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BIOGRAPHICAL SUMMARY

POSITIONS

The University of Michigan, Professor Emeritus of Materials Engineering, 1993-
The University of Michigan, Professor of Materials Engineering, 1971-1993
The University of Michigan, Professor of Chemical & Metallurgical Engineering, 1962-1971
The University of Michigan, Associate Professor of Chemical & Metallurgical Engineering, 1959-1962
The University of Michigan, Assistant Professor of Science, 1955-1959
The University of Michigan, Research Associate, 1952-55
The Naval Research Laboratory, Research Chemist, 1944-46

EDUCATION

Ph.D. in Physical Chemistry, The University of Michigan, 1952
(L. O. Brockway - thesis director)
M.S. in Chemistry, The University of Michigan, 1948
B.S. in Agricultural & Biological Chemistry, Pennsylvania State University, 1944

Birth Date: 18 March 1923

RESEARCH ACTIVITIES

Professor in charge of the Electron Microscopy and X-ray Diffraction Laboratories in the Department of Materials Science and Engineering from 1960 - 1991.
Founder of the Electron Microbeam Analysis Laboratory, a central university research instrumentation facility, and Director from 1969 to 1987.
Primary research interests have involved the application of the methods of electron microscopy and x-ray and electron diffraction to the study of structure-property relationships in engineering materials.
Collaborator in research on: surface chemistry and lubrication; scale formation in the conversion of saline to fresh water; the distribution of silica and heavy metals in plant tissues; and indexing methods for X-ray powder diffraction data.

Because of my retirement from the University of Michigan (June 1993) I do not have any currently-active graduate students or sponsored research projects. However, I have served as a consultant on problems involving such topics as: the applications of transmission electron microscopy in studies of metal and ceramic materials; the examination of fractured surfaces by scanning electron microscopy; the analysis of preferred orientation in polycrystalline materials by x-ray diffraction pole figure methods; and the chemical analysis of materials by electron microbeam techniques.

Since retiring from active teaching at the University of Michigan, I have served as a consultant to Dr. L. F. Allard in the Materials Analysis Section of the High Temperature Materials

Laboratory at the Oak Ridge National Laboratory. In this capacity I have designed and supervised the construction of a high speed shutter and a special stage and reaction chamber for use in examining catalyst specimens for their Hitachi HF-2000 high resolution transmission electron microscope. I have also designed and built a similar system for examining catalysts in the JEOL 2010 HRTEM at the University of New Mexico, Recently I have designed specimen rods for the JEOL ACEM and the Hitachi HF3300 electron microscopes that permit utilization of special heating chips, manufactured by the Protochips Company, to examine specimens at high temperatures, and an ex-situ reactor for exposing electron microscope specimens to hydrogen gas at high temperatures for studies of hydrogen embrittlement at MIT.

TEACHING EXPERIENCE

I have taught introductory courses in the principles of engineering materials, and senior- and graduate-level courses on electron microscopy and microbeam analysis and electron and x-ray diffraction, for more than twenty five years. I have also taught general and physical chemistry, physical metallurgy, and the use of statistical methods in analysis of scientific data.

PROFESSIONAL SERVICES

Program advisor for undergraduate students in Materials Science & Engineering from 1967 to 1991.

Founder of the University of Michigan Electron Microbeam Analysis Laboratory, and Director of it from 1969 to 1987.

President of the Electron Microscopy Society of America in 1969, after having served several years on the Board of Directors and in the capacities of Membership Secretary and Program Chairman for the National Meetings.

President of the Midwest Chapter of the Microbeam Analysis Society in 1978.

PUBLICATIONS

I am a co-author on more than eighty publications on a variety of topics, including: the microstructure of heat-resistant alloys; the structure and surface chemistry of monolayers adsorbed from oil solutions; scale formation in the conversion of saline to fresh water; the distribution of silica and heavy metals in plant tissues; methods for indexing and searching x-ray powder diffraction data files, and special methods in electron microscopy,

I have also written a book on *Vacuum Methods in Electron Microscopy* that was published by Portland Press, London, 492 pp., 1994.

PROFESSIONAL SOCIETIES

The American Chemical Society (since 1944, 60-year member)
The Microscopy Society of America (since 1954, National President in 1969)
The Microbeam Analysis Society (charter member, 1968; Local Chapter President in 1978)
The Joint Committee for Powder Diffraction Standards
The Sigma Xi Research Society, Alpha Chi Sigma Chemistry Fraternity,
Tau Beta Pi Engineering Society

MILITARY SERVICE

Ensign, USNR 1944-46 doing research on special lubricating oils and rust inhibitors for Naval applications at the U. S. Naval Research Laboratory, Anacostia, D. C.

Active member of Naval Research Reserve Unit at the University of Michigan from 19 46 until retirement as Lt. Commander, USNR in 1965.