

## BOOK REVIEWS

### **Synchrotron Radiation : Selected Experiments in Condensed Matter Physics**

*edited by W Czaja*

Birk Hauser-Verlag : Basel, Boston, Berlin, 1991

187 pages; price : SFr. 58. - /DM 68. - (Hard cover) : ISBN 3-7643-2594-1

The present volume, edited by Prof Dr Czaja, is a compilation of the invited talks and two contributed posters of a workshop which was held in July 1990 in Switzerland. The field of synchrotron radiation has recently emerged as a new exciting field of powerful source of radiation extending from optical region to X-rays. The development of synchrotron radiation sources in USA, Europe and Japan has opened up new horizons of fresh activities in many areas. The very fast accumulation of experimental data and their analyses have shown possibilities and challenges for the coming years. In this respect, the present collection of articles from reputed scientists in some well-known areas of condensed matter physics deserves praise and attention.

The collection deals with magnetic properties, electronic structure, interface, crystal structure etc. The consideration of magnetic properties includes dichroism effects in the X-ray spectroscopy of magnetically ordered systems, magnetic photoabsorption with circularly polarized X-rays and observation of dichroism in the 3d-4f transition of Ho on Si (111). The advantages of using synchrotron radiation in the determinations of crystal structure have been highlighted by Prof Weber in his detailed article. It is shown that high brightness of SR allows one to use single crystals of a smaller size and short beam life time to study biological samples. The systematic errors in the data of absorption and extinction have also been reduced, thereby improving the quality of the data. The tremendous advantages of SR over conventional generators have been illustrated. The advantages of high pressure research in solids have also been enumerated. The energy dispersive powder diffraction analysis has also become very important now-a-days. The surface structure studies by grazing incidence method have yielded new data and thrown light on chemisorption. In fact, Weber's long article has dealt with various aspects of structural studies with SR and as such the article is of great importance.

In recent years, quite a large number of publications of SR have been or are being made bringing out newer phenomena and opening up new possibilities to work with the most powerful source of electromagnetic radiation. The present collection of articles are,

therefore, interesting inspite of the limitations that fewer aspects have only been dealt with. However, there is compactness which will allow one to concentrate upon some selected topics. We look forward receiving future compilations on exciting SR.

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**Physics of Quantum Electron Devices (Springer Series in Electronics & Photonics, Vol 28)**

*edited by* Federico Capasso

Springer - Verlag : Berlin - Heidelberg - New York - London - Paris - Tokyo - Hongkong, 1990

xvi + 403 pages, 262 figures; prices : DM 109,00 (Hardcover) ; ISBN 3-540-51128-8

This 28th volume under the Springer Series, edited by Dr Federico Capasso of AT & T Bell Labs, USA, is an important collection of twelve articles providing an in-depth study on the recent advances in the rapidly expanding area of semiconductor quantum electron devices. If one looks at the evolution of quantum semiconductor devices, one comes to the realization that while the early half of the present century witnessed a scientific revolution in the development of quantum mechanics, the latter half had shown the ability to conceive and realize devices based on the principles of quantum mechanics. This was possible primarily with the advent of transistor in the late forties and subsequently junction diodes, bipolar transistor, semiconductor lasers, and tunnel diode representing the first example of a semiconductor devices whose I-V characteristic and operations directly controlled by quantum tunnelling effects. Finally, "the invention of molecular beam epitaxy (MBE) by Arthur & Cho in sixties paved the way for unprecedented progress in the heterojunction structure and quantum devices for the next two decades. This epitaxial growth technique allowed the realization of multilayered heterojunctions with automatically abrupt interfaces and nowadays, with its latest advance, electron beam assisted MBE applied to III-V alloys, precisely controlled compositional and doping profiles over distances, as short as a few tens of angstroms. This has now led to the emergence of a new picture of band gap engineering to tailor a specific device application. When applied to quantum devices, this approach enables one to control externally the wave function of carriers i.e. the picture of "do it yourself quantum mechanics" as jokingly called by Leo Esaki, the Noble Prize winner of 1974 in Physics alongwith Josephson and Giaever for tunnelling phenomena.

The present volume is an excellent collection of articles written in this direction by eminent workers. The articles include the aspects of MBE, Nanolithography, Resonant Tunnelling and Superlattices, Hot Electron Transistors, Quantum Interference Devices,

MOSFET etc. The articles are detailed both from fundamental and applied aspects and will be very much useful to Semiconductor physics and device people. Research workers will receive a lot of information in tailoring semiconductor devices from quantum effects. This is a new challenging state-of-the art of quantum devices. We welcome this and certainly other future volumes dealing with advances in quantum electron devices and principles.

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### **Polycrystalline Semiconductors : Grain Boundaries and Interfaces**

*edited by* H J Möller, H P Strunk and J H Werner

Springer - Verlag : Berlin - Heidelberg - New York - London - Paris - Tokyo - Hongkong, 1989  
xi + 394 pages, 323 figures; price : DM 104,00 (Hardcover) ; ISBN 3-540-50887-2

This book deals with the structure and different physical, chemical and electronic properties of grain boundaries. It contains the review talks delivered by twelve scientists at the International symposium, Malente FRG from Aug. 29-Sep. 2, 1988 and forty-one contributed papers. The contents of the book is divided into nine parts. A short review of the papers presented in different part is given below.

Part I consists of 5 papers where the grain boundary structure has been studied both experimentally and theoretically using high resolution electric microscopy (HREM), High voltage electron microscopy (HVEM) and computer modelling . HREM has been used to <001> pure tilt grain boundaries in germanium using molecular statics modelling.

Part II deals with the grain boundary chemistry and electronic properties. Bicrystals are often used to study a single grain boundary (gb). Deep level transient spectroscopy in conjunction with transmission electron microscopy (TEM) has revealed that impurities like copper, nickel and oxygen etc. precipitated along such an isolated g.b. controls the electrical activities. Similar works have been performed by another group using energy dispersive X-ray analysis (EDX), Secondary ion mass spectroscopy (SIMS) and they too arrive at similar conclusion. Most of the investigations in this part deal with the electrical activity in silicon grain boundaries excepting one where germanium has been studied.

Parts III and IV of the book consider the segregation, activation and passivation properties of semiconductors mainly on polycrystalline silicon using new techniques like spectroscopic scanning tunnelling microscopy, volume mapping surface analysis, Mossbauer spectroscopy etc. There are five interesting papers on hydrogen passivation studies in polycrystalline silicon. It is concluded that hydrogen passivation is sensitively

dependent on Si substrate temperature, prior implantation dose of Ar, the dislocation network which connects gb's and grains etc.

Part V contains mainly some papers dealing with interfacial problems generally encountered on silicon substrates at the metal contact. As for example, the studies on NiSi<sub>2</sub> formed on thermal annealing of Ni films on Si, TiSi<sub>2</sub> formed at the TiNi/Si contacts etc are of much technological importance.

Part VI and part IX contain papers on thin film which have also technological implications. The papers in part VI discuss on polycrystalline II-VI and I-II-VI<sub>2</sub> compounds which are considered as important option for low cost photo voltaics. CuInSe<sub>2</sub>, CuGaS<sub>2</sub>, CdSe films have been used to fabricate solar cells and thin film transistors fabricated from evaporated undoped and doped poly-Si, the microstructure of polysilicon thin films to silicon substrates, effect of grain boundaries in poly-Si thin film transistors etc have been described in details. The papers on crystallization process, structure nucleation process etc have been collected under the heading "Crystallization" in part VII. For improved device quality the question of laser recrystallization has been investigated.

Lastly, Part VIII dealing with the transport properties contains few papers on the electrical properties of grain boundaries, Hall mobility measurements in thin film specimen and numerical modelling of intergranular potential height.

Since this volume contains both microscopic and macroscopic picture of grain boundaries, chemistry and electronic properties of them, it must be useful to both the technologists and scientists.

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**Principles of Magnetic Resonance by C P Slichter (Springer Series in Solid State Sciences, Vol 1, 3rd enlarged and updated edition)**

by C P Slichter

Springer - Verlag : Berlin - Heidelberg - New York - London - Paris - Tokyo - Hongkong, 1990  
xi + 655 pages, 185 figures; price : DM 89,00 (Hardcover) ; ISBN 3-540-50157-6

Basically the book is a text-book for graduate students who intend to pursue research work in magnetic resonance. The first edition of the book was published as early as 1963 when there were a few books available in the market. There was a second edition in the year 1980 and the present edition is further enlarged and revised.

The author is a well-known researcher and a great teacher in the field of magnetic resonance. His main aim has been to explain in a rigorous but physical manner, concepts which are helpful in preparing a student of magnetic resonance to read the literature on that topic.

There are eleven chapters in the book. The first six chapters deal with the basic theory, magnetic depolar, broadening of rigid lattices, magnetic interaction of nuclei with electrons, spin-lattice relaxation and motional narrowing of resonance lines, spin temperature in magnification and magnetic resonance. There is a chapter also on electron spin resonance and electric quadrupole effects. In the remaining chapters, the main additions include an enlargement and modest rewrite of the topic of double resonance, explanations of the 1D and 2D Fourier transform methods, of coherence transfer, of multiple quantum coherence and of important topics related to dipolar coupling that underline the method of spin-flip line narrowing. The Chapter of density matrix focusses on its use in analysing relaxation processes and also its use in analysing the effect of rf fields.

The book is strongly recommended for graduate students requiring specialization in magnetic resonance.

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The major applications of synchrotron light are in condensed matter physics, materials science, biology and medicine. A large fraction of experiments using synchrotron light involve probing the structure of matter from the sub-nanometer level of electronic structure to the micrometer and millimeter level important in medical imaging. An example of a practical industrial application is the manufacturing of microstructures by the LIGA process. Synchrotron radiation from accelerators[edit]. Synchrotron radiation may occur in accelerators either as a nuisance, causing undesired energy loss in particle physics contexts, or as a deliberately produced radiation source for numerous laboratory applications. Request PDF on ResearchGate | Soft Condensed Matter Experiments Using Synchrotron Radiation | The intense and well-collimated X-ray beams that can be generated by using synchrotron radiation have had a major impact on polymer science in the last decade. We give here a brief overview of the opportunities for polymer scientists when using such devices, and describe some... The underlying physics of the early stages of crystallization are discussed and a number of scenarios eliminated; at high temperature Avrami kinetics are not observed whereas at low temperatures the structure in both the small-angle and wide-angle regimes grow contemporaneously following secondary nucleation. A combination of synchrotron radiation small-angle x-ray scattering and Books related to Synchrotron Radiation: Selected Experiments in Condensed Matter Physics. Skip this list. Fundamentals of Charged Particle Transport in Gases and Condensed Matter. Malte Hildebrandt. \$52.19.