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Yu. P. Raizer

Gas Discharge Physics



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is both a textbook for beginners and a handbook for specialists in plasma physics and gaseous electronics. The book contains useful data: results of experiments and calculations, and reference data. It provides tables of typical parameters and formulas suitable for computations. Discharges of all important types are considered: breakdown, glow, arc, spark and corona, radio frequency, microwave and laser. The interaction between plasma ions and electrostatic and electromagnetic fields, low-temperature plasma production, and applications to high-power lasers are treated in detail.

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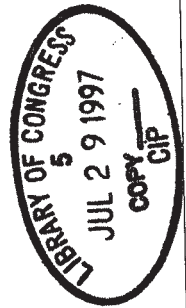
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Preface

Gas discharges are of interest to physicists and engineers in a number of fields. Several decades ago excellent textbooks were written by von Engel and Steenbeck, Loeb, Brown, Kapsov and several other authors. These books faithfully served many generations of students, and specialists still refer to them. Nevertheless, their usefulness does suffer from the time elapsed since publication: It is not that the material they present has become obsolete and irrelevant - this has happened to a very minor extent, if at all. Rather, the subject has greatly advanced both in scope and in depth, and its emphases have somewhat shifted. Of course, new books have been written, mostly monographs devoted to narrow branches of gas discharge physics. But these books are typically intended for the specialist and not so much for the novice in the field.

The need for a new textbook that is understandable to a beginner in gas discharge physics, and that conveys the right amount of information (even more important: information of the right kind) making it also useful to the specialist is apparent. With this in mind, our intention has been to produce a book that serves both as a textbook and a handbook.

From an immense amount of material we have selected, as best we could, the parts that are required for an understanding of the physics and those points that are most frequently needed in research. As a convenient and comprehensive volume, the book contains a maximum of useful data: experimental results, results of calculations, and reference data; formulas required for estimates have been reduced to a form suitable for computations.

This work was published in Russian in 1987 as a substantially larger volume. The English edition has been abridged at the expense of ancillary material concerning collisions, elementary processes, plasma radiation, plasma diagnostics, and other topics, though the chapters dealing with the central themes of discharge physics are retained in full, and even expanded by the addition of new data.

We have decided not to cover actual circuits, techniques, or methods (we will cover the ideas, though) of experiments and measurements; instead we concentrate on the physics of the processes of interest. Purely technical applications of gas discharges are not discussed for the same reason.

It would be impossible to give a comprehensive bibliography when covering such an immensely wide scope of topics; hence, original papers are cited only when recent results are discussed. In all other cases we refer to a book or review paper where more complete references are given.

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Yu. P. Raizer

Moscow, April 1991

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