

# CONTENTS

Preface vii

## [A] ION TRANSPORT MODELS/GENERAL

- Modelling of Point Defects in Ionic Materials (Invited)  
*Y. V. G. S. Murti and Radha D. Banhatti* 3
- Mass and Charge Transport Through Boundaries (Invited)  
*J. Jamnik* 13
- Progress Towards Building a 'Working Theory' of Ion Transport in Glasses (Invited)  
*Malcolm D. Ingram* 21
- Model Studies of Diffusion in Glassy and Polymer Ion Conductors (Invited)  
*O. Dürr, P. Pendzig, W. Dieterich and A. Nitzan* 33
- Effective Number of Valence Electrons in  $\alpha$ - and  $\beta$ -AgI**  
*Masaru Aniya and Kunio Wakamura* 43
- Interference Between Ions and Electrons Upon Their Transfer in Mixed Ionic  
Electronic Conductors (Invited)  
*Han-Il Yoo* 49
- Interpretation of the Anomalous Electronic Properties of Liquid Silver  
Chalcogenides from a Model of Superionic Conductors  
*Masaru Aniya* 57
- Demixing, Formation of New Phases and Morphological Changes of Materials  
in Electric Fields (Invited)  
*M. Martin* 63
- New Interfacial Phase Formation in  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}:\text{Al}_2\text{O}_3$  Composite and Ion  
Transport Properties  
*N. Lakshmi, Kamlesh Pandey, P. K. Singh and S. Chandra* 65
- Spectral Hole-Burning in  $\beta''$ -alumina (Invited)**  
*Takeshi Hattori, Ryotaro Yagi, Kazuhiro Aso and Mareo Ishigame* 71

|  |     |
|--|-----|
| <b>Formation and Properties of <math>\alpha</math>-AgI-Stabilized Superionic Composites (Invited)</b><br><i>Masahiro Tatsumisago and Tsutomu Minami</i>  | 81  |
| <b>[B] EXPERIMENTAL TECHNIQUES</b>   |     |
| <b>New Aspects of NMR Studies in Solid Electrolytes (Invited)</b><br><i>Detlef Brinkmann</i>   | 93  |
| <b>Studies on Ion Dynamics in <math>\alpha</math>-Na<sub>3</sub>PO<sub>4</sub>: Paddle-Wheel Mechanism Better Defined</b><br><i>R. D. Banhatti, M. Witschas, D. Wilmer and K. Funke</i>  | 103 |
| <b>Conductivity Exponent for Debye and Non-Debye Response Functions</b><br><i>G. Govindaraj and R. Murugaraj</i>   | 109 |
| <b>AC and DC Activation Energies and its Relation to Frequency Exponent</b><br><i>G. Govindaraj and R. Murugaraj</i>   | 115 |
| <b>Ion Penetration in Materials by High Energy Irradiation</b><br><i>P. C. Srivastava, S. P. Pandey and O. P. Sinhal</i>   | 121 |
| <b>Estimation of Mobile Ion Concentration in Some Silver Ion Conducting Solid Electrolyte Systems by DC Polarization/Depolarization Studies</b><br><i>R. C. Agrawal, Mohan L. Verma, R. K. Gupta, R. Kumar, M. L. Verma and S. K. Pandey</i> | 127 |
| <b>Determination of Chemical Diffusion Coefficients of Mixed Conductors with Predominantly Electronic as well as Comparable Electronic and Ionic Conductivities (Invited)</b><br><i>W. Sitte</i>   | 133 |
| <b>Coulometric Titrations and Conductivity Relaxation Experiments on Ni<sub>1-<math>\delta</math></sub>O at High Temperatures</b><br><i>M. Holzinger, W. Jantscher I. Rom and W. Sitte</i>   | 143 |
| <b>Chemical Diffusivity of Al-Doped BaTiO<sub>3</sub></b><br><i>Chang-Rock Song and Han-Ill Yoo</i>  | 149 |
| <b>Temperature Dependence of the Resistivity and Magnetic Susceptibility of <math>\beta</math>-(BEDT-TTF)<sub>2</sub>PF<sub>6</sub> Family Salts</b><br><i>G. R. K. Senadeera, T. Kawamoto, T. Mori, J. Yamaura and T. Enoki</i>             | 155 |

## [C] POLYMERS

- Ionic Motion in Polypyrrole Doped with Ions of Different Sizes (Invited)  
*Steen Skaarup, Keld West, L. M. W. K. Gunaratne and K. P. Vidanapathirana* 163
- Polymers in Lithium Batteries (Invited)  
*Jean-Yves Sanchez, Fannie Alloin, Nicolas Chaix and Johann Saunier* 173
- Enhancing the Electrical Conductivity of Poly-Methylpyrrole Polymer Films  
*M. A. Careem and K. P. Vidanapathirana* 183
- Semiconductor Dispersed Polymer Electrolyte Composites  
*Bhaskar Bhattacharya, Amita Chandra, N. Srivastava and S. Chandra* 189
- Characteristics of Chitosan Film Doped with Lithium and Zinc Acetate  
*M. Z. Yahya, M. R. Muhamad and A. K. Arof* 195
- Electrical Conductivity of Impurity Doped Polyvinyl Chloride  
*S. Ramesh, L. Rekha, S. Radhakrishna and A. K. Arof* 201
- Fractal Growth in Chitosan Films  
*A. M. M. Ali, A. M. Morni, B. M. Yamin and A. K. Arof* 207
- Studies on Temperature Dependence of Conductivity of PVA Based Composite Polymer Electrolytes  
*P. K. Shukla and S. L. Agrawal* 211
- Fast Ion Conducting Lithium Electrolyte Gelled with PMMA  
*S. S. Sekhon, Pradeep and S. A. Agnihotry* 217
- PEO Based Polymer Electrolytes Complexed with  $\text{NaNO}_3$  and  $\text{KNO}_3$  Salts  
*S. Ramalingaiah, T. Sreekanth, M. Jaipal Reddy and U. V. Subba Rao* 223
- PEO +  $\text{NaClO}_4$  Based Composite Polymer Electrolyte Dispersed with  $\text{SnO}_2$   
*Awalendra K. Thakur; H. M. Upadhyaya, S. A. Hashmi and A. Li Verma* 229

## [D] GLASSES

- Structural Characterisation of  $\text{Cu}_2\text{O}\cdot\text{TeO}_2\cdot\text{WO}_3$  Glass System  
*B. V. R. Chowdari, K. L. Tan and Ling Fang* 237

- Dynamic Conductivity Studies on Copper-Silver Iodo-Vanadate Superionic Material  
*A. Viswanathan and S. A. Suthanthiraraj* 243
- Preparation and Thermal Characterisation of a New Mixed System  $\text{CdI}_2\text{-Ag}_2\text{O-MoO}_3$   
*S. A. Suthanthiraraj and A. C. Ganeshkumar* 249
- X-Ray Diffraction and Differential Scanning Calorimetric Studies of the Fast Ionic System  $\text{CuI-Ag}_2\text{O-SiO}_2$   
*S. A. Suthanthiraraj and G. Kumar Sathian* 253
- Glass Former-Compositional Dependent Conductivity Studies on a New  $\text{Ag}^+$  Ion Conducting Glassy System:  
 $0.7[0.75\text{AgI}:0.25\text{AgCl}]:0.3[\text{Ag}_2\text{O}:\{x\text{B}_2\text{O}_3:(1-x)\text{MoO}_3\}]$   
*R. C. Agrawal, R. Kumar and M. L. Verma* 257

## [E] PROTON CONDUCTORS

- New Proton Conducting Polymers for Fuel Cell Applications (Invited)  
*K. D. Kreuer* 263
- Protonic Conductivity of Amorphous Polytungstic Acid with Oxalato or Malonato Ligands (Invited)  
*M. Hibino, T. Kusakabe and T. Kudo* 275
- Proton Dynamics Study in Solid Solution and Superlattice of Perovskite-Type Oxides  
*N. Sata, H. Yugami, H. Sone, N. Kitamura, T. Hattori and M. Ishigame* 281
- Hydrogen Permeation in  $(\text{ZrO}_2)_{0.85}(\text{CaO})_{0.15}$  at High Temperatures  
*Y. Nigara, K. Kawamura, T. Kawada, J. Mizusaki and M. Ishigame* 287
- Studies on Proton-Conducting Composite Electrolytes: Aluminium Oxide-Ammonium Heptamolybdate Tetrahydrate System  
*S. A. Hashmi and H. M. Upadhyaya* 293
- Effect of Adsorbed Water on Proton Conductivity of Porous Silica Gels Obtained by the Thermal Decomposition of Organic Additive  
*Atsunori Matsuda, Yoshinori Kotani, Kunihiko Kamon, Masahiro Tatsumisago and Tsutomu Minami* 299

- Unit Cell Symmetries and Electrochemical Investigation of Proton-Conducting Calcium-Doped Barium Cerate Ceramics  
*Narendra Singh and Robert C. Tl Slade* 305
- A Proton Conducting Gel using Precursor Tetraethyl Orthosilicate (TEOs) Doped with  $\text{H}_3\text{PO}_4$   
*Ritu Srivastava, D. K. Rai, B. Singh and S. Chandra* 317

## [F] ANION CONDUCTORS ( $\text{O}^{2-}$ , $\text{F}^-$ , $\text{Cl}^-$ ) AND OTHER MATERIALS

- Microstructure and Physical Properties of Superionic Eutectic Composites Prepared from Melt (Invited)  
*V. Trnovcova, P.P. Fedorov, V. Labaš and M. Yu. Starostin* 325
- Ionic Conductivity and Dynamic Behavior in Halocomplexes of the Group 14 and 15 Elements (Invited)  
*Tsutomi* 335
- Fast Ionic Conductors  $\text{Pb}_{0.67}\text{Cd}_{0.33}\text{F}_2:\text{MF}(\text{M} = \text{PbF}_2, \text{ScF}_3)$   
*V. Trnovcová, I. I. Buchinskaya, P.P. Fedorov and B. P. Maximov* 343
- Mixed Cationic Effects in Multicomponent Fluorite-Structured Fluorides  
*V. Trnovcová, P. P. Fedorov, I. I. Buchinskaya and T. Srámková* 349
- Study on Mineral Fast Ion Conductors of Al-R-NASICON  
*Wenji Wang and Zhenshan Guo* 355
- Thermal Expansion Studies on Some Oxygen Ion Conducting Compounds  
*S. J. Patwe, A. N. Achary, M. D. Mathews and A. K. Tyagi* 359
- Effect of Dopants on the Ionic Conductivity of  $\text{Na}_2\text{SO}_4$   
*S. Rahman, A. Singh, P. Gopalan and A. R. Kulkarni* 365
- Effect of Cationic Substitution on the Conductivity of the  $\text{Li}_2\text{SO}_4\text{-ZnSO}_4$  System  
*P. Jha, Piyush, P. Gopalan and A. R. Kulkarni* 371
- $\text{La}_2(\text{SO}_4)_3$   $\text{Na}_2\text{SO}_4\text{-MnSO}_4$   
*A. Mathur and A.* 377

AFM Studies on  $\text{PbCl}_2\text{-Al}_2\text{O}_3$  Composite Solid Electrolytes*Askoki Kumar*

383

## [G] FUEL CELLS AND BATTERIES

Possibilities of New Type Solid Oxide Fuel Cells (Invited)

*Hiroyasu Iwahara*

391

Recent Trend of Solid Oxide Fuel Cells Technology (Invited)

*Masayuki Dokiya*

401

New Cathode Materials for Oxide Ionic Electrolyte

*S. Hashimoto and H. Iwahara*

411

Enhancement of Electrochemically Effective Area of Ni/YSZ Anodes

*P. Ekanayake, M. Gödickemeier and L. J. Gauckler*

417

Microbatteries: An Original Concept with New Materials for Micropower Devices (Invited)

*A. Levasseur and P. Vinatier*

421

Status of Lithium Polymer Electrolyte Battery Development (Invited)

*M. Z. A. Munshi*

431

Nanostructured Materials and Polymer Electrolytes for Secondary Batteries (Invited)

*V. Badri, A. M. Hermann and P. Lyman*

441

Lithium Insertion of  $\text{ReO}_3$ -Type Metastable Phase in the System  $\text{Nb}_2\text{O}_5\text{-WO}_3$ *Hirotohi Yamada, Mitsuhiro Hibino and Tetsuichi Kudo*

451

Electrical Properties of  $\text{Li}(\text{Ni}_{1-\delta}\text{Co}_\delta)\text{O}_2$  and  $\text{Li}(\text{Mn}_{1-\delta}\text{M}_\delta)_2\text{O}_4$  ( $\text{M} = \text{Ti}, \text{Nb}$ )  
Cathode Materials for Lithium Secondary Batteries*Kwang Soo Yoo and Yong-Joo Oh*

455

Thin Film Polymer Batteries Based on PVDF Polymer Electrolytes

*M. M. E. Jacob and A. K. Arof*

457

- Thermoelectric Power and Battery Discharge Characteristic Studies on a New Silver Ion Conducting Composite Electrolyte System  
*R. C. Agrawal, Mohan Lj Verma, R. K. Gupta and S. Thaker* 465

## [I-I] ELECTROCHROMIC DISPLAY, SENSOR AND OTHER DEVICES

- Compositional Aspects & Some Properties of Peroxotungstic Acid for EC Applications  
*Deepa, Pradeep, R. Ramachandran and S. A. Agnihotry* 473
- Lactate Biosensor Based on Polypyrrole-Polyvinylsulphonate Composites  
*Ashd Chaubey, Rahul Singhal, Manju Gerard and B. D. Malhotra* 479
- Electrode Reactions of  $\text{Cu}_2\text{O}$  Based Photoelectrochemical Cell and Study of its Quantum Efficiency  
*K. A. Khan* 485
- Dye Sensitized Photoelectrochemical Solar Cells with PEO Based Solid Polymer Electrolytes  
*L. R. A. K. Bandara, M. A. K. L. Dissanayake, G. W. K. Ekanayake, O. A. Ileperuma and T. T. K. Weeraman* 493
- Preparation of  $\text{Li}_3\text{Fe}_2(\text{PO}_4)_3$  Solid Electrolyte by Ultrasonic Spray Pyrolysis for Application in Electrochemical Gas Sensors  
*A. K. Ivanov-Schitz, A. V. Nitsuk and N. G. Chaban* 499
- Electrochromism in Tetraphenyl Porphine Vanadium(IV) Oxide Langmuir-Blodgett Films  
*M. M. Salleh, M. Yahaya and Mursyidah* 503
- Electrochromic Effects in  $\text{MoO}_3$  Thin Films  
*Muhammad Yahaya, M. M. Salleh and Ibrahim A. Talib* 509

## [II] LATE ENTRIES

- Causality, Stability and Fractal in Ionic Materials (Invited)  
*M. Kobayashi and F. Shimojo* 515

|  |     |
|--|-----|
| Orientational Dynamics and Quantum Mechanical Tunneling of Molecular Ions in Solids (Invited)<br><i>A. L. Verma</i>  | 525 |
| Thermodynamic Characteristics of the Electrochemical Materials (Invited)<br><i>H. Yokokawa, K. Yamaji, T. Horita and N. Sakai</i>                            | 537 |
| Growth of Single Crystals of Superionic Conductors (Invited)<br><i>A. K. Ivanov-Schitz, L. N. Demianets</i>  | 547 |
| Transport-Structure Correlations in AgI-Based Silver Oxysalt Glasses (Invited)<br><i>A. Magistris, P. Mustarelli and C. Tomasi</i>                           | 557 |
| Fuel Cells: An Environmentally Friendly Power Generation Technology for the Next Century (Invited)<br><i>S. P. S. Badwal</i>                                 | 567 |
| Nucleation and Growth in Polymer-Salt Complex Films<br><i>A. J. Bhattacharyya and S. Tarafdar</i>  | 579 |
| Study of $\text{Li}_{0.9}\text{Mn}_2\text{O}_4$ /Polymer Electrolyte/Graphite Solid State Electrochemical Cell<br><i>S. Selladurai and R. Chandrasekaran</i> | 585 |
| Author Index   | 593 |
| List of Participants   | 597 |