Solid State Ionics
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Preface

Solid state ionics has grown rapidly during the last decade and became an important area in solid state chemistry, solid state physics, electrochemistry and materials science. Several new materials with unique properties and a few solid state devices have been introduced. Many new ideas toward micro and macro-devices are being tested in research laboratories around the world. Materials modification and device fabrication in the area of solid state ionics require knowledge from many disciplines and provide diverse research opportunities.

The aim of this proceedings volume is to introduce the interdisciplinary nature of the solid state ionics and diverse research opportunities in this field to the communities of solid state chemists, solid state physicists, electrochemists and materials scientists. This volume includes invited and contributed papers on fundamentals, materials, techniques and applications of solid state ionics presented at the 1988 MRS Fall Meeting in Boston. The symposium was the first on this topic to be held at an MRS meeting. It was a truly international forum on fast ionic transport and related phenomena in materials. The symposium included 24 invited and 61 contributed papers, of which 47, or 55%, were from outside the United States. The attendance and active interest in this symposium showed the dynamic character of the general interest in ionically conductive solids and mixed conductors, and the transition of this area from one of pure science into one with great technological opportunities.

The first section of this proceedings volume deals with theoretical treatments of ion transport in solids. Several approaches, such as molecular dynamics simulation, percolation theory, relaxation in solid electrolytes and ionic motion in solids, are presented. The second part of the book focuses on materials and techniques. The mechanism of ion transport in glassy electrolytes and the large enhancement in ionic conductivity in the presence of dispersed particles are discussed. In the context of materials characterization, the use of both in-situ and ex-situ techniques, such as x-ray and neutron diffraction, EXAFS, IR and Raman spectroscopy, NMR, ultrasonic attenuation, XPS, TEM, impedance spectroscopy and electrochemical techniques, for the investigation of both structural and dynamic aspects of materials with unusual mass transport properties are discussed. The third part of the book deals with ionically conductive polymers. Several new polymers electrolytes are introduced and the mechanisms of ion transport in this new class of electrolytes are discussed. The polymer dynamics and single ion conductive polymers are included in this part.

The fourth part of this book deals with low dimensional layered and skeletal compounds, the principle features of insertion phenomena and composition-driven phase transformations. The structure-property relationships of mixed conducting chalcogenides are discussed from materials science, chemistry and physics viewpoints. The mixed-conducting copper oxide
bronzes, some of which are interesting high temperature superconductors, are among the materials families of interest in this connection. The fifth part introduces the science and technology of 8-aluminas from structural, ion transport, and chemical reactivity viewpoints. Finally, the sixth part covers recent advances in a number of applicational areas, including solid state lithium batteries, the high power sodium-poly sulfide and new sodium-transition metal chloride battery systems, solid state sensors, and electrochromic materials and devices. Applications, from solid electrolyte batteries in electric vehicles to integrated circuits and the fabrication of thin film devices, such as batteries and microsensors, are discussed.

It would be difficult to list all the people who have helped, directly or indirectly in this work, but we sincerely thank Drs. J.R. Akridge, C.A. Angell, M. Balkanski, G.C. Farrington, J.B. Goodenough, P. Hagemmuller, J. Livage, J. Rouxel, J.M. Tarascon, K.C. Taylor, M. Thacheray, L.M. Torell, H.L. Tuller, P. Vashishta, and W. Weppner for their illuminating discussions. We would like to express special thanks to professor Mark A. Ratner for many discussions concerning the theoretical materials as well as organization of the symposium. Mrs. Dorothy A. Woods is owed a special debt of thanks for excellent secretarial help and for hours of painstaking typing.

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