BOOK REVIEW

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Industrial Plasma Engineering, Volume 1: Principles

Author	J. Reece Roth
Publisher	Institute of Physics, Bristol, Bristol BS1 6NX, United Kingdom and Philadelphia, Pennsylvania
Pages	538
Price	$135
Reviewer	Brian C. Gregory

This is a well-written textbook that will find ample use in the classroom in the early-graduate-studies phase for students involved with plasmas for industrial applications. The text, the first of two volumes, provides the basic physics necessary to understanding the various configurations of plasma setups used in processing materials in industry. It also describes these different configurations with excellent diagrams and provides fairly simple explanations of the physics—to the extent that an explanation is possible. The second volume will be devoted to application and will appear early in 1997.

The first chapter, "Introduction," might strike some readers as overly didactic, going to the extent of providing lists and descriptions of scientific reviews and conferences for the field. The section on "Global Energy Issues" makes splendid reading but is more appropriate for a book on fusion. This chapter can be skipped without losing continuity. The second, third, and fourth chapters provide the theoretical background for the understanding and analyses in the rest of the text. These chapters are very well done; they are clearly written with many figures and a minimum of mathematical complexity. Chapter 2 deals with the kinetic theory of gases; Chap. 3 deals with the motion of charges in electric and magnetic fields, including diode theory; and Chap. 4 deals with the characteristics of plasma, including the bulk properties, collisions, sheaths, transport, and simple discharge physics. The plasma model used is essentially Lorentzian. Readers familiar with basic plasma theory can omit the first four chapters, but I found them refreshing to read and a very good review of concepts and details that can stand some dusting-off from time to time.

Next, Professor Roth treats electron sources and beams (Chap. 5) and ion sources and beams (Chap. 6). This material is very complete with many illustrations and covers the difficult subject of hollow cathode sources and several different types of ion sources. Chapter 7 covers cyclotrons, the betatron, the synchrotron, pinches, and the plasma focus as sources of ionizing radiation. Chapter 8 describes dark discharges in gases including the Townsend and coronal discharges. Chapters 9 and 10 cover glow discharges and direct-current arcs with emphasis on configurations used for industrial applications. In the former, the difficult topics of sheaths and moving striations are well presented. Both these chapters conclude with sections on outstanding issues in their respective fields—a useful addition.

The three final chapters in the text deal with radio-frequency (rf) discharges. Chapter 11 discusses inductive rf discharges and the inductive plasma torch in some detail. Chapter 12 treats capacitively coupled rf discharges, both with and without a magnetic field. The rf sheath is discussed in some detail, and examples of both plasma reactors and plasma sources are provided. Again, Professor Roth includes a section on unresolved issues in capacitive rf discharges as well as a section on applications. The subject of the final chapter in this volume is microwave discharges both with magnetic fields (electron cyclotron resonance sources) and without. The theory of microwave breakdown is thoroughly treated.

Throughout, adequate references are given at the end of each chapter. There are a few typographical errors and an occasional mistake on a diagram, but these are not a major impediment to the reader's understanding. I enjoyed reading the book and recommend it highly to others as a clearly written, well-illustrated and very informative text, which brings up to date the material in several older "classics" such as Cobine, Loeb, and Von Engel.

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