
Contents

Preface	ix
Acknowledgments	xi
HYDROGEN	
Hydrogen Storage Technologies—A Tutorial with Perspectives from the US National Program Ned T. Stetson and Larry S. Blair	3
Structural Study and Hydrogen Sorption Kinetics of Ball-Milled Mg-10 wt% Ni Alloy Catalysed by Nb Sima Aminorroaya, Abbas Ranjbar, Younghee Cho, Hua Liu, and Arne Dahle	17
Mechanical Processing—Experimental Tool or New Chemistry? Viktor P. Balema	25
Production of Hydrogen and Carbon Monoxide from Water and Carbon Dioxide through Metal Oxide Thermochemical Cycles Eric N. Coker, Andrea Ambrosini, Mark A. Rodriguez, Terry J. Garino, and James E. Miller	37
Ultrasmall Angle X-Ray Scattering (USAXS) Studies of Morphological Changes in NaAlH_4 Shathabish Narase Gowda, Scott A. Gold, Jan Ilavsky, and Tabbetha A. Dobbins	51
Carbon Building Materials from Coal Char: Durable Materials for Solid Carbon Sequestration to Enable Hydrogen Production by Coal Pyrolysis John W. Halloran and Zuimdie Guerra	61

Thermal Decomposition of t-Butylamine Borane Studied by In Situ Solid State NMR	73
Jordan Feigerle, Norm Smyrl, Jonathan Morrell, and Ashley C. Stowe	
The Performances of Ceramic Based Membranes for Fuel Cells	81
Uma Thanganathan, and Masayuki Nogami	
Microcrack Resistant Polymers Enabling Lightweight Composite Hydrogen Storage Vessels	91
Kaushik Mallick, John Cronin, Paul Fabian, and Mike Tupper	
A Study of the Thermodynamic Destabilization of Sodium Aluminum Hydride (NaAlH ₄) with Titanium Nitride (TiN) using X-ray Diffraction and Residual Gas Analysis	99
Whitney Fisher Ukpai and Tabbetha A. Dobbins	

BATTERIES AND ENERGY STORAGE MATERIALS

Rapid Synthesis of Electrode Materials (Li ₄ Ti ₅ O ₁₂ and LiFePO ₄) for Lithium Ion Batteries through Microwave Enhanced Processing Techniques	109
K. Cherian, M. Kirksey, A. Kasik, M. Armenta, X. Sun and S. K. Dey	
Lithium Storage Characteristics in Nano-Graphene Platelets	117
S. L. Cheekati, Y. Xing, Y. Zhuang, and H. Huang	
In-Situ Impedance Spectroscopy of LiMn _{1.5} Ni _{0.4} Cr _{0.1} O ₄ Cathode Material	129
Karina Asmar, Rahul Singhal, Rajesh K. Katiyar, Ram S. Katiyar, Andrea Sakla, and A. Manivannan	
Cu ₂ (Zn _x Sn _{2-x})(SySe _{1-y}) ₄ Monograin Materials for Photovoltaics	137
E. Mellikov, M. Altosaar, J. Raudoja, K. Timmo, O. Volobujeva, M. Kauk, J. Krustok, T. Varema, M. Grossberg, M. Danilson, K. Muska, K. Ernits, F. Lehner, and D. Meissner	
Determination of the Diffusion Coefficient of Lithium Ions in Graphite Coated with Polymer-Derived SiCN Ceramic	143
Andrzej P. Nowak, Magdalena Graczyk-Zajac, and Ralf Riedel	
Nano-Aggregate Synthesis by Gas Condensation in a Magnetron Source for Efficient Energy Conversion Devices	153
E. Pauliac-Vaujour, E. Quesnel, V. Muffato, O. Sicardy, N. Guillet, R. Bouchmila, P. Fugier, H. Okuno, and L. Guetaz	
Modeling Nanoparticle Synthesis by Gas Condensation in a Nanocluster Source for Applications in Photovoltaic and Hydrogen Fuel Cells	163
E. Pauliac-Vaujour, E. Quesnel, and V. Muffato	

Carbon Encapsulated-Iron Lithium Fluoride Nanocomposite as High Cyclic Stability Cathode Material in Lithium Batteries Raju Prakash, Christian Kübel, and Maximilian Fichtner	173
The Ortho-Phosphate Arrojadite as a New Material for Cathodes in Li-Ion Batteries C. Kallfaß, C. Hoch and H. Schier, Wituchowski, O. Görke, and H. Schubert	183
SOLAR	
A Novel Purification Method for Production of Solar Grade Silicon Shaghayegh Esfahani and Mansoor Barati	195
Metallurgical Refining of Silicon for Solar Applications by Slagging of Impurity Elements M. D. Johnston and M. Barati	207
Ocean Thermal Energy Conversion: Heat Exchanger Evaluation and Selection Manuel A.J. Laboy, Orlando E. Ruiz, and José A. Martí	219
Synthesis of Solar-Grade Silicon from Rice Husk Ash—An Integrated Process K. K. Larbi, M. Barati, A. McLean, and R. Roy	231
Suitability of Pyrolytic Boron Nitride, Hot Pressed Boron Nitride, and Pyrolytic Graphite for CIGS Processes John T. Mariner	241
Materials Selection and Processing for Lunar Based Space Solar Power Peter J. Schubert	249
$\text{Cu}_2\text{ZnSnSe}_4$ Thin Films Produced by Selenization of Cu-Zn-Sn Composition Precursor Films O. Volobujeva, E. Mellikov, S. Bereznev, J. Raudoja, A. Õpik, and T. Raadik	257
HYDROPOWER	
Martensitic Stainless Steel $0\text{Cr}_{13}\text{Ni}_4\text{Mo}$ for Hydraulic Runner D. Z. Li, Y. Y. Li, P. Wang, and S. P. Lu	267
Advanced Composite Materials for Tidal Turbine Blades Mike Hulse, John Cronin, and Mike Tupper	279
NUCLEAR	
Immobilization of Tc in a Metallic Waste Form W. L. Ebert, J. C. Cunnane, S. M. Frank, and M. J. Williamson	291

Development of Iodine Waste Forms using Low-Temperature Sintering Glass	305
Terry J. Garino, Tina M. Nenoff, James L. Krumhansl, and David Rademacher	
WIND	
Nanostrength® Block Copolymers for Wind Energy	315
Robert Barsotti, John Chen, and Alexandre Alu	
Development of Multifunctional Nanocomposite Coatings for Wind Turbine Blades	325
Fei Liang, Yong Tang, Jihua Gou, and Jay Kapat	
BIOMASS	
Volatility of Inorganics during the Gasification of Dried Sludge	339
C. Bourgel, J. Poirier, F. Defoort, J-M Seiler, and C. Peregrina	
Catalysts and Sorbents for Thermochemical Conversion of Biomass to Renewable Biofuels—Material Development Needs	349
Singfoong Cheah, Stefan Czernik, Robert M. Baldwin, Kimberly A. Magrini-Bair, and Jesse E. Hensley	
Material Characterization and Analysis for Selection of Refractories used in Black Liquor Gasification	363
James G. Hemrick and James R. Keiser, and Roberta A. Peascoe-Meisner	
Addressing the Materials Challenges in Converting Biomass to Energy	377
Cynthia Powell, James Bennett, Bryan Morreale, and Todd Gardner	
GEOHERMAL	
Experience with the Development of Advanced Materials for Geothermal Systems	389
Toshifumi Sugama, Thomas Butcher, and Lynne Ecker	
Novel High-Temperature Materials Enabling Operation of Equipment in Enhanced Geothermal Systems	403
Matthew W. Hooker, Craig S. Hazelton, Kimiko S. Kano, Larry G. Adams, Michael L. Tupper, and Steven Breit	
Author Index	413