application of these techniques for the determination of geometric and electronic factors and effects of the 'active site'. This section is particularly instructive in giving a complete survey of the variety of surface topography characterization.

The fourth part, *Imaging and microanalysis in STEM* by P. M. Williams, is a well illustrated review of scanning transmission electron microscopy for catalytic studies. The information on the instrumental aspects is followed by the description of STEM as an imaging and structural tool. The chapter ends with the microanalysis capabilities using energy-dispersive X-ray analysis and energy-loss spectroscopy.

In the article entitled *The formation and ordering of shear planes in non-stoichiometric oxides*, by C. R. A. Catlow & R. James, techniques for atomistic calculations are summarized which may contribute to the fundamental understanding of complex problems in inorganic shear plane structures. Thermodynamic and kinetic problems such as shear plane and point defect energetics, the ordering of extended defects, and the nucleation of shear planes are considered.

Non-stoichiometric crystals containing planar defects by R. J. D. Tilley gives a description of planar faults in inorganic compounds from the structural point of view. The crystal chemistry of various crystallographic phases containing planar faults is reported, tabulated and illustrated by structure models and high-resolution electron microscopic photographs. The author particularly emphasizes theoretical aspects in dealing with the questions 'why do planar faults form rather than point defects, what are the indices of the planar faults formed, and how do the faults interact and order?'

The final comprehensive report, *New trends and strategies in organic solid-state chemistry* by L. Addali *et al.*, outlines some of the authors' personal views on the subject of solid-state chemistry. The understanding of interaction modes of functional groups in defining molecular arrangements is applied in planning and execution of chiral polymer synthesis and purification of enantiomers. Further outlines are conformational isomorphism, host–guest and gas–solid reactions.

The contributions of the book are clearly written and are well illustrated. There are more than 800 references.

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Electrical transport in solids, with particular reference to organic semiconductors. By K. C. KAO and W. HWANG. Pp. xx + 663. Oxford: Pergamon Press, 1981. Price £50·00, US $120.00.

This volume is no. 14 in the *International Series on the Science of the Solid State*. It deals extensively with work on semiconduction, photoconduction, and luminescence. Of its seven chapters, one deals with charge-carrier injection from contacts, and three with space-charge currents and related effects. There is a subject index, and a bibliography, both valuable, but the lack of an author index is frustrating. When I wished to read the authors' treatment of Schmidlin–Roberts theory of localized levels, referred to in the bibliography, I had no alternative but to wade through the book from beginning to end. This is my only real criticism. The book is clearly written and well referenced, to 1977 inclusive. The last chapter deals with luminescence and includes a careful account of the neglected area of electroluminescence, where the authors have themselves researched.

The main area of experimental activity in organics is presently concerned with organic metals. This is probably only temporary, a balance of activity will be restored. It would be a mistake to imagine that the organic semiconductor and photoconductor field is worked out. In thirty years it has so far yielded only one really important industrial development, polyvinyl carbazole–trinitrofluorenone for photocopying. The reviewer believes that increased understanding will bring increased applications as in the classical areas of inorganic solid-state physics. This book forms an excellent textbook for postgraduates entering the research field to help in this endeavour.

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Topics in current physics. Vol. 25. Mössbauer spectroscopy. II. The exotic side of the method. Edited by U. GONSER. Pp. xii + 196, Figs. 67. Berlin: Springer-Verlag, 1981. Price DM 62.00, US $29.80.

There are many books available which describe the more conventional aspects of Mössbauer spectroscopy, but this volume is unique in that it concentrates on some of the more unconventional (or 'exotic') developments which are either taking place or are hoped for in the future.

Following a brief introduction by Professor Gonser, the first major chapter by Mössbauer, Parak & Hoppe gives an admirable description of an attempt to solve the long-standing phase problem in the structural analysis of biological macromolecules. It has been shown that measurements of the interference between gamma radiation scattered by Rayleigh (from electrons of all the atoms) and Mössbauer (from ^{57}Fe nuclei) mechanisms can, in principle, be combined with conventional X-ray diffraction data to solve structures with molecular weights of the order of 240 000 Daltons. The recent development of a two-dimensional position-sensitive proportional counter should overcome the inherent problem of a low radiation flux from the Mössbauer source by allowing the simultaneous observation of many reflections, and it seems likely that a practical demonstration of structure analysis could be achieved within the next decade.

The chapter by Pound is largely historical in that it gives a detailed description of the classic measurements at Harvard of the gravitational red-shift. However, the summary of possibilities for the future suggests that the technical difficulties associated with the ^{181}Ta and ^{67}Zn resonances

may make it difficult to utilize the improvements in resolution which are inherent in the narrow linewidths. One interesting technical development is the use of a 'light pipe' with total internal reflection of the γ-rays, but so far only a limited demonstration has been achieved.

The following two chapters are more hypothetical. Goldanskii, Kuzmin & Namiot discuss the problems in developing a gamma-ray laser. Although many scientists have addressed themselves to this problem in the past, this review shows that a realization of the idea may still be a long way off. The contribution by Cohen on resonance experiments using synchrotron sources is equally speculative, and developments are also likely to be on a long time scale.

The chapter by Gonser & Fischer on resonance γ-ray polarimetry is the only one in the book to describe experiments which can be performed by the adaptation of the more conventional form of Mössbauer spectrometer. The detailed description of the various polarization phenomena is very good and should help others to design their own experiments, but detailed examples are taken mainly from the authors' own work, and the practical use of polarization measurements in determining the orientation of magnetic spins or the orientation of an electric-field gradient tensor is only treated briefly.

The chapter by Sawicka & Sawicki discusses the implantation of iron atoms into host materials and their subsequent study by conversion-electron Mössbauer spectroscopy. The hyperfine effects observed enable a study of implanted iron atoms and their aggregation processes. This technique should become increasingly important as a means of studying solid phases far from thermodynamic equilibrium.

A short chapter by Preston & Gonser on 'selected exotic applications' contains brief reference to experimental tests of relativity theory, and various modulation effects on γ-quanta, which are in keeping with the rest of the book; however, other sections on atmospheric aerosols, archaeology and art, medicine and biology merely refer to conventional Mössbauer experiments on unusual materials and contribute little to the central theme. Similarly the brief account by Hanna of experimental work at the Argonne laboratory in 1959–60 is of historical interest only, and both chapters could easily have been omitted from this volume.

Of the six main chapters, only that on polarization has practical relevance to more than a few workers at the present time, and for most of us this is a book which at best is read quickly out of general interest and then placed on the shelf to gather dust in peace.

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Laser spectroscopy of solids. Edited by W. M. YEN & P. M. SELZER. Pp. xii + 310. Berlin: Springer-Verlag, 1981. Price DM 112.00, US $58.80.

This book is Volume 49 of the series *Topics in Applied Physics*, and the editors have attempted to give the readers a general insight into laser spectroscopy of solids. As has been successful in gaseous spectroscopy of atoms and molecules, the use of the tunable dye laser has allowed the extension and the refinement of optical measurements in the condensed phase to ultra-high resolutions in the frequency and temporal domains. In turn, these experimental findings have led to a more sophisticated theoretical analysis of optically excited states with major modification being apparent in the area of their dynamic behavior. There has been much progress in theory and experiment over the past ten years and this review work has been published at an appropriate time for an understanding of the current status and for further advance of the research in this field.

There are seven chapters. G. F. Imbusch & R. Kopelman present an outline of the optical spectroscopy of ions and molecules in solids. Chapter 2 is written by T. Holstein, S. K. Lyo & R. Orbach, and describes excitation transfer in disordered systems, in which expressions for the rates characterizing the transfer of excitation between individual ions, atoms or molecules are given on the basis of Fermi's golden rule. The calculation shows how centers having different excitation energies can transfer excitations with the assistance of phonon processes. In chapter 3, D. L. Huber gives a brief summary of recent phenomenological theory of the dynamics of optically excited states with emphasis on ion–ion interactions which are responsible for optical energy transfer in condensed phases. The microscopic and macroscopic aspects of the theoretical analysis elucidate the importance of the relaxation mechanisms of an individual optical center due to its interaction with the host, and the propagation of the optical excitation within the solid due to the mutual interaction between different centers; the former process gives rise to homogeneous line broadening and the latter to temporal evolution of the individual fluorescence line.

Narrow-band tunable lasers can be used to excite ions in a small subset of sites, where the absorption frequencies are within the narrow laser width. The luminescence re-emitted by these excited ions will be contained in the same frequency band, which is much narrower than the inhomogeneous line width of material. This is termed fluorescence line narrowing. If the ions are excited by a narrow-band pulse of very short duration, the interesting time evolution of the narrow-band excitation can be studied. Chapter 4 describes the various methods of laser spectroscopy of solids, *i.e.* fluorescence line narrowing, saturation spectroscopy, photon echo and other techniques which have become generally viable with the advent of the high-resolution tunable dye laser. Most emphasis is devoted to fluorescence line narrowing since this is a very versatile method for observing both relaxation and energy migration, and presumably because the author of this chapter, P. M. Selzer, has been an active investigator in this field.

The last three chapters present surveys of the experimental results of laser spectroscopy of ions in crystals, glassine or amorphous solids, and also discussions on excitation dynamics in molecular solids. W. M. Yen & P. M. Selzer provide a useful chapter on high-resolution laser spectroscopy of optically active ions in insulators. M. J. Weber focuses on the experimental results of laser-excited fluorescence spectroscopy of ions in glass. As glass is an inherently disordered medium, the environment of each ion in a glass is not identical. The existence of large site-to-site