Engineering Design: A Systematic Approach

G. Pahl and W. Beitz; translated by K. Wallace, L. Blessing, and F. Bauert; and edited by K. Wallace (Springer-Verlag, London, 1996)
ISBN 3-540-19917-9

As the demand for greater design content in engineering education increases, the need for appropriate textbooks on the subject also grows. This need is particularly acute in materials engineering curricula where design education has often been haphazard at best. As a result, several new or revised engineering design texts have appeared in recent years with a particular focus on product development and production. *Engineering Design: A Systematic Approach* is the second English-language version of a popular German text; its predecessors include G.E. Dieter's *Engineering Design: A Materials and Processing Approach* (2d ed., McGraw-Hill, New York, 1991), and A. Ertas and J. Jones's The *Engineering Design Process* (Wiley, New York, 1993).

An engineering design textbook can fulfill two functions: describe to students the general principles behind the invention of new products or processes, and introduce design-related engineering topics which the authors consider relatively ignored elsewhere in the curriculum. Primarily focusing on the first of these tasks, *Engineering Design: A Systematic Approach* introduces a seven-step design sequence corresponding to four phases of the overall process in Chapter One, then, in much of the remainder of the book, elaborates on the different steps. The sequence is similar to that used by Dieter and by Ertas and Jones, although product optimization is more emphasized by Pahl and Beitz, and competition between alternatives less so.

As with other design texts, this book is intended for mechanical engineering students rather than those in materials-oriented curricula. Nevertheless. much of the more general topics covered will be of interest. Engineering design philosophy should be applicable to all disciplines in the field, and the examples provided in the text are accessible for materials students. The book makes an effort to include the nontechnical (i.e., human) factors associated with product development, as well as the application of engineering principles.

Engineering Design: A Systematic Approach has some advantages over its alternatives. It is well-illustrated, thorough, and reasonably priced. If the presentation of design philosophy is the primary goal of an instructor, this book deserves consideration. However, the writing style is not as "undergraduate-friendly" as that of Dieter and of Ertas and Jones, and the introductions to "affiliated engineering topics" (such as engineering economy, ethics, and statistical process control) in the latter two texts are not available in Pahl and Beitz's work. North American instructors will also be required to replace the European standards and regulations described in the text with the appropriate equivalents.

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Plasma Deposition of Amorphous Silicon-Based Materials

Giovanni Bruno, Pio Capezzuto and Arun Madan, eds. (Academic Press, San Diego, 1995)
ISBN 0-12-137940-X

Academic Press advertises that *"Plasma Deposition of Amorphous Silicon-Based Materials*...links the fundamental growth kinetics involving complex plasma chemistry with the resulting semiconductor film properties and the subsequent effect on the performance of the electronic device produced." However, co-editors G. Bruno and P. Capezzuto write in chapter 1 that "There is little understanding of the complex and multiple interaction processes that occur at the juncture of the plasma and a surface...." The current state of understanding lies in between these extreme statements. Research during the past decade has elucidated many of the major features of film growth and the relationship between film structure and properties; but the formation of defects in small concentrations remains both the major limitation to device performance and the most difficult aspect to study experimentally. This book, consisting of six chapters written by a total of thirteen authors, provides uneven coverage of the subject matter. The concept is good: The six chapters are concerned with (1) the chemistry of a-Si:H deposition; (2) diagnostics of plasma processes; (3) the relationship between deposition conditions and film properties; (4) reactor design; (5) the properties of films; and (6) devices. For the reader who has little acquaintance with amorphous silicon deposition and devices, this book provides a rapid means to become acquainted with the major phenomena and current issues, for example, the mechanisms and role of dust formation in reactive plasmas and the need for compositionally graded interfaces in solar cells.

Unfortunately this volume has shortcomings which render it unsatisfactory for the expert reader who seeks a precise knowledge of the leading edge challenges. Chapters 1, 3, 5, and 6 excessively focus on the work and interests of the particular authors rather than provide thorough reviews. These chapters present large quantities of data, but lack critical discussion of insightful analysis. There are signs of hasty preparation, including occasional misstatements; lack of reference, inconsistencies, and redundancy between chapters; and poor quality figures which were obviously submitted by facsimile. Not enough mention is made of the excellent books and review chapters of the past, and in many instances the authors cite the earliest reference to a technique or finding, but not the latest or best-developed one(s). Fortunately, chapter 2 by Guy Turban et al. and chapter 4 by Jerome Perrin are excellent. This may reflect the fact that the subjects—the diagnostics of plasma processes and reactor design, respectively—are branches of more mature fields of study.

This book is useful for the beginning or intermediate student since it provides broad coverage of the important issues and sometimes conflicting observations in this diverse field. Two of the six chapters provide excellent and insightful reviews of plasma processes. But the mixed quality of the other chapters places this work below the mark of archival quality which was achieved in past works on amorphous silicon, such as *Semiconductors and Semimetals* Vol. 21 A–D, (edited by Pankove, Academic Press, Orlando, 1984), *Topics in Applied Physics* Vols. 55–56 (edited by J.D. Joannopoulos and G. Lucovsky with contributions by D.E. Carlson et al., Springer-Verlag, Berlin, 1984), or *Advances in Amorphous Semiconductors*, parts 1–2 (edited by H. Fritzsche, World Scientific, Singapore, 1988).

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https://doi.org/10.1557/S0883769400035776 Published online by Cambridge University Press