow of the American Society for Materials and other organisations as the Steering Committee of the International Conferences on the Science of Hard Materials. It was certainly self-

understood that the next conference in this series (taking place in Puerto Rico this November) should be dedicated to honour his memory and to celebrate his pioneering contributions.

Joseph Gurland will be remembered by the scientific community as one of the outstanding personalities and one of the early pioneers in many fields of materials science. His students will continue to think of him gratefully as their beloved teacher and to be inspired by his ideas, his work and his achievements. His friends will miss his fascinating peace of mind, his affirmative devotion for human values and his inexhaustible

humour. Memory to this great man will not compensate the loss but will help to make it easier to bear it.

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