density-independent mortality. The effect of the environment on the vegetation is determined by the characteristics of the vegetation.

The second, and in this reviewer's opinion more serious, problem is the lack of an attempt to develop a good predictive theory or to identify the physicochemical and physiological constraints that determine that a species with a given set of morphological and physiological characteristics can grow and survive only under a limited number of environmental conditions.

In spite of these drawbacks, plant population biologists and ecologists will find a lot of information and a wealth of correlational data that are interesting and thought-provoking. The book is well written and well presented.

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Ion Diffusion

Physics of Superionic Conductors. M. B. SALAMON, Ed. Springer-Verlag, New York, 1979. xii, 256 pp., illus. $29.80. Topics in Current Physics, vol. 15.

The name "superionic conductor" was introduced by Walter Roth and Michael Rice in 1972 to describe a class of ionic solids that conduct ions extraordinarily well. As Salamon notes, "hyperionic" would be a better term than "superionic," since the Latin "super" and the Greek "ion" make strange word fellows. Nonetheless, "superionic" is now accepted in this extremely old field of electrochemistry, which has only recently become a branch of solid state physics. Although Michael Faraday observed in 1834 that AgI seems to have unusual properties upon heating, it was not until 1974 that solid state physicists began to study these solids with modern methods. In that year Bernardo Huberman gave the only contributed paper on the subject at a meeting of the American Physical Society, and this reviewer asked the only question. Since then the topic has played a larger role, with many scheduled sessions each year.

The present volume is a collection of eight contributed chapters on the physics of ion diffusion. Physicists have brought to this topic a variety of experimental techniques and goals quite different from those of the traditional electrochemists. The physicist wants to know why the ions move so easily through the solid and whether there are collective phenomena. The electrochemist wants to build batteries for electrical vehicles or peak power loading and is usually concerned with chemical questions of stability and compatibility. Although there are numerous other review volumes by electrochemists, such as *Solid Electrolytes* edited by Hagenmuller and van Gool (Academic Press, 1978), the present volume is the first entirely devoted to the physics.

One example of a physicist's viewpoint concerns phase transitions. High ionic conductivity is a result of ion disordering, which is often caused by an order-disorder phase transition. Yet it was not until the work of Salamon that the modern ideas of critical phenomena were applied to investigate the phase transitions. Salamon showed that the critical properties in $RbAg_4I_5$ revealed the nature of the order parameter, which enabled him to construct realistic models of the ion disordering. His chapter on phase transitions in the book under review gives a good summary of this work. He also classifies the phase transitions within Landau's system and provides a framework for the entire subject of phase transitions in these materials.

Another difference between the physicist and the electrochemist is in the materials they choose to study. The electrochemist wants materials to use in batteries, which invariably have a minimum of 50 atoms in each unit cell of the crystal. The physicist wants to study how ions diffuse in a collective system and chooses the simplest framework for the study. Thus physicists investigate the simple systems such as the silver and copper halides and the fluorite materials such as CaF_2 and $SrCl_2$.

Other chapters in the volume review the experimental techniques of x-ray absorption fine structure, neutron scattering, nuclear magnetic resonance, and light scattering. Each technique has been extensively used to study simple ionic solids, with a focus on description of the mechanism of ion diffusion. Does the ion hop from site to site, with a relatively large dwell time on each site, or does it continuously migrate? Is the ion disordering a collective phenomenon or an individual one? Is it necessary to have a low-frequency phonon mode? Not all of the experimental techniques reviewed in the book provide equal insight. Of those included, neutron experiments seem the most useful, since they can be used to measure both individual and collective modes. One criticism of the book is that it lacks a chapter on x-ray scattering, which may be the single most useful experimental tool for measuring ion disordering. Geisel's theoretical chapter on continuous stochastic models is the best introduction to the subject ever written.

The book is technique-oriented, in that each chapter is written by an expert in some experimental or theoretical technique who advocates that particular method and its associated interpretative models. It might be useful to have a review volume in which each chapter is about a single material. Each chapter author would be assigned a solid, for example AgI, and be asked to explain its behavior by unraveling the competing and conflicting claims of different experimental methods. Only in that way will we attain a true picture of ion motion in a collective system.

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