

tions preceding the first chapter.

Nevertheless, the writing is literate and well organized, with good motivations and an easy flow of thought into which the symbolic expressions are smoothly integrated. A liberal sprinkling of carefully conceived figures supplements the text. Particularly helpful is the list of 15 or more exercises appended to each chapter, with which the serious student can check and reinforce his or her comprehension. In sum, it seems evident that this textbook evolved from course notes that, in the spirit of the 1990s, were continually improved, over several incarnations, to their present highly developed state. This very precision of development aims Smith's treatise squarely at the level of an introductory graduate course, although the work will also serve as an excellent reference and study volume for the knowledgeable practitioner.

The text is organized into ten chapters and five appendices. After a short introductory chapter, the next two chapters review the underlying subjects of gas kinetics and vacuum technology in preparation for the subsequent treatments of evaporation, deposition and epitaxy, wherein thermal evaporation is regarded as the classical mode of vaporization for thin-film deposition. Alternative modes of vaporization by chemistry (volatile compounds), energetic beams (electron, ion and laser) and glow-discharge sputtering are then considered, where the all-important subject of energetic deposition is embedded in the latter two chapters. The final chapter considers thin-film analysis and properties while each chapter contains its own list of references and recommended readings, and the book concludes with an 18-page index that will serve the reader well.

Notwithstanding the breadth of his approach, Smith also includes such recent developments as laser ablation, modification of depositing films by low-energy ion bombardment and control of macroparticles from cathode arc and laser ablation vapor sources. The author's allusion to the nuances of his subject, such as the variation and measurement of residual stress during thin-film deposition, is impressive; although one wonders if this level of detail might be confusing to a student entering the field, it is eminently useful to those who may use this book as a reference.

In a monograph this ambitious, it is perhaps inevitable that some misconceptions and errors should go undetected, as in figure 9.11, where the indicated nonuniform magnetic field configuration would concentrate plasma erosion of the cylindrical sputtering

target at its midpoint, contrary to the efficient utilization (uniform erosion) of the sputtering target referred to in the text. In fact, practical cylindrical magnetron development hinges on the imposition of both exterior and interior magnetic coils carefully configured and aligned so that the imposed field is highly uniform and parallel to the axis of the target, thereby effecting a uniform plasma discharge and uniform target erosion. The reader should bear in mind the possibility of such occasional inaccuracies.

Regarding the overall organization of this book, my principal comment is that the essential and current subject of energetic deposition, which is fundamental to the understanding of thin films, could have been usefully consolidated and elaborated as a separate chapter. Nevertheless, this attractively presented monograph is an admirable effort and an important addition to the literature on thin-film deposition. It should stand the test of time and deserves to be issued in subsequent corrected and updated editions. Buy it!

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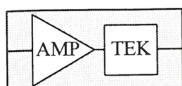
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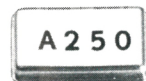
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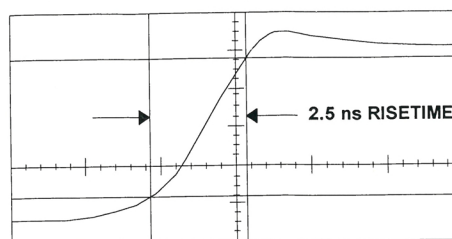
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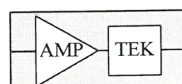
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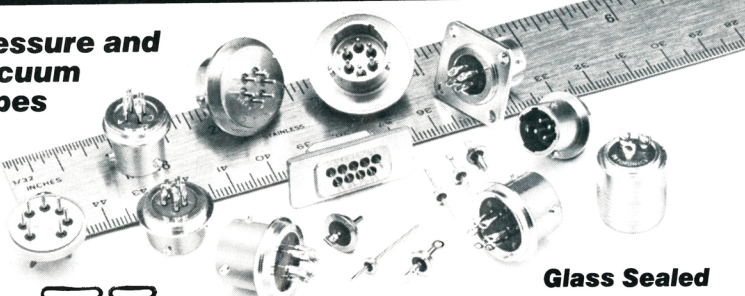
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