Materials Sciences: Federal Policies, Research and Technology Transfer

Carolyn Bloch

(Noyes Publications, 1987)

Don't be fooled by the impression of comprehensive coverage that the title conveys. This volume consists of a concatenation of what appear to be anecdotal reports of government lab and agency missions and activities. Although no explicit source citations can be found in the text (a serious deficiency in itself), it appears that information has been gleaned from existing laboratory and agency reports which vary widely in depth, breadth and completeness. It is also left unclear as to what if any special expertise or perspective can be expected from the author since no disciplinary or institutional affiliation is given.

The book is organized into three sections: materials related legislation and studies (a scant 23 pages of large dot-matrix quality double-spaced print); federal agency research (142 pages organized by agency, laboratory, and/or program); and federal collaboration with universities and industry (64 pages of brief technology-transfer program descriptions). No single entry provides enough detail to obviate the need to find original source material or contact principals directly.

Perhaps, therefore, the most useful aspect of this work is the appendix which tabulates federal information sources including addresses and telephone numbers.

Another useful feature is simply the appreciation this text forces on the reader for the large number of separate and independent federally connected materials-related foci which exist in the United States. The table of contents serves this purpose well without need to refer to the rest of the book. This last point, of course, explains why an effort to comprehensively deliver what is implied by this book's title in a single volume was bound to and did fail.

Reviewer: E.N. Kaufmann is an associate division leader for materials research at the Lawrence Livermore National Laboratory.

Laser Processing of Thin Films and Microstructures: Oxidation, Deposition and Etching of Insulators

Ian W. Boyd

(Springer-Verlag, 1987)

This volume reviews much of the basic physics and chemistry needed to understand developments in the expanding interdisciplinary field of laser chemical processing of surfaces. It also provides a detailed overview of one important subset of this field, chemical processing of insulators with lasers. The stated twin goals of this book are to serve as an up-to-date review of the field and as a pedagogical introductory text for the area.

After the broadbrush introduction to laser technology and processing in Chapter 1, Chapter 2 launches into an extensive review of the fundamental and applied science needed to do work in this field. Topics discussed include laser spectroscopy of molecules and solids; surface desorption and adsorption; laser heating of substrates; and laser-assisted deposition. This treatment has more depth and breadth than that usually found in journal review articles, though it is much briefer than that expected in an advanced-level textbook. Most points are made on the basis of the author's good physical insight, with relatively little resort to rigor. The range of topics covered is quite complete. They are treated on a fairly elementary level, and yet are geared to people with at least some background in the area.

Chapter 3 enters into a reasonably detailed discussion of experimental considerations in laser processing. It is devoted to the general properties of laser beams and relative advantages of various lasers, the spatial resolution achievable in laser-assisted processing, and the various experimental arrangements needed in serial and parallel laser processing for pattern generation in laser chemical processing of surfaces. The novice needs to be careful of the use of the unit radians, instead of the intended milliradians, in the discussion of laser divergence, both in this chapter and in Chapter 1. The introductory material in Chapters 1-3 constitutes about one half of this 320-page volume.

Chapters 4-7 detail laser-assisted formation and removal of insulators. The emphasis is on insulators of microelectronics importance, such as silicon dioxide, silicon nitride, and polymers, and as such, accurately reflects recent research. Occasional reference is also made to laser chemical processing of semiconductors and metals.

Laser-assisted oxidation and nitridation is covered in some detail in Chapter 4, with the emphasis on laser oxidation of silicon. A thorough review of conventional thermal oxidation of silicon is provided in this chapter. Chapter 5 concerns the same types of surface modifications under laser annealing and melting conditions. Pyrolytic and photolytic growth of thin film insulators from gas-phase reactants is reviewed in Chapter 6.

The discussion of laser-assisted removal of insulators in Chapter 7 carefully distinguishes between the several mechanisms of etching, including pyrolytic and photolytic chemical etching, ablation, and evaporation. Laser etching of a wide range of insulators is covered, for both cw and pulsed laser processing. Specific reference is made to the mechanistic details of etching when satisfactorily known.

Though the subject of Chapter 8 specifically addresses the applications of laser processing, the discussion throughout this volume is very well motivated. An impressive list of specific and general references is provided at the end of the book. Because of the continuing rapid advances in laser processing, the reader must be careful to consult the literature appearing after the publication of this book.

The volume is well written and presented. Given the constraints of length and timeliness, it is a fine effort.

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Correct answers for JMR "Figure This" Contest

Figure 1: Beta-Al_9Mn_3Si (Caption 3)
Figure 2: $Al_{0.3}Ga_{0.7}As$ tunnel barrier map (Caption 17)
Figure 3: Glass corrosion (Caption 15)
Figure 4: Ti:Al_2O_3 (Caption 13)
Figure 5: Simulated mullite (Caption 2)
Figure 6: Chaos trajectory (Caption 19)
Figure 7: Laser heating (Caption 16)
Figure 8: Diamond (Caption 6)
Figure 9: Alumina (Caption 9)
Figure 10: Crept nickel aluminide (Caption 11)