

Table of Contents

Preface

Chapter 1: Proton Exchange Membrane Fuel Cells (PEMFC)

Facile Fabrication of Bimetallic PtCo Nanoparticles Supported on Three-Dimensional Reduced Graphene Oxide by Ultrasonic-Assisted Method for Oxygen Reduction Reaction Y. Li, J. Yang and K. Xu	3
MOF Derived Catalysts for Oxygen Reduction Reaction in Proton Exchange Membrane Fuel Cell N. Khan, S. Saim, X. Shi, M. Noman, M.W. Durani and A. Ali	8
The Influence of Gas Diffusion Media Morphology on Hydrogen Fuel Cell Performance B. Gould, Y. Garsany, M. Sassin, R. Atkinson III, I. Zenyuk and K. Swider-Lyons	16
Ionic Transport in Sol-Gel Derived Organic-Inorganic Composites Y. Dzyazko and Y. Volfkovich	22
On Computational Model of Nafion Membrane with Molecular Dynamic Method I. Riku, K. Kawanishi, R. Oka and K. Mimura	56
MD Analysis of Effect of Relative Humidity on Molecular Chain's Network Structure of PEM I. Riku, K. Kawanishi and K. Mimura	62
Morphological and Thermal Characterization of Nafion/CNT/PVA Nanocomposite Membranes Y.H. Kim, Y.K. Lee, B.K. Kang, H.J. Kim and S.J. Choi	67
Synthesis and Characterization by Ellipsometry of Cationic Membranes for Fuel Cells B.L.S. Cadinelli, F.C. do Nascimento, T.A.A. Faria, L.M. Freire, L. da Silva, J.A. de Castro and F.J.B. Brum	74
Hydration Behaviour of Sufonated Polyetheretherketone (SPEEK) Membranes K. Veldre, E. Sala, E. Āboltiņa and G. Vaivars	80
A Study on Acidification and Intercalation of Illite Clay Minerals and their Potential Use as a Filler in SPEEK Composite Membranes A. Trubača-Boginska, R. Ādiņa, G. Vaivars and J. Švirksts	86
Synthesis and Characterization of Sulfonated PVDF TiO₂-Natural Zeolite Nanocomposites Membrane Juliandri, A. Nurfadillah, Rukiah, M. Nasir and R.A. Lubis	92
Effects of Natural Clay on Ionic Conductivity, Crystallinity and Thermal Properties of PEO-LiCF₃SO₃-Natural Clay as Solid Polymer Electrolyte Nanocomposites P. Pongsuk and J. Pumchusak	98
Research Regarding Molding of Fuel Cell Bipolar Plates Made of Polymeric-Carbon Composites D. Serban, L. Alexandrescu and C.G. Opran	104
Expanded Graphite/Epoxy/Aliphatic Amine Composites for Bipolar Plates Applications in Polymer Electrolyte Fuel Cells A.F. Rigail-Cedeño, M. Espinoza-Andaluz, J. Medina-Andrade and K. Leal-Zavala	114
Lightweight Titanium Metal Bipolar Plates for PEM Fuel Cells K.S. Lyons and B.D. Gould	121
Numerical Study on the Influence of Cathode Flow Channel Baffles on PEM Fuel Cell Performance X. Shen, J.Z. Tan and Y. Li	127
Metal-Foam Bipolar Plate for PEM Fuel Cells: Simulations and Preliminary Results Y. Awin and N. Dukhan	133
Thermodynamic Analysis of the Performance of an Irreversible PEMFC C.J. Li, Y. Liu and Z. Ma	142

Chapter 2: Direct Methanol Fuel Cells (DMFC)

Use of Carbon Nanomaterials as a Catalyst Support in Fuel Cells Y. Suda	155
Calcium-Doped Y114 Layered Cobalt Perovskite, a Promising Anodic Material for Direct Methanol Fuel Cell V.D. Craia-Joldes, M.L. Dan, D.A. Duca and N. Vaszilcsin	162
Microfluidic Synthesis and Electrochemical Performance of Ternary Metals Nanoalloy: FePtSn J.G. Ma, J.M. Wang, S. Li and Y.J. Song	173
Preliminary Study of ABS/Chitosan Blend Polymer for DMFC Membranes N. Hidayati, M. Mujiburohman, Hamid, H. Purnama, A. Dwilaksana and F.R. Zubaida	180
The Morphology Effect on the Selectivity of SPEEK/ENR Membranes for Direct Methanol Fuel Cell W.N.E. Wan Mohd Norazman, J. Jaafar, W.N.W. Salleh, A.F. Ismail, M.H.D. Othman, M.A. Rahman, F. Aziz and N. Yusof	187
Effects of SPEEK/Cloisite Concentration as Electrospinning Parameter on Proton Exchange Membrane for Direct Methanol Fuel Cell Application N. Awang, J. Jaafar, A.F. Ismail, M.H.D. Othman and M.A. Rahman	194
Experimental Study on the Performance of DMFC Using Novel Composite Materials of Polypyrrole-Coated Polypropylene as BPs R. Yeetsorn, C. Prapainainar, M.W. Fowler and Y. Maiket	201

Chapter 3: Microbial Fuel Cell (MFC)

Chemical Etching of TiO₂ Nanorods Greatly Improves Current Generation of <i>S. loihica</i> PV-4 on a Carbon Paper Electrode L. Dong, T. Yin, L. Su and D.G. Fu	209
Pre-Immobilization of Anaerobic Mixed Culture on Electrode of the Upflow Bio-Filter Circuit Microbial Fuel Cell C. Sinprasertchok, N. Chollacoop, S. Charojrochkul and K. Sombatmankhong	214
Potential of Palm Oil Mill Effluent (POME) as Growth Medium for Sulfate-Reducing Bacterium in Microbial Fuel Cell Z. Abdul Halim, N.R. Abu Sepian and K. Abd Karim	218
Electricity Production from Organic Wastes Fermentation by Microbial Fuel Cell Process P. Moonsri, W. Pongpian and P. Juantrong	225
Design and Implementation of Microbial Fuel Cell Using Carbon Paste Electrode A.P. Luna, F.K.B. Manalo and E.A. Florido	232

Chapter 4: Solid Oxide Fuel Cells (SOFC)

Symmetric Electrodes for Solid Fuel Cells Based on Sr-Doped LaFe_{0.7}Ni_{0.3}O_{3-δ} O. Ben Mya, M. Omari, L. dos Santos-Gomez and D. Marerro-Lopezd	241
Synthesis, Structural and Thermal Properties of Layered Perovskites SmBaMn₂O_{5+d} for SOFCs Applications A.M. Abdalla, S. Hossain, J. Zhou, P.M.I. Petra and A.K. Azad	249
Fabrication of the Anode Supported Solid Oxide Fuel Cells by Tape-Casting Process and Infiltration Method Y.J. Kwon and Y.B. Han	255
Investigation on the Performance and Durability Behavior for the Anode-Supported Solid Oxide Fuel Cell with Composite Cathodes T.N. Lin, Y.C. Chang, M.C. Lee and W.X. Kao	264
A Simulation of Ferroelastic Phase Formation by Using Phase Field Model M. Muramatsu, T. Kawada and K. Terada	275
Conductivity Characterization of Iron Oxide Doped 8 mol% Yttria Stabilized Zirconia T. Selvaraj, B. Johar, S.F. Khor and M.N. Mohd Zainol	281
Effect of Niobium Doping on the Properties of Yttria-Stabilised Zirconia for Solid Electrolyte in Solid Oxide Fuel Cell B. Johar and C.S. Lexus	288

Effect of Precursor Grain Size on the Sinterability and Conductivity of Commercial Yttria-Stabilized Zirconia as Solid Electrolyte	
A.R.T. Mercado, E.S. Mesina, J.R. Rabo and R.B.M. Cervera	294
Morphological and Structural Characterization of YSZ Thin Film Fabricated by Electrophoretic Deposition on LSM/YSZ Substrate	
A.K. Garcia and R.B.M. Cervera	299
Effect of Pulse Frequency on the Deposition of Cu-Fe Alloy via Pulsed Current Electrodeposition Method	
A.R. Setiawan, A. Ramelan, A. Nuruddin and I.U. Hasanah	304
Synthesis and Characterization of $\text{LaCr}_{1-x}\text{Sn}_x\text{O}_3$ Nanopowders ($x = 0$ and 0.1)	
A.C.S. Costa, A.P.S. Peres, A.C. Lima, C.P. Bergmann and W. Acchar	310
Fabrication of $(\text{Mn}_x\text{Co}_{1-x})_3\text{O}_4$ Coated Stainless Steel AISI 430 by Electrodeposition with AC+DC Signals	
P. Wiman, T. Thublaor, O. Witthayarungruengsri and T. Siripongsakul	314
Chromia Evaporation of Ferritic Stainless Steel AISI430 Coated by $(\text{La,Sr})\text{CrO}_3$ Perovskite and Mn-Co Oxide Spinel	
T. Siripongsakul, T. Thublaor, V. Prajakesakul, S. Kachaban and S. Chandra-Ambhorn	320
Residual Stress Depth Distributions for Atmospheric Plasma Sprayed $\text{MnCo}_{1.9}\text{Fe}_{0.1}\text{O}_4$ Spinel Layers on Crofer Steel Substrate	
H.C. Back, M. Mutter, J. Gibmeier, R. Mücke and R. Vaßen	326
Barium (Zinc) Borosilicate Sealing Glass and Joining Interface with YSZ Electrolyte and Crofer22APU Interconnect in SOFCs	
N. Kingnoi, J. Ayawanna and N. Laorodphan	334
$\text{BaO-Al}_2\text{O}_3\text{-SiO}_2\text{-B}_2\text{O}_3$ Glass-Ceramic SOFCs Sealant: Effect of ZnO Additive	
N. Laorodphan and J. Ayawanna	340
Influence of Bi_2O_3 on Crystalline Phase Content and Thermal Properties of Akermanite and Diopside Based Glass-Ceramic Sealant for SOFCs	
P. Lawita, A. Theerapapvisetpong and S. Jiemsirilers	346
Material of High Temperature Heat Exchanger in Fuel Cell System	
Z.H. Zhang, L.M. Ba, C.F. Li, X. Li and Q. Guo	352

Chapter 5: Intermediate-Temperature Solid Oxide Fuel Cells (IT-SOFC)

Electrical Conductivity of NiO-Gadolinia Doped Ceria Anode Material for Intermediate Temperature Solid Oxide Fuel Cells	
A.K. Soman, P. Kuppusami and A.M. Rabel	359
$\text{Ni}_{0.75}\text{Fe}_{0.25}$ Coated Tubular GDC Anode for Cathode-Supported IT-SOFC with High Anode Porosity	
H.X. You, L. Peng and Q. Wang	372
Preparation of Nano-Structured Cathode for Proton-Conducting Fuel Cell by Dispersing Agent-Assisted Sol-Gel Method	
I. Ismail, A.M. Md Jani and N. Osman	378
Effects of Milling Speed and Calcination Temperature on the Phase Stability of $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Co}_{0.8}\text{Fe}_{3-\delta}$	
K.H. Ng, H.A. Rahman and S. Afandi	383
Structural and Electrical Properties of Barium Strontium Cobaltite Nanoparticles Synthesized by Wet Chemical Methods	
T. Akhtar, O. Farooq and M. Anis-ur-Rehman	388
The Investigation of Perovskite $\text{LaCo}_{0.6}\text{Ni}_{0.4}\text{O}_{3-\delta}$ as Cathode Interface Contact Material for Intermediate Temperature Solid Oxide Fuel Cells	
Z. Li, D. Yan, Q. Zhang and J. Pu	395
Synthesis of $\text{La}_2\text{NiO}_{4+\delta}$ Nanofibers by Electrospinning Method and their Application	
Y. Xing, M.F. Zhang, T.J. Li and W. Pan	400
Sol-Gel Synthesis of Solid Solution Based on Cerate-Zirconate Ceramics	
N. Osman, A.S. Abdullah, W.Z. Wan Zulkifli, M.R. Somalu, A. Muchtar, A.M. Md Jani and O.H. Hassan	406

Synthesis and Characterization of $\text{Sm}_{1-x}\text{Zr}_x\text{Fe}_{1-y}\text{Mg}_y\text{O}_3$ ($x, y = 0.5, 0.7, 0.9$) as Possible Electrolytes for SOFCs	
A.M. Abdalla, S. Hossain, N. Radenahmad, P.M.I. Petra, M.R. Somalu, S.M.H. Rahman, S.G. Eriksson and A.K. Azad	412
Synthesis of $\text{La}_{10}\text{Si}_{6-2x}\text{Bi}_{2x}\text{O}_{27-x}$ as Possible Electrolyte Materials for Solid Oxide Fuel Cells	
H.Q.H.H. Absah, A.H. Karim, M.S. Abu Bakar, L.C. Ming and A.K. Azad	417
Synthesis and Characterizations of Y-Doped BaCeO_3 Ceramic for Use as Electrolyte in Solid Oxide Fuel Cell	
W. Somkhuan, P. Butnoi, P. Jaita, N. Lertcumfu, G. Rujijanagul and T. Tunkasiri	422
Conductivity of Yttria-Stabilized Zirconia Nanostructure Electrolyte for Solid Oxide Fuel Cell Application by Using RF Magnetron Sputtering	
S.Y. Jaffar, Y. Wahab, R. Muhammad, Z. Othaman, Z. Ibrahim, N. Nayan and R.K. Tan	428
Fabrication of YSZ/SNDC Bilayer Electrolytes by Spark Plasma Sintering	
T.J. Li, M.F. Zhang, Y.J. Yuan, X.H. Zhao and W. Pan	434
Synthesis and Conductivity Investigation of Cu Doped Apatite Type Lanthanum Silicate Electrolyte	
W.Z. Li, Z.L. Huang, Z. Li and J. Chen	440
Bi Doping Effect on the Conductivity of Lanthanum Silicate Apatite	
A.R. Noviyanti, N. Akbar, I. Hastiawan, I. Rahayu, Haryono, Y.T. Malik and R. Risdiana	445
Enhanced Ionic Conductivity in $\text{Ce}_{0.8}\text{Gd}_{0.2}\text{O}_{2-\delta}$ Nanofiber: Effect of the Crystallite Size	
M.F. Zhang, T.J. Li, X.H. Zhao, H.J. Zhou and W. Pan	450
Preparation and Property of LSGM-Carbonate Composite Electrolyte for Low Temperature Solid Oxide Fuel Cell	
X.P. Lin, H.T. Zhong, X. Chen, B. Ge and D.S. Ai	456
Advanced Microstructural Investigations of AISI 441 Early Stage Oxidation in Wet Atmosphere	
W. Wongpromrat, V. Parry, W. Chandra-Ambhorn, S. Chandra-Ambhorn, A. Galerie and Y. Wouters	463
Performance Characteristics of Solid Oxide Fuel Cells with YSZ/CGO Electrolyte	
A.N. Kovalchuk, A.M. Lebedinskiy, A.A. Solovyev, I.V. Ionov, E.A. Smolyanskiy, A.V. Shipilova, A.L. Lauk and M.R. Rombaeva	469

Chapter 6: Hydrogen Production and Storage

The Design and Performance Study of Polymer Electrolyte Membrane Using 3-D Mesh	
A. Tugirumubano, K.S. Kim, H.J. Shin, C.H. Kim, L.K. Kwac and H.G. Kim	477
Moisture Elimination of the Wet Hydrogen Gas Using the Electrochemical Hydrogen Compressor with a Modified MEA Composition	
H.Y. Jeong, S.A. Jeon, H.N. Jeong, S.H. Go, M.S. Lee and H.G. Kim	482
Effect of NaOH Concentration on the Formation of TiO_2 Nanotube Arrays by Anodic Oxidation Process for Photoelectrochemical Cell	
N. Nyein, M.A. Zulkifli, T.W. Kian, A. Matsuda and Z. Lockman	488
Surface Engineering of Metal Oxide Photoelectrodes for Improved Band Alignment in Solar Water Splitting Cells	
S.L. Sim, Y.R. Liu, Y.W. Soon and J.R. Jennings	492
Engineering Solutions in Scale-Up and Tank Design for Metal Hydrides	
G. Capurso, J. Jepsen, J.M. Bellosta von Colbe, C. Pistidda, O. Metz, D. Yigit, H.J. Cao, R. Hardian, A. Strauch, K. Taube, T. Klassen and M. Dornheim	498

Chapter 7: Some Aspects of Implementation Fuel Cells into Power Supply Systems

Model of a Power-to-Gas System with Fuel Cell in a Mixed Integer Linear Program for the Energy Supply of Residential and Commercial Buildings	
N. Ebell, A. Bott, T. Beck, J. Bürner, J. Praß and J. Franke	507
Renewable Hydrogen-Based Energy System for Supplying Power to Telecoms Base Station	
D.N. Luta and A.K. Raji	516

Hydrogenous Fuel as an Energy Material for Efficient Operation of Tandem System Based on Fuel Cells

M. Zubkova, A. Stroganov, A. Chusov and D. Molodtsov

531