

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

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Excitons. Edited by E. I. RASHBA and M. D. STURGE.
Pp. xii + 865. Amsterdam: North-Holland, 1982.
Price US \$197.50, Dfl 425.00.

This is the second volume of a series of monographs titled *Modern Problems in Condensed Matter Sciences* with series editors V. M. Agranovich & A. A. Maradudin.

The contributors, who are drawn mainly from the USA and the Soviet Union, constitute an international and distinguished panel of authors who are experts in the various areas of the subject.

The first chapter, written by Sturge, is an *Introduction* which contains an elementary treatment of the exciton. It discusses the different types, namely Frenkel, charge transfer and Wannier excitons, and provides a brief resumé on various exciton interactions such as exciton-photon, exciton-phonon, exciton-magnon, citing examples from molecular crystals, semi-conducting alloys, alkali halides *etc.* The *Introduction* also contains a general overview of the other chapters and the extent of coverage of the entire book.

In subsequent chapters, various aspects of exciton research are discussed. It is not practicable to give a detailed description of the results in this review, however we can highlight some interesting aspects.

One chapter contains a review of the exciton polariton in a bounded crystal, analysing the optical effects due to wave-number dependence of the dielectric response function. Another chapter deals with the exciton polariton structure giving full discussions of the theory and reporting the results of the determination of the dispersion curves of simple and complex exciton polaritons. The tunable dye laser, a versatile and valuable tool, has been used extensively to probe the details, and investigations carried out include hyper Raman scattering, time-resolved spectroscopy, and resonant Raman and Brillouin scattering. In general, the theoretical results are in good agreement with experimental findings.

Another section of the book looks at exciton band structure and discusses the effect of the band-structure peculiarities upon reflectivity and transmittivity. The optical emission due to exciton scattering by LO phonons in semiconductors is considered and, after a careful analysis of the data, the conclusion is reached that scattering of excitons by LO phonons constitutes an essential part of many emission processes in the region of the fundamental edge.

Some aspects of the book also deal with a review of the studies of excitons in semiconductors using optical orientation techniques which, together with measurements of lifetimes and spin relaxation times, provide valuable results on the fine structure of excitonic levels.

Exciton electrooptics, which is analogous to Stark-effect experiments in gases, is not left out. This is used for band-structure analysis in semiconductors. There is also a review

of excitons in semiconductor alloys and a full discussion of excitons bound to Coulomb impurities and to composition fluctuations. A similarly detailed review is also included in another chapter for the exciton complexes in the indirect-gap semiconductors.

Good coverage is given to bound multiexciton complexes and a separate chapter is devoted to the review of biexcitons in CuCl and related systems. There is a review of free and self-trapped excitons in alkali halides providing the various experimental results. Another chapter discusses the theoretical formulation of self-trapping of excitons.

The two chapters on molecular excitons cover exciton dynamics, disorder, coherence, dephasing and exciton spectra in strained molecular crystals.

A theoretical treatment of excitons in magnetic insulators is also available. A chapter also deals with excitons in photosynthetic systems involving the exciton states of chlorophyll in certain protein complexes and the transport of excitation energy through the chlorophyll in the lipoprotein complexes of photosynthetic membranes.

The last chapter, which deals with the Frenkel excitons, contains a theoretical treatment of anharmonic interaction of vibrational excitons using exciton-exciton and exciton-impurity interactions.

A rough classification shows that the contents of the book are loaded in favour of Wannier excitons in semiconductors because ten chapters are devoted to Wannier, two to charge transfer and five to Frenkel excitons. (There is some overlap between the material of various chapters.) The loading is not a defect because adequate bibliography has been provided to take care of the latter two types.

The book provides a well documented collation of up-to-date theoretical and experimental results from the frontiers of exciton research thus saving the beginner from many hours of intensive search through the literature. Each chapter is thoroughly written and comprehensive with copious references and illustrations which are useful to the reader. In addition, a valuable bibliography is furnished at the end of the book which should be an asset to both newcomers and experts in the field. The style of writing is clear and lucid and the print is excellent and easy to read. As the book is bound in attractive hard cover, it should be a beautiful addition to any library.

The entire package of more than 800 pages contains materials for physicists, solid-state chemists, biologists and materials scientists thus emphasizing the interdisciplinary nature of the subject, the unity of which is clearly portrayed by the authors. The book is highly recommended for all post-graduate students and researchers in the field. The contributors and the editors should be congratulated on a job well done and the outcome of their efforts is an excellent example of a successful and fruitful international collaboration in the scientific field.

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