

PROCEEDINGS
ELECTRON MICROSCOPY
SOCIETY OF AMERICA

THIRTY-FIFTH ANNUAL
MEETING

1977

Edited by
G. W. BAILEY

PROCEEDINGS

THIRTY-FIFTH ANNUAL MEETING
ELECTRON MICROSCOPY SOCIETY OF AMERICA

BOSTON, MASSACHUSETTS

August 22-26, 1977

Editor

G. W. BAILEY

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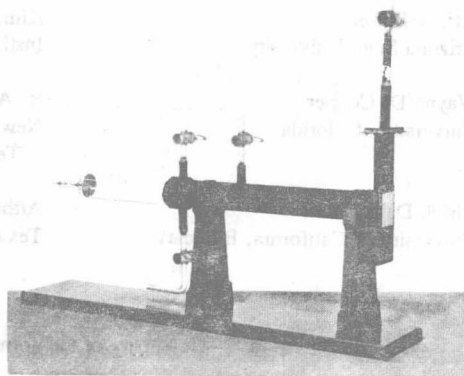
50TH ANNIVERSARY OF ELECTRON DIFFRACTION



In 1927, Clinton J. Davisson (right) and his associate, Lester H. Germer, with the tube they used in their classic experiments.



G.P. Thomson



Vacuum tube used by G. P. Thomson and A. Reid in the first demonstration of transmission electron diffraction.

This year marks the 50th Anniversary of the experimental verification of the wave nature of electrons by Davisson and Germer in the United States and Thomson and Reid in Britain. In 1937, Davisson and Thomson shared the Nobel Prize for their work.

PREFACE

This year marks a number of milestones for those of us active in the field of electron optics: our Society presents its thirty-fifth annual meeting, this is the fiftieth anniversary of electron diffraction and we are beginning the second decade of these EMSA Proceedings. Progress in our field has been at an increasing rate and EMSA has played an important role in the dissemination of the technical details of the discoveries and accomplishments of the past thirty-five years. During recent years, our Proceedings has provided a permanent record of many of these discoveries and accomplishments. We are continuing in our efforts to improve the Proceedings and hope that this 1977 volume will reflect those efforts.

Many people have played an important role in the assembly and preparation of this Proceedings. I would like to acknowledge the assistance of the Program Committee, our president, Tom Everhart, and my editorial staff including Creighton Smith for his editorial assistance, my wife Pat, for her secretarial work and my family of proofreaders. I would also like to acknowledge the assistance and encouragement that I have received from the Exxon Research and Development Laboratories during the past year while this Proceedings was being prepared.

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FOREWORD

T. E. EVERHART

President of the Electron Microscopy Society of America

Welcome to the thirty-fifth Annual Meeting of the Electron Microscopy Society of America, held in Boston in conjunction with the eighth International Conference on X-Ray Optics and Microanalysis. These joint meetings benefit not only those who are members of both societies (EMSA and MAS), but also other members of each society who we hope will learn something extra from the enriched program. For many years, the Transmission Electron Microscope was the instrument we used to learn about the physical and biological world. More recently, many of us have used the Scanning Electron Microscope, and now that commercial Scanning Transmission Electron Microscopes are becoming available, we have become a multi-instrument society. In the early days, information came only in the contrast change of the image. Today, it may come from nondispersive x-ray analysis, from the characteristic energy loss of a primary electron, or from many other mechanisms. We gain increasing amounts of information through our better quantitative understanding of these instruments, and what is taking place within them . . . and yet perhaps our contributions are most easily understood because "a picture is worth a thousand words."

Our local and regional meetings have been strong recently, showing a grass-roots strength that promises vitality for the future of the national society. Next year, we shall participate in the International Meeting of the Federated Societies of Electron Microscopy, which will be in Montreal, Canada. Being absolved from our normal annual involvement with program, the Council is working on new directions for the Society, including improved relations with Cell Biology and a reviewing procedure for proceedings papers. We plan to experiment with poster sessions for applications papers, in order to emphasize instrumentation, techniques, and novel image formation papers in the lecture sessions, since we feel these papers will be of more general interest to our membership.

On behalf of all of us, I wish to thank those responsible for the Boston meeting. Paul Lublin has led the local arrangements committee for this meeting; his team has handled a myriad of details necessary to make such a large meeting run smoothly. Our program committee has worked hard under the capable leadership of John Hren, ably assisted by Bill Massover. The program committee has argued (successfully) to have certain policies modified to improve their flexibility and the total program. This dynamic interaction in the society is most healthy. Continuity to our year-to-year operations is provided by Frances Ball, our council secretary, and Kenneth Lawless, our treasurer, who should receive much credit for their devoted service to the society. An important source of periodic information about the society is the EMSA Bulletin, edited by Larry Thurston. Bill Bailey deserves much credit for the quality of the Proceedings, which you are reading. Behind the scenes, many others work quietly but effectively on various committees. And of course, all of you who submitted papers to this meeting should be thanked—the meeting would not be possible without your efforts.

One EMSA Distinguished Award will be presented to Professor Robley C. Williams, who introduced shadow-casting techniques, the use of polystyrene latex spheres, has been a pioneer in the electron microscopy of viruses, and served as president of the EMSA in 1951. The other Distinguished Award will be presented to Dr. James Hillier, who helped build the first transmission electron microscope on this continent in 1939-40, is joint author of a pioneering book on electron microscopy, and has also served as president of the EMSA. The Burton Award goes to Dr. Robert Sinclair of Stanford University for his EM contributions to Materials Science. The young scientists involved in our society are its assurances of future vitality. Those graduate students who have been awarded EMSA Presidential Scholarships are listed with other award winners separately. I congratulate them on behalf of us all.

Berkeley, California
April, 1977

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