delineated, and warnings as to the limitations of various techniques are also given in this chapter. A chapter by J. S. Kouvel deals with the effects of atomic disorder. In particular, it is concerned with the effect of order-disorder (for intermetallic systems on or near stoichiometry) on the Curie temperature, magnetostriction, and magnetization parameters. The phenomenological model used is presented clearly and its consequences are discussed systematically.

Although the treatise will be of greatest worth to persons concerned with the role of metallurgy in magnetization curves or the use of magnetic properties in metallurgical studies, it also contains much information relevant for investigators of critical phenomena if they substitute do's for don't's and vice versa. Although the exact role of defects in altering the nature of the phase transition is not yet known, their elimination and then controlled introduction are central to the study of critical phenomena in magnetic systems.

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Effects of Nuclear Motion

Impurity Spectra of Solids. Elementary Theory of Vibrational Structure. KARL K. REBANE. Translated from the Russian edition (Moscow, 1968) by John S. Shier. Plenum, New York, 1970. xvi, 254 pp., illus. $19.50.

Because of the vast difference between the mass of the electron and that of the nucleus, it makes some sense initially to discuss the electronic spectra of solids in terms of a rigid lattice. There are several excellent books on the spectra of impurities and localized defects in solids which are based on this approximation, treating nuclear motion as a side effect. However, in the last few years a substantial theoretical and experimental effort has been made to understand in detail the effects of nuclear motion; and this book, which is devoted to the general theory of these effects, is most welcome.

The author tacitly confines his attention to transitions between nondegenerate electronic states. Within this limitation his treatment is as general as current theory permits, without, however, demanding mathematical apparatus beyond standard quantum mechanics. He begins with a careful discussion of the adiabatic approximation (by which the electronic and nuclear motions are separated). The second chapter treats a simplified but general model of the electron-vibration interaction covering strong and weak coupling to phonons, local modes, and quasi-localized modes (which are a cross between the first two). The extraordinarily wide variety of spectra so obtained is compared with some beautiful spectra obtained by the author and his colleagues in Tartu. Most of this work appeared in obscure journals of the Estonian S.S.R., not readily available in the West. Further chapters discuss the analogy with the Mössbauer effect, extend the simple theory to take more recherché effects such as anharmonicity into account, and discuss the effect of a localized electronic state on infrared and Raman spectra.

By ignoring electronic degeneracy (and thereby dismissing a large body of experimental data from his attention) the author permits himself a rigorous quantum mechanical approach. He can afford to be slightly contemptuous of the "semiclassical" approximation (in which initial states are treated quantum-mechanically and final states classically), since in the nondegenerate case it is merely a heuristic device for visualizing results obtained from the exact theory. It is indeed a mongrel theory, but it remains the only way of dealing, even qualitatively, with transitions to a degenerate state strongly coupled to the lattice. Excellent results have been obtained with it which should make us forgive, though not forget, the illegitimacy of its origins. For the same reason the method of moments is treated as little more than a mathematical exercise. Only in the degenerate case does the method reveal its power, and it is not for nothing that C. H. Henry and C. P. Slichter entitle their fine chapter in *The Physics of Color Centers* (W. B. Fowler, Ed., Academic Press, 1968) "Moments and degeneracy in optical spectra." It is a pity that Rebane has limited his purview in this way, particularly as he nowhere says that he has done so.

The book is studded with "exercises for the reader"; these are well chosen, but since no answers are given and many of the questions are in the form "Explain . . ." they are likely to be a source of frustration to the solitary student. The translation is free of obvious errors and reasonably clear, though often making heavy reading. The proofreaders did a good job except that they failed to check the cross references to equations. The bibliography is large and up to date to 1968; it is likely to be most useful to a reader of Russian.

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Solid-State Technique

Field-Ion Microscopy. K. M. BOWKETT and D. A. SMITH. North-Holland, Amsterdam, and Elsevier, New York, 1970. x, 258 pp., illus. $17.25. Defects in Crystalline Solids, vol. 2.

As part of the series Defects in Crystalline Solids (edited by S. Amelinckx, R. Gevers, and J. Nihoul) this book must serve two purposes. It must describe the technique of field-ion microscopy and its capabilities, and it must discuss those types of solid-state defects that can be studied by this type of microscopy. The authors achieve both of these ends in their compact monograph.

The complex principles underlying field-ion microscopy are presented concisely and yet sufficiently that anyone now using field-ion microscopy or anyone wishing to do so could easily understand them. The presentation allows the reader to see how each principle stands in relation to the experimental images and also introduces him to the conventions used in the practice of this type of microscopy. It is this very close connection between theory, experiment, and current literature that makes this monograph very useful to those interested in either the method or the results. Throughout the text there are citations from the present and historic literature that are more than ample to provide background to any particular topic.

The authors provide an experimentalist view of the construction and operation of field-ion microscopes as well as the names and addresses of suppliers of unusual but necessary components. They discuss methods of specimen preparation and provide detailed lists of procedures for each material that has been imaged.

Many schematics are coupled with experimental micrographs and text to explain the various types of defects