

and a fourth study will consist of a comparison of the first three; it is unfortunate that there are no present plans for a study of the *Referativnij Žurnal*. In each case the study was made by punching cards, one for each citation, containing information on the journal, the country of publication, the language of the paper (when this was easily ascertained – for the *Bulletin Signalétique* this was not always the case), the time lag of the entry, whether an abstract (as distinct from merely a title citation) was included, if so whether it was signed, and the subject classification of the paper. These cards were then processed by computer and the results analysed in various graphs and tables, so that one can see, for example, what fraction of the total literature, or the literature from any one main subdivision of physics, is contained within what fraction of the total number of journals. Many of the results are of interest primarily as a study of the abstracting journals, but some reveal important facts about the literature of physics, such as the predominance of the English language, and the predominance of the major journals (five per cent of the journals produce fifty per cent of the citations). Each study has a list of all the journals that appeared in the entries for 1964 in order of the number of entries; *Acta Crystallographica* is in thirtieth and twenty-eighth place in the two lists.

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***F*-centers in alkali halides. Solid state physics, supplement 8.** BY JORDAN J. MARKHAM. Pp. x + 400. New York and London: Academic Press, 1966. Price \$ 16.

First impressions carry considerable weight, and in this case I was struck by the time gap between the literature covered and the present day. The author in his preface, dated July 1966, 'believes most of the experimental aspects of the *F*-center are covered until about the middle of 1963', though in fact several 1964 papers are quoted. The book has an old-fashioned air due to the approach adopted by the author. He does not arrive, in any detail, at the de Boer model for the *F*-centre till page 292. In this model, now universally accepted, an *F*-centre consists of an electron bound to a negative ion vacancy.

The book contains ten chapters which fall naturally into three sections. The first five chapters review the optical properties of the *F*-centre, and related topics such as photoconductivity and the production of *F*-centres. This is followed by three chapters on electron paramagnetic resonance in theory and practice, including the ENDOR measurements which were decisively in favour of the de Boer model. In the last two chapters the author describes the theory of

F-centre wave functions and of strong electron-phonon interactions. He is especially well fitted for this section in view of his well-known review article in this field. The author quotes his own work in the text, but over-modestly excludes his own name from the author index. It is not clear that very much is gained by having these three sections bound together, especially if doing so has resulted in delayed publication.

The author is aware that the 'major problem related to the de Boer model is the production of negative ion vacancies' (p. 293). This problem has been further emphasized by the experimental discovery of ultraviolet coloration of alkali halides published in 1964. The proposals of Pooley and Hersh suggest that non-radiative transitions play a key role. Unfortunately non-radiative transitions are given scant treatment.

This work is well written and well produced with few errors. Some of the figure captions are too brief; in particular that for Fig. 3.4 does not list the temperatures for the curves shown. There is some confusion on page 57 where in a summary it is stated that 'some alkali halides color more easily at low temperatures than at high', though the reverse statement occurred in the preceding section. Possibly this arose since both statements are true, some alkali halides showing a maximum in the curve of coloration efficiency *versus* temperature. This is true for ultraviolet coloration, which is one of the sections of the book which has been overtaken by recent experiments. On the theoretical side there is now more understanding of the anomalously long lifetime of *F*-centre fluorescence. With regard to the study of aggregates of *F*-centres whole new fields of study have emerged, including the effect of uniaxial stress on the optical and fluorescence spectra. This clarifies the symmetry and degeneracy of these centres in much the same way that this was accomplished for *F*-centres by electron paramagnetic resonance. A full treatment of these more complex centres falls outside the scope of the book under review, but I feel that the relative neglect of the *M*-centre is hard to justify. No reference is made to the van Doorn and Haven model suggested in 1956, and further supported by Pick in 1960, in which the *M*-centre simply consists of a close pair of *F*-centres.

I feel it is unlikely that this book will fulfil its avowed aim of assisting the beginner in this field. A beginner would be well advised to consult the simpler and more extensive book by Schulman and Compton, *Color Centers in Solids*. However the specialist will find much useful material in this scholarly work.

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