Metallurgical Applications of Shock-Wave and High-Strain-Rate Phenomena

Edited by Lawrence E. Murr, Karl P. Staudhammer, and Marc A. Meyers

(Volume 52, Mechanical Engineering, edited by L.L. Faulkner and S. B. Menkes, 1986, Marcel Decker)

This massive volume (1120 pages) is the proceedings from the International Conference of Metallurgical Applications of Shock-Wave and High Strain-Rate Phenomena (Explomet 85). The book contains 63 research papers and is divided into ten sections. The first section contains a review article by George Duvall titled "The Physics Connection," which provides a historical overview of the field of shock physics and discusses both *in situ* and recovery experiments. Included for those who are old hands in the business are 19th century photographs of Rankine and Hugoniot, upon whose equations we all depend. For those who are new to shock-waves and want to augment the historical review with a more technical presentation, the articles by Duvall and Graham in *Reviews of Modern Physics*, Vol. 49, No. 3, 1977, or the one by Rice, Mcqueen, and Walsh in Vol. 6 of *Solid State Physics* (edited by Seitz and Turnbull, 1958) are excellent reviews which are readily available.

The remaining 62 articles, reports of current research, are directed to active workers in the field. The second section, on dynamic consolidation, contains 16 articles dealing with both the physics and the technology of this important area. Sections 3 and 4 are titled Shock-Waves and High-Strain-Rate Deformation, respectively. Sections 5-7 cover Adiabatic Shear Band Phenomena, Dynamic Fracture, and Explosive Metal Working, while section 8 deals with Shock Synthesis and Property Modification of Materials. Section 9, on Novel Concepts and Applications of High Pressure, includes articles on the effects of hot dense gases on material structure and composition, ferroelectric polarization of copolymers, and the rapid application of pressure during solidification. Section 10 contains a discussion and summary by the editors on the current state of the field, and where they feel progress will be most rapid in the coming years.

The book presents the metallurgical applications of the rapidly growing area of shock-wave physics. A companion volume, *Shock-Waves in Condensed Matter* (edited by Y.M. Gupta, Plenum, 1986), which is the Proceedings of the APS Shock-Wave Conference held the week prior to Explomet 85, emphasizes the physics aspects of shock-wave research, rather than the metallurgical applications. The two volumes together provide an excellent record of the current state of this field of endeavor.

Overall, the quality of the book is quite good. Though large, it is well organized, easy to use, and should prove an excellent reference text. The editors have done a good job of tying the different areas into a cohesive whole, with each section prefaced by an introdution explaining the context of the following work. Since the volume is a conference proceedings, it is, by definition, aimed at researchers in the field. Because the articles are generally well written, they will be fairly accessible to those not currently working in shock-wave metallurgy, but wishing to survey the field. The papers are referenced by author, and a good subject index is included. The book is also aesthetically pleasing with excellent quality printing and photomicrograghs which are extremely clear and beautiful. The book should prove useful both to experts and those just starting in this interdisciplinary field.

Reviewer: Harry B. Radousky is a member of the Physics Department at Lawrence Livermore National Laboratory.

The Physics and Fabrication of Microstructures and Microdevices

Edited by M.J. Kelly and C. Weisbuch

(Springer-Verlag, 1986)

This book is a compilation of papers from a meeting organized to bring together some of the most innovative workers in a field currently eliciting enormous scientific and technological interest. As such there is a danger that it might function only as reference material for specialists already working in the field. In any event, most of the papers are clearly aimed at informing the wider scientific community, and so the book is a valuable contribution of some of the more recent achievements in solving the problems encountered in fabricating and testing devices which are submicron in at least one dimension.

Part I of this volume includes papers on high resolution lithography techniques, including descriptions of the resist materials being developed to allow definition of submicron features. Oxidation and silicide deposition processes are both covered in some depth, indicating the novel approaches being used to fabricate features with especially fine geometries in these materials. Two papers highlight recent advances in two of the most powerful techniques for investigating the structure of microdevices—x-ray diffraction and transmission electron microscopy. I was especially interested to read the paper by H. Mohwad, which contains some new results on the microstructures of organic materials in the form of mono- or multilayers.

Part II concentrates on the physical properties of microdevices. Here the emphasis is on developing theoretical models to explain the properties of microdevices that have been produced, and on predicting the properties of some structures that are not yet fabricated. The electronic properties of submicron devices are covered by M.J. Kelly, M. Jones and J.R. Barker, and the novel field of noise in these small geometry structures by J.P. Nougier. Many individual contributions on the properties of multiquantum well structures are also included.

Part III contains contributions on the practicalities of fabricating real devices with dimensions much smaller than those used in current VLSI. Discussions on the technological problems that must be overcome in the production of both Si and GaAs-based devices are given; and a paper on the part that computer-aided design can play in this process was contributed by R. Seneor. I was particularly struck by the elegant metal base transistors made by the epitaxial growth of Si/$CoSi_2$/Si heterostructures, which are included in the paper by E. Rosencher.

This book offers the nonspecialist a chance to discover how the science of microdevices has progressed, while containing much detailed information on the theory and practice of designing, fabricating, and testing these exciting structures, which will be of interest to all working in the field.

Reviewer: Chris Grovenor is an information technology lecturer in the Metallurgy and Science of Materials Department, University of Oxford.

Heterojunctions and Semiconductor Superlattices

Edited by G. Allan, G. Bastard, N. Boccara, M. Lannoo, and M. Voos

(Springer-Verlag 1986)

This book of the proceedings of the 1985 Winter School at Les Houches, France, gives a good survey of recent advances in the brisk field of heterostructures. The contributors are European, with a few notable exceptions such as L. Esaki, who gives a well-structured introduction, with characteristic emphasis on the interesting GaSb/InAs interface, and fairly extensive and comprehensive referencing.

The second part of the book has two papers on theory. The first looks at calculations, both self-consistent and non-self-consistent, on superlattices using the envelope function approximation. The second paper is on electrons at heterojunctions.

Continued

Part three, on experimental studies, indicates the book's focus, containing over half the total number of pages and 11 of the 19 contributions. Many important topics are handled with insight and authority, such as the fractional quantum Hall effect, Raman scattering, and electron transport in superlattices. In some presentations, clarity seems subordinate to mathematical rigor, but this is generally consistent with the nature of the topic discussed.

Specific material systems, such as GaSb/InAs and CdTe/HgTe, are well treated and strained layer superlattices are given good coverage, though the chapter on doping superlattices is rather brief.

The technology of growing heterostructures is discussed in part four, with molecular beam epitaxy in the forefront of the techniques reviewed. The inevitable dominance of the most mature material system, GaAs/AlGaAs, is complemented by a paper on CdTe/HgTe superlattice growth. There is a disappointing lack of discussion on the phosphide and antimonide systems, though, to be fair, the space available would permit only a limited investigation of each and it is better to examine a few in some depth than a larger number cursorily.

The same can be said of the last part of the book on applications of heterostructures which deals exclusively with that creature of many names, the MODFET, TEGFET, HEMT, or SDHT. This technologically oriented view completes this book in a down-to-earth manner and still gives the impression that many aspects of this dynamic and vigorous field of research are advancing quickly into the scope of the device scientist.

Reviewer: John Walker is a consultant with AT&T Bell Laboratories, Murray Hill, NJ.

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