

PRENTICE-HALL
INTERNATIONAL SERIES IN ELECTRICAL ENGINEERING



SERIES

Roberts and Vanderslice



Ultrahigh Vacuum and its Applications

ULTRAHIGH VACUUM

AND ITS APPLICATIONS

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PRENTICE-HALL, INC.

Englewood Cliffs, N.J.

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Englewood Cliffs, N.J.

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Current printing (last digit):

12 11 10 9 8 7 6 5 4 3

Library of Congress
Catalog Card No. 63-18110
Printed in the United States of America
C 93565

2

*Dedicated to
Katharine B. Blodgett
and
W. D. Walters*

PREFACE

Historically, vacuum technology has been of major importance in the evolution of electronics ever since the first vacuum tube was constructed. Means for obtaining and measuring vacuums have proven indispensable in the development of nearly all electronic devices. Likewise, such means are basic to the understanding of surface physics and surface chemistry.

For many experiments and purposes, pressures of the order of 10^{-6} torr (10^{-6} mm Hg or about 10^{-9} atmosphere) are low enough, even though surface phenomena studies show that at 10^{-6} torr a surface becomes covered with adsorbed gas in only a few seconds. Other experiments, however, require the use of ultrahigh vacuum. At lower pressures the number of collisions of gas phase atoms and molecules with a surface is so small that a clean surface remains free of contamination long enough to do experiments on the surface itself. Recent surface studies have required pressures of 10^{-9} torr or lower. At this pressure no significant surface contamination occurs for a several-hour period. Pressures of 10^{-8} torr and below are generally called the ultrahigh vacuum range. Ultrahigh vacuum is a requisite for many experiments that involve either the reaction between a surface and a gas or the properties of the surface itself.

Currently, the understanding and application of techniques of ultrahigh vacuum are somewhat restricted to specialists who of necessity are familiar with meeting reports, subject literature that appears in scientific journals, and parts of textbooks. From this material these men have gained a working knowledge of the inherently simple techniques needed in ultrahigh vacuum experiments. It has been clear for some time that a book devoted to the study of ultrahigh vacuum was needed. We trust that this book answers such a need.

Ultrahigh Vacuum and Its Applications is written primarily for the experimental scientist, engineer, or technician who has a nodding acquaintance with ordinary vacuum techniques and wishes to extend his knowledge to include ultrahigh vacuum technology. We have carefully considered the components, their theories of operation, their assembly and use, and the nature of the materials of construction necessary for work in this field. Data and guides for the production and use of ultrahigh vacuum have been collected in one place. The impact of ultrahigh vacuum on problems of technology is illustrated by a brief discussion of thin films, catalysis, boundary lubrication, and space simulation. This book spells out how to do it and where to find it.

R. W. Roberts and T. A. Vanderslice

ACKNOWLEDGMENTS

The need for a small book on ultrahigh vacuum technology was first pointed out to us by Dr. F. J. Norton and Dr. L. E. St. Pierre. Dr. St. Pierre participated in the early preparation of the manuscript and wrote the section on boundary lubrication (7-2).

We are grateful to Dr. K. B. Blodgett and Dr. G. L. Gaines, Jr., for their penetrating criticisms of the manuscript and their many suggestions for improvement. We would also like to thank Dr. P. Cannon, Dr. C. W. Tucker, Dr. N. R. Whetten, and Dr. J. R. Young for helpful discussions.

Mrs. N. L. Gaertner and Miss C. W. Wilson aided in the preparation of the figures and tables.

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