

edge of the nature of both the upper layers of the earth and its deep interior. The third edition contains much new material on long-period oscillations of the earth as a whole, and on the seismological detection of nuclear explosions.

The book contains an unusually thorough bibliography. From the clarity of its style and its ample coverage of material, the work should continue to be of great value to all workers in this important field of physical science.

X-Ray Optics and X-Ray Microanalysis. Symp. Proc. (Stanford, Calif., August 1962). H. H. Pattee, V. E. Cosslett, and Arne Engström, eds. 622 pp. Academic Press, New York, 1963. \$22.00.
Reviewed by L. Marton, National Bureau of Standards.

The triennial series of symposia on x-ray microtechniques publishes its proceedings under varying titles. The first of these symposia was published under the title *X-ray Microscopy and Micro-radiography*. The second had in common with the present third one, the title: *X-ray Optics and X-ray Microanalysis*. The emphasis, however, has shifted this time quite considerably with a greater emphasis on x-ray microanalysis than on the other techniques. Simple statistics illustrate this point better than anything else. Of the sixty papers presented at the third symposium, 52 are contained in the present volume. Due to lack of space, eight had to be omitted. More than a third of all the papers deal with the Castaing technique; in the present volume twenty papers are devoted to this last subject, twelve to all aspects of instrumentation of x-ray optics, two to metallurgy and mineralogy, eleven to biology, and only seven to physics. The distribution of the unprinted papers is roughly the same.

Among the physics papers one of the longest and best documented is by Vittorio Luzzati on "Small Angle X-Ray Scattering on an Absolute Scale." Quite interesting is W. Hink's contribution on "Spectral Emission of a Microfocus X-ray Tube" as well as a paper by M. Green on "The Efficiency of Production of Characteristic X-Radiation." Another contribution worth mentioning is that of G. L.

Johnson and R. F. Wuerker on "Reflectance Measurements at Carbon-K and Beryllium-K Wavelengths."

Instrumentation papers contain many ingenious ideas. I would like to pick out a contribution by Paul Kirkpatrick on "Grazing-Incidence Telescopic Systems" as well as the paper by W. Petzold and W. Hink on "Substratum Influence on the Reflectance of Aluminum Vapor-Deposited Films for X-Rays."

The papers which have not been printed in the volume are listed in the preface. Out of the eight listed, I would have liked to have seen at least two, one by Pattee on "Selected-Area, Soft X-Ray Microdiffraction", and Friedman's "X-Ray Astronomy." There is some justification for not including the "X-Ray Astronomy" paper because after all his is not an x-ray microtechnique contribution and it has been published elsewhere. Nevertheless it would have been stimulating for those reading on x-ray microtechniques to have an inclusion of a not too distant area where techniques are somewhat similar to the ones employed by the microtechnique.

Point Defects in Metals. By A. C. Damask and G. J. Dienes. 314 pp. Gordon & Breach, New York, 1964. \$19.50. Professional edition (individuals only) \$9.50.
Reviewed by R. Smoluchowski, Princeton University.

Even those who have only a nodding acquaintance with the solid state know that the expressions "crystal clear" and "crystal perfect" are the result of a misunderstanding. The ideal and esthetically very attractive notion of crystalline order is only a rough first approximation to physical reality. The next step, the consideration of crystalline defects, is a condition *sine qua non* for a proper understanding of most of the observed facts. The plethora of various defects, their complementarity, symmetry, interrelation, and interaction remind us in many ways of the abundance and nature of elementary particles in nuclear physics. There are two defects which are truly basic and particularly simple: the vacancy and the interstitial. To be sure the crystalline surface is an even more basic and unavoidable defect but for various reasons it is an

exceedingly complicated imperfection and elusive both from theoretical and experimental points of view. In solids other than metals, vacancies and interstitials involve serious electronic perturbations which make their complete understanding considerably more difficult than in metals. For this reason the greatest progress has been made in the area of "point" defects in metals. Damask and Dienes' book provides an excellent systematic introduction into this very active field by giving an up-to-date summary of the experimental facts and of the theoretical background.

For many readers the book's most valuable part will be its last and longest chapter which describes some of the essential experimental facts on which our present knowledge of point defects in metals is based. In a very clear, concise, and impartial way the various results are discussed and the conclusions concerning such areas as quenching, irradiation, plastic deformation, mechanical properties, and annealing are presented. The first chapter is devoted to a treatment of the general theory of point defects, and, apart from a couple of short excursions into statistical mechanics, it requires either none or only the simplest mathematical tools. The arguments are usually presented in the language of thermodynamics and physical chemistry. The quite spectacular recent computational results on the formation and stability of various radiation induced defects are fully discussed. The subsequent chapter on the formalism of annealing kinetics as related to the atomic mechanism is an excellent summary of the authors' most recent contribution in this field. A very useful discussion of the numerous methods of determination of activation energies from the analysis of annealing curves is given in a separate short chapter. Finally a chapter is devoted to the relation between point defects and various measurable properties such as neutron transmission, lattice constants, stored energy, electrical resistivity, etc.

The book is eminently suitable for an experimentalist and a theoretician as a key to the whole area of point defects in solids. The accent is on reasonably well established facts and