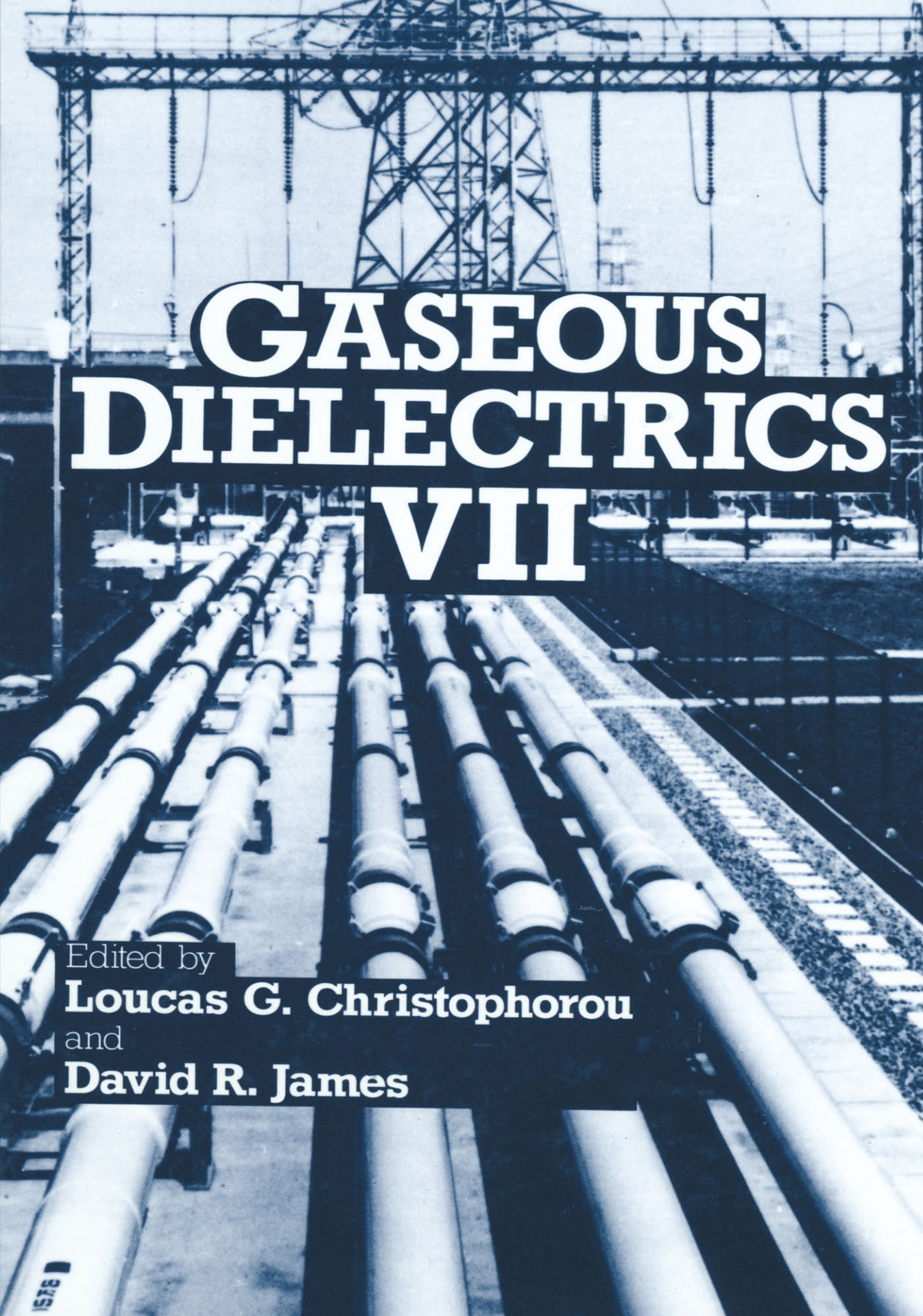

GASEOUS DIELECTRICS VII

Edited by
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PREFACE

The Seventh International Symposium on Gaseous Dielectrics was held in Knoxville, Tennessee, U.S.A., on April 24-28, 1994. The symposium continued the interdisciplinary character and comprehensive approach of the preceding six symposia.

Gaseous Dielectrics VII is a detailed record of the symposium proceedings. It covers recent advances and developments in a wide range of basic, applied and industrial areas of gaseous dielectrics. It is hoped that *Gaseous Dielectrics VII* will aid future research and development in, and encourage wider industrial use of, gaseous dielectrics.

The Organizing Committee of the Seventh International Symposium on Gaseous Dielectrics consisted of G. Addis (U.S.A.), L. G. Christophorou (U.S.A.), F. Y. Chu (Canada), A. H. Cookson (U.S.A.), O. Farish (U.K.), I. Gallimberti (Italy), A. Garscadden (U.S.A.), D. R. James (U. S. A.), E. Marode (France), T. Nitta (Japan), W. Pfeiffer (Germany), Y. Qiu (China), I. Sauers (U.S.A.), R. J. Van Brunt (U.S.A.), and W. Zaengl (Switzerland). The local arrangements committee consisted of members of the Health Sciences Research Division and personnel of the Conference Office of the Oak Ridge National Laboratory, and staff of the University of Tennessee (UTK). The contributions of each member of these committees, the work of the Session Chairmen, the interest of the participants, and the advice of innumerable colleagues are gratefully acknowledged. I am especially indebted to Dr. Isidor Sauers, Dr. David R. James, Mrs. Joan E. Carrington, Ms. Jo Ann Cripps, and Mrs. Doris Crowell for their assistance during the symposium and for their help with the manuscripts.

The symposium was hosted by the Oak Ridge National Laboratory and the University of Tennessee and was sponsored by the U.S. Department of Energy, the UTK/ORNL Science Alliance, the Aero Propulsion and Power Laboratories of the Wright Research and Development Center and the Tennessee Valley Authority; it was organized in cooperation with the Institute of Electrical and Electronics Engineers, Inc., the Power Engineering Society, and the Dielectrics and Electrical Insulation Society. The continued support of the Oak Ridge National Laboratory and the University of Tennessee and the financial assistance of the sponsors are acknowledged with gratitude.

L. G. Christophorou, Symposium Chairman

Oak Ridge, Tennessee
July, 1994

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SECTION 1: BASIC PHYSICS OF GASEOUS DIELECTRICS

ANION FORMATION IN MOLECULES AND CLUSTERS: ELEMENTARY PROCESSES INDUCED BY SLOW ELECTRONS

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INTRODUCTION

We will discuss here some basic aspects in the interaction of low energy electrons (0-10 eV) with molecules and weakly bound van der Waals clusters with particular emphasis to processes resulting in negative ions. We shall illustrate in a case study that (i) the primary step of electron localization und (ii) the evolution of a temporary negative ion differs substantially on going from isolated molecules under single collision conditions ($\leq 10^{-5}$ mbar) to higher pressures (beyond single collision conditions , $\geq 10^{-4}$ mbar) and finally to the corresponding molecular clusters.

Consider a neutral molecule M (isolated or in close proximity to other molecules) interacting with free electrons. At certain specific energies resonant electron capture can directly form a "temporary negative ion" (TNI): [1-3]

$$e^- + M \rightarrow M^{-(*)} \quad (1)$$

which can principally react via the following scheme

$$M^{-(*)} \xrightarrow{\tau_a} M^{(*)} + e^- \quad (2)$$

$$M^{-(*)} \xrightarrow{\tau_d} R + X^- \quad (3)$$

$$M^{-(*)} \xrightarrow{\tau_s} M^- + \text{Energy} \quad (4)$$

Process (2) is autodetachment recovering the neutral molecule (eventually in an excited state), (3) is dissociative electron attachment leading to stable fragments, and (4) is stabilization into the thermodynamically stable parent anion. This last process can only occur for molecules possessing a *positive electron affinity.*