Optica Applicata, Vol. XVIII, No. 2, 1988

Book reviews

Tunable Solid State Lasers for Remote Sensing

Editors: R. L. BYER, E. K. GUSTAFSON, and R. TREBINO

Springer Series in Optical Sciences, Vol. 51

Springer–Verlag, Berlin, Heidelberg, New York, Tokyo 1985
[pp. i–xi + 153, with 58 Figs.]

The book is a publication of a set of materials presented at a symposium devoted to tunable solid state lasers for remote sensing. The symposium was held at the Stanford University (USA) in 1984 under the auspices of both OAST (Office of Aeronautics and Space Technology) and NASA (National Aeronautics and Space Administration). The book contains the works concerning both technology and parameters of solid state lasers, which are believed to find a future application in LIDARS installed on the boards of aeroplanes, space shuttles, and orbital stations. The lasers of that type are interesting because of their compact sizes, low weight, high efficiency, and a long operational lifetime.

The book is devided into nine parts, each dealing with different topics.

Part I deals with the plans and proposals of lidar installations in the cosmic space and associated research programms concerning the lasering materials. The plans of research development presented by NASA go forward as far as to the year 2000, when Earth Observing System (EOS) enabling an achievement of full information about the Earth atmospher is expected to operate. The examinations in the EOS will be carried out by using lidar device with tunable solid state lasers.

In Part II the information about the solid state lasers already applied to remote detection of aerosols (Nd:YAG and ruby lasers), the measurements of atmosphere pressure (alexandrite laser) are given, and the results of examinations presented. Besides, the concept of using the lasers located on space shuttles to detect sodium in the atmosphere is discussed.

Part III (the shortest one) contains two communicates concerning semiconductor lasers used to pumping the solid state lasers.

Part IV is of reviewing character and contains general discussion of the tunable solid state lasers.

The whole Part V is devoted to the properties of the tunable $Ti:Al_2O_3$ lasers. These lasers as well as alexandrite ($Cr:BeAl_2O_4$) lasers were subject to intensive examinations in the course of last years. The technology of production, all their properties and the possibilities of their examinations are of equal interest. This interest is mainly due to the properties of the active media of the lasers and, above all, to generation wavelength tunability. The tuning range of these lasers is wider than that of the dye lasers.

In Part VI new proposals of the geometric shape of the active media are considered. The examinations of the generation efficiency of the lasers of differently shaped active media aim at finding the possibilities of maximal energy extraction from the unit volume. Therefore, high attention is paid to such shapes of active media for which the amplified radiation travels along the path much longer than geometric dimensions of the medium. This occurs in the case when the radiation propagates under an angle with respect to any of the side walls. In this case, exploiting the effect of the total internal reflection, the path along which the radiation is amplified may be made significantly longer.

Part VII contains three discussions of new host materials of solid state lasers (e.g., emerald, LLGG, GSGG, GGG, YGG, and so on). The aim of seeking and examination of new crystal and amorphic host materials for lasers is to find media of higher generation efficiency and wider tuning range.

Part VIII is devoted to crystal growth technology as applied in the laser techniques. There, the conditions for crystal growth for active materials (GGG, GSGG, alexandrite) as well as nonlinear crystal media (KTP) are discussed.

In the last Part IX the frequency conversion problems are considered, as based on such effects as stimulated Raman scattering, harmonic generation, oscillations and parametric amplification, and generation on dye centres.

As it follows from the above review, this book contains broad spectrum of problems connected with the tunable solid state lasers, starting with the technology of active media growth via the examination of their properties up to the review of the present and future applications in the cosmic examinations of the Earth atmosphere. Therefore, the book may serve as a source of information and may be of interest for many readers who professionally deal with the solid state lasers.

Unfortunately, this book, as almost any book of this kind, presents the materials in a very condensed form. Nevertheless, it is worth having it in the personal library.

Jerzy Szydlak
Military Technical Academy,
Institute of Optoelectronics,
Warsaw, Poland

Microscopic Methods in Metals

Editor: U. GONSER

Topics in Current Physics, Vol. 40

Springer–Verlag, Berlin, Heidelberg, New York, Tokyo 1986
[pp. i–xvi + 457, with 253 Figs.]

The book edited by ULRICH GONSER, entitled *Microscopic Methods in Metals*, is a consecutive fortieth position of the series *Topics in Current Physics* devoted to presentation of the newest theories, methods of examination and achievements in physical research. It consists of 13 chapters elaborated by 18 authors specialized in the field of examinations of structure and properties of solid state.

Each chapter devoted to the mentioned research problems constitutes a separate compact entirety ended with an extensive list of references including the newest bibliography.

As suggested by the author himself, this book has been written in order to create a bridge connecting various fields of research carried out with the use of selected microscopic methods with the possibility of their application to the more detailed study of both structure and properties of solids.

The book is addressed to physicists, chemists and engineers, and to all interested in practical application of microscopic methods in the examinations of metal structures. The theoretical fundamentals and examples of practical applications have been presented there together with some particularly interesting results of metal structure examining with the use of the microscopic, spectroscopic, diffraction, and magnetic resonance methods. As far as the methods of microscopic examinations are concerned, the fundamentals of image creation and contrast enhancement by the methods of scanning acoustic microscopy, high resolution microscopy, and field ion microscopy have been presented. Also, the techniques of sample preparation, suitable for the microscopic methods mentioned above have been described. The examples of applications of the results obtained with the use of the described microscopic

methods in the examinations of solid state structure have been given, a particular emphasis being laid on the phenomena observable with the said methods.

The X-ray examinations comprise the X-ray photoelectron spectroscopy, extended X-ray absorption, fine structure, and X-ray and neutron diffraction. The theoretical fundamentals of those effects have been given and the experimental techniques including some examples of basic applications have been described.

Also, a comparison study of the results obtained with the help of other spectroscopic methods is offered.

A particular attention is paid to the Auger electron spectroscopy, Muon spectroscopy, and Mössbauer spectroscopy.

In the chapters devoted to those methods, a particular attention is paid to the analysis of the phenomena occurring in microregions of the examined materials and the analysis of influence of defects and impurities. Also numerous examples of applications of the presented types of research have been given.

Similarly, the methods of position annihilation, perturbed angular correlation, and nuclear magnetic resonance have been described. In the chapters devoted to those problems a particular attention is paid to the analysis of the results obtained, as well as to the numerous practical applications.

The book is very interesting due to its subject matter. A careful graphic work and clear arrangement of the content facilitates familiarization with the problems described.

All the methods presented and described in details take into account the actual trends in the field of the examinations actually carried out, and will certainly contribute to the further development of the knowledge about the structure and the properties of solids.

Włodzimierz Dudziński
Institute of Materials Science and Technical Mechanics,
Technical University of Wrocław,
Wrocław, Poland