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Introduction

THE SEVENTH Annual Reliability of Physics Symposium sponsored by the Electron Device and the Reliability Groups of the IEEE was held in Washington, D. C., on December 2–4, 1968.

The classifications of the seven sessions were: 1) Electromigration Effects, 2) Semiconductor Bulk and Surface Effects, 3) Metallization and Contacts, 4) Physical Reliability, 5) Mathematics of Reliability, 6) Scanning Electron Microscopy, and 7) Current Developments.

A cross section of the scientific community in the field of Reliability of Physics was reflected by those attending this conference; the materials scientist, the processing engineer, the device designer, the metallurgist, the analytical instrumentation specialist, the reliability engineer, and the electronic engineer.

The subject matter discussed at this conference emphasized the critical areas responsible for the predominant failure modes in integrated circuits as well as the analytical techniques and instrumentation necessary for failure mode characterization.

The fact that metallization and surface effects are the most important failure mechanisms was underscored by the predominance of papers on these subjects. The papers selected from the symposium for this publication are representative of all of the subject matter of the symposium and are indicative of the scientific interest toward better understanding of physics of reliability.

This publication is unique in that it has provided for the dissemination of the papers of a major symposium in a relatively short time interval. This has been made possible by the very close cooperation and the selective reviewing by the following scientists who have acted both as assistant guest editors and reviewers: Arnold Lesk, Karl H. Zaininger, Clare Thornton, George Schnable, Harry Sello, Steven R. Hofstein, Jane Partridge, Robert E. Ogilvie, Joseph Vacarro, David Barber, George Jacobi, John Silverstein, David Metz, and Philip Eisenberg. Appreciation is also extended to Glen Wade, Editor of this TRANSACTIONS, and to Mrs. Oneita Wilde for her assistance.

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Guest Editor

Seymour Schwartz (S'42–A'43–M'53–SM'56) was born in Lowell, Mass., on April 11, 1923. He received the B.S. degree in physics from Harvard University, Cambridge, Mass., in 1948, and the M.S. degree in material science from Northeastern University, Boston, Mass., in 1968.

He was formerly the Chairman of the Board of Directors and Director of Research of Transistor Applications Inc., and President of Transistor Corporation of America. During the past 25 years he has been employed as a physicist, electronic engineer, and integrated circuit consultant at Harvard University, M.I.T. Lincoln Laboratories, Sylvania, Melpar, and C.B.S. He has also been an instructor at Northeastern University and at M.I.T. in their summer program. He is the editor and co-author of the book *Integrated Circuit Technology: Instrumentation and Techniques for Measurement, Process and Failure Analysis*, and editor-in-chief of the book *Selected Semiconductor Circuits Handbook*. He is a contributing author to the *Radio Engineering Handbook*, and *Transistor Circuits and Applications*. He is also the author of numerous technical publications, and is the co-inventor of U. S. Patent 2 962 292 on power transistors. He served as technical program chairman of the 1968 IEEE Physics of Reliability Symposium. He is currently the Chief of the Failure Mechanisms Branch of the Advanced Technology Directorate, NASA Electronics Research Center, Cambridge, Mass.

Mr. Schwartz is a member of the Electrochemical Society.