BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Properties of Atomic Defects in Metals
(Proceedings of the International Conference on the Properties of Atomic Defects in Metals, Argonne, Illinois, October 18-22, 1976)

Editors	N. L. Peterson and R. W. Siegel
Publisher	North Holland Publishing Company, New York (1978)
Pages	856
Price	$165.25
Reviewer	James M. Galligan

Defects in crystals are important in understanding many of the basic physical and chemical properties of materials. This is especially true in irradiated materials, since typical reactor conditions introduce defects well in excess of any defect densities achievable under normal equilibrium conditions. The property changes in irradiated materials can be horrifying from the designer's standpoint, quite often because these property changes may not be steady-state values even after extensive amounts of time in a nuclear reactor. Another component of the problem of defects in crystals, especially in terms of nuclear reactor materials, is that the chemical composition during the irradiation time of a material is not constant. This changes the whole ball game, since not only can the properties be changed by the point defects introduced by irradiation–i.e., isolated vacant lattice sites and atoms at nonlattice sites–but the new chemical species may also upset the balance of the point defects with each other. The present book–really a collection of papers that have resulted from an international conference of experts on the subjects–sets out to review and present new material on the broad aspect of the problem of point defects. To do this, it gives a balance between review papers, about half, and shorter publications, the other half. Given the bewildering variety of techniques, experiments used, and theoretical treatments utilized, it is encouraging that there can be some focus to the whole thing, and the organizers are to be congratulated on this. For example, the subject of diffusion in metals is an underlying theme that is touched on in a number of places. N. L. Peterson gives a review of the subject of self-diffusion. Vacancy mobilities, another component of diffusion, is covered by R. W. Balluffi, and the metals where mechanical creep rates often have the same activation energy as that of self-diffusion are treated by Nichols.

Although there is not unanimity of opinion on the conclusions to be reached from all of the work, this brings up another interesting theme of the conference, concerning the interpretation of many of the experiments. There are two schools of thought on almost every major question considered. For example, when metals are irradiated at low temperatures and the metal warmed to room temperature or above, then the properties that are affected by the irradiation recover in more or less distinct stages. A further common feature of this problem is that if the absolute temperature of the recovery stage is scaled to the metals' respective melting temperatures, then many metals show similar distinct recovery stages at the same fraction of their melting point. The interpretation of these recovery stages has generated many long-standing arguments. Perhaps one of the longest standing is in the area of defects in crystals. It is not that the models are similar–they are not–but both sides seem to be ingenious in getting around the others' arguments. Thus, there has been no agreement by many of the participants on just what defect to assign to stage III recovery.

Where does this leave the reader? Well, to buy the book for oneself is out of the question–the price makes that impossible. But the properties measured and the ideas discussed are important, important enough to be available to a researcher or, perhaps, to a designer in the field of nuclear materials. The final pieces may not be there, but the pattern is a little less fuzzy than it was a few years ago.

James M. Galligan has a long-standing interest in the field of point defects and was responsible for first finding and establishing depleted zones in a number of metals. In addition to his work in the fields of radiation damage and point defects, he is also involved in studies of plasticity at low temperatures, with special emphasis on plasticity in high magnetic fields, as expected in the fusion reactor.