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Volumes 1–56 are listed on the back inside cover

Electrets

Edited by G. M. Sessler

With Contributions by
M. G. Broadhurst G. T. Davis
R. Gerhard-Multhaupt B. Gross S. Mascarenhas
G. M. Sessler J. van Turnhout J. E. West

Second Enlarged Edition

With 227 Figures

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Professor Dr. *Gerhard M. Sessler*

Fachgebiet Elektroakustik, Universität Darmstadt, Merckstraße 25,
D-6100 Darmstadt, Fed. Rep. of Germany

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Preface to the Second Edition

The first edition of this volume has been well received by readers and reviewers. In addition to the original English version published in 1980, MIR in Moscow issued a Russian edition in 1983. Since copies of the first edition are now exhausted while interest in the material continues, Springer-Verlag has asked the editor to prepare a new edition.

The present second edition contains the seven chapters of the original book and one additional chapter outlining recent progress in the field. The older chapters are essentially unchanged, except for the correction of misprints that came to the attention of the authors. Since the literature on electrets has significantly increased in the interim period, the discussion in the new chapter had to be much more concise than in the existing parts of the book. Even so, many of the new papers could, for reasons of space, not be included. A listing of recent literature concludes the book.

The editor expresses his gratitude to his fellow contributors for providing valuable suggestions concerning the new edition and to Springer-Verlag, especially to Dr. H. K. V. Lotsch, for a most gratifying collaboration.

Darmstadt, January 1987 *Gerhard M. Sessler*

Preface to the First Edition

Electrets have, over the past decade, emerged as invaluable components in an ever increasing number of applications. Their usefulness is responsible for the recent impressive growth of research work in a field which had been actively investigated since about 1920.

This volume aims to present the fundamental aspects of electret research as well as a detailed review of recent work in this area. The book is broad in scope, extending from the physical principles of the field to isothermal and thermally stimulated processes, radiation effects, piezoelectric and pyroelectric phenomena, bioelectret behavior, and, last, but not least, to applications of electrets. The emphasis of the experimental work discussed is on polymer electrets, but work performed on other organic substances, notably biomaterials, and on inorganic materials, such as ionic crystals or metal oxides, is also reviewed.

The interest in polymer electrets is due to the fact that these show extremely good charge-storage capabilities and are available as flexible thin films. In the 1960s attention focussed on highly insulating polymers, such as polytetrafluoroethylene, which have deep traps that store charges for extremely long periods of time. Around 1970, discovery of the strong piezoelectric properties of polyvinylidenefluoride attracted the imagination of many researchers and an enormous amount of work was devoted to the investigation of the physical and chemical properties of this and similar materials. Today, very active research is underway on charge-storage properties of both classes of polymers.

The chapters of this book are generally self-contained in the sense that each can be understood on its own. There are, however, many cross-references between chapters which will help to guide the reader to related or supplemental material in other parts of the volume. Uniform symbols and abbreviations are employed for the most-frequently used quantities and polymer names. A list of polymer names will be found in Chapter 1, a partial list of symbols at the end of the volume.

Although there have been a few monographs on specific topics of electret research and a number of conference proceedings, a cohesive treatment of the entire field of electrets has so far been lacking. The present volume, by covering many aspects of the field in a relatively small space, is an attempt in this direction. We realize, however, that a number of important questions are not, or not sufficiently, discussed, and that the views held by the different contributors are not always congruent.

It is with great pleasure that the editor expresses his gratitude to his fellow contributors, each being a renowned authority in his field, for their collaboration. The preparation and updating of the manuscripts placed a considerable burden on these colleagues, which they carried with understanding.

The book is dedicated to Professor *Bernhard Gross*, himself a contributor, by his fellow contributors. *Bernhard Gross* is the nestor of electret research, both theoretical and experimental. Apart from this, he has enhanced the knowledge in many other parts of physics. Without his contributions, electret research would not be what it is today. It is with admiration and gratitude that his coauthors devote this book to him.

Darmstadt, September 1979 *Gerhard M. Sessler*

Contents

5. Piezo- and Pyroelectric Properties

8. Recent Progress in Electret Research

Contributors

Broadhurst, Martin G.
United States Department of Commerce, National Bureau of Standards, Washington DC 20234, USA

Davis, G. Thomas
United States Department of Commerce, National Bureau of Standards, Washington DC 20234, USA

Gerhard-Multhaupt, Reimund
Heinrich-Hertz-Institut für Nachrichtentechnik Berlin GmbH, Abteilung S+E, Einsteinufer 37, D-1000 Berlin 10, Germany

Gross, Bernhard
Institute of Physics and Chemistry of São Carlos-University of São Paulo, Caixa Postal 369, 13560 São Carlos, S. P., Brazil

Mascarenhas, Sérgio
Institute of Physics and Chemistry of São Carlos-University of São Paulo, Caixa Postal 369, 13560 São Carlos, S. P., Brazil

Sessler, Gerhard M.
Fachgebiet Elektroakustik, Universität Darmstadt
Merckstraße 25, D-6100 Darmstadt, Fed. Rep. of Germany

van Turnhout, Jan
Plastics and Rubber Research Institute TNO, PO Box 71, 2600 AB Delft, The Netherlands

West, James Edward
AT & T Bell Laboratories, 600 Mountain Avenue, Murray Hill, NJ 07974, USA