

# Journal <sup>of The</sup> Electrochemical Society

---

2011 • Volume 158, Number 3

*JESQAN 158 (3)*



A Journal for Solid-State and  
Electrochemical Science and Technology

# Table of Contents

## Batteries and Energy Storage

### Modeling All-Solid-State Li-Ion Batteries

D. Danilov, R. A. H. Niessen, P. H. L. Notten ..... A215

### Electrodes for Nonaqueous Oxygen Reduction Based upon Conductive Polymer-Silver Composites

A. C. Marschilok, S. Zhu, C. C. Milleville, S. H. Lee, E. S. Takeuchi, K. J. Takeuchi ..... A223

### Carbon Coated LiMnPO<sub>4</sub> Nanorods for Lithium Batteries

P. R. Kumar, M. Venkateswarlu, M. Misra, A. K. Mobanty, N. Satyanarayana ..... A227

### Iron Oxide Nanosheets and Nanoparticles Synthesized by a Facile Single-Step Coprecipitation Method for Lithium-Ion Batteries

M.-S. Wu, Y.-H. Ou, Y.-P. Lin ..... A231

### PCBM-Grafted MWNT for Enhanced Electron Transport in Polymer Solar Cells

Y. S. Jung, Y.-H. Hwang, A. Javey, M. Pyo ..... A237

### Carbon Fabric Supported Manganese and Ruthenium Oxide Thin Films for Supercapacitors

X. Liu, P. G. Pickup ..... A241

### Mg and Fe Co-doped Mn Based Olivine Cathode Material for High Power Capability

J. Kim, Y.-U. Park, D.-H. Seo, J. Kim, S.-W. Kim, K. Kang ..... A250

### Evaluation of Effects of Additives in Wound Li-Ion Cells Through High Precision Coulometry

J. C. Burns, G. Jain, A. J. Smith, K. W. Eberman, E. Scott, J. P. Gardner, J. R. Dahn ..... A255

### Combinational Effects of Oxygen Plasma Irradiation and Annealing on LiMn<sub>2</sub>O<sub>4</sub> Thin Film Cathodes

C. C. Chen, K.-F. Chiu, K. M. Lin, H. C. Lin, C.-R. Yang, F. M. Wang ..... A262

### Structure and Electrochemical Performance of Niobium-Substituted Spinel Lithium Titanium Oxide Synthesized by Solid-State Method

T.-F. Yi, Y. Xie, J. Shu, Z. Wang, C.-B. Yue, R.-S. Zhu, H.-B. Qiao ..... A266

### Enhanced High-Rate Performance of Li<sub>4</sub>Ti<sub>5</sub>O<sub>12</sub> Nanoparticles for Rechargeable Li-Ion Batteries

J. Lim, E. Choi, V. Mathew, D. Kim, D. Abn, J. Gim, S.-H. Kang, J. Kim ..... A275

### Effect of Primary Particle Size upon Polarization and Cycling Stability of 5-V Lithium Insertion Material of Li[Ni<sub>1/2</sub>Mn<sub>3/2</sub>]O<sub>4</sub>

K. Ariyoshi, Y. Maeda, T. Kawai, T. Ohzuku ..... A281

### Electrochemistry of ZnO<sub>1-x</sub>S<sub>x</sub> Thin Film with Lithium

H. Xu, Y.-N. Zhou, F. Lu, Z.-W. Fu ..... A285

### Electrochemical Performance of Organic Radical Cathode with Ionic Liquid Based Electrolyte

Y. Dai, Y. Zhang, L. Gao, G. Xu, J. Xie ..... A291

### Simple Synthesis of Carbon/Tin Oxide Composite as Anodes for Lithium-Ion Batteries

M.-Y. Li, C.-L. Liu, Y. Wang, W.-S. Dong ..... A296

### Rechargeable Lithium/TEGDME-LiPF<sub>6</sub>/O<sub>2</sub> Battery

C. G. Laoire, S. Mukerjee, E. J. Plichta, M. A. Hendrickson, K. M. Abraham ..... A302

### Synthesis and Electrochemical Properties of Monoclinic LiMnBO<sub>3</sub> as a Li Intercalation Material

J. C. Kim, C. J. Moore, B. Kang, G. Hautier, A. Jain, G. Ceder ..... A309

### Effect of Organic Additives on Electrochemical Properties of Li Anode in Room Temperature Ionic Liquid

H. Sano, H. Sakaebe, H. Matsumoto ..... A316

### A Study on the Cause of Deterioration in Float-Charged Lithium-Ion Batteries Using LiMn<sub>2</sub>O<sub>4</sub> as a Cathode Active Material

T. Tsujikawa, K. Yabuta, T. Matsushita, M. Arakawa, K. Hayashi ..... A322



#### Editor

Daniel Scherson

Case Western Reserve University  
Cleveland, Ohio 44106, USA

#### Associate Editors

Jonah D. Erlebacher

Johns Hopkins University  
Baltimore, Maryland 21218, USA

Thomas F. Fuller

Georgia Institute of Technology  
Atlanta, Georgia 30332, USA

Raymond J. Gorte

University of Pennsylvania  
Philadelphia, Pennsylvania 19104, USA

Takayuki Homma

Waseda University  
Tokyo, Japan

Charles L. Hussey

University of Mississippi  
University, Mississippi 38677, USA

Yue Kuo

Texas A&M University  
College Station, Texas 77843, USA

Dolf Landheer

National Research Council – Canada  
Ottawa, Ontario, Canada

Mark E. Orazem

University of Florida  
Gainesville, Florida 32611, USA

Martin Winter

University of Münster  
Münster, Germany

#### Editorial Board

Doron Aurbach, Jennifer Bardwell, Jonah D. Erlebacher, Thomas F. Fuller, Andrew Gewirth, Raymond J. Gorte, Dennis Hess, Takayuki Homma, Charles Hussey, Yue Kuo, Dolf Landheer, Mark E. Orazem, Daniel Scherson, Martin Winter,

#### Editorial Advisory Committee

Silvia Armini, S. V. Babu, Teng-Ming Chen, Shimshon Gottesfeld, Rika Hagiwara, Ray Hua Horng, Daniel Lincot, Arumugam Manthiram, Kailash Mishra, Thomas Moffat, S. J. Pearton, Tae-Yeon Seong, Gery Stafford, Bernard Tribollet, John Wilkes, Rong-Jun Xie

#### Publications Staff

Annie Goedkoop, *Director of Publications*  
Dinia Agrawala, Anne L. Clementson, Paul Cooper, Andrea L. Guenzel, John Lewis, Heather McAlinn, Elizabeth Schademann, Beth Anne Stuebe

#### Publication Committee

Subhash Singhal, *Chairman*  
Scott A. Calabrese Barton, Dennis W. Hess, Alanah Fitch, Johna Leddy, Randy Leising, Andrew Lin, Hiroshi Nishihara, Krishnan Rajeshwar, Don Roeper, Andrea Russell, Jerzy Ruzyllo, Daniel Scherson, Enrico Traversa, Jennifer Wang, John Weidner

The *Journal of The Electrochemical Society* (J. Electrochem. Soc.) (USPS 284-140) (ISSN 0013-4651) is published monthly by The Electrochemical Society, 65 South Main Street, Pennington, NJ 08534-2839, USA, at Cummings Printing Co., 4 Peters Brook Drive, PO Box 16495, Hooksett, NH 03106-6495, USA. Periodicals postage paid at Pennington, New Jersey, USA and at additional mailing offices. POSTMASTER: Send address changes to: The Electrochemical Society, 65 South Main Street, Pennington, NJ 08534-2839, USA. Canada Post: Publications Mail Agreement #40612608 Canada Returns to be sent to Bleuchip International, P.O. Box 25542, London, ON N6C 6B2.

© Copyright 2011 by The Electrochemical Society, Inc.

## Publication Information

**ECS Members:** Access to the online edition of the current volume plus the entire online archive of the Journal is available to ECS members as part of their ECS Member Article Pack. The paper edition of the current volume is available to the members at an additional charge. Annual dues: \$98 for Active Members and \$18 for Student Members.

**Subscriptions:** Rates and packages vary. Send inquiries to Corey Eberhart, Global Sales Manager, ECS, 65 South Main Street, Pennington, New Jersey, 08534-2839, USA. Tel.: 609.647.3616; Fax: 609.737.2743; E-mail: corey.eberhart@electrochem.org. Visit the ECS website for more information.

**Address:** The address for the Executive Offices and Editorial Department of the Journal is: The Electrochemical Society, 65 South Main Street, Pennington, New Jersey, 08534-2839, USA. Tel.: 609.737.1902; Fax: 609.737.2743; E-mail: ecs@electrochem.org; Web: www.electrochem.org.

The address of the Circulation Department for ECS members is: 65 South Main Street, Pennington, New Jersey, 08534-2839, USA.

The address for the nonmembers' Circulation Department is: American Institute of Physics, P.O. Box 503284, St. Louis, MO 63150-2839, USA.

**Manuscripts:** Manuscripts are accepted for publication by the *Journal* with the understanding that they are unpublished, original works that have not been submitted elsewhere while under consideration by the *Journal* Editorial Board. See the "Instructions to Authors," which can be found in this issue. To help offset publication costs, a payment of \$80 per printed page is required. A discount is given if at least one author is a Society member at the time of a paper's submission.

**Permission to Re-publish:** The *Journal* is a copyrighted publication, and manuscripts submitted to the *Journal* become the property of ECS. Permission to re-publish parts of papers in the *Journal* is granted to current periodicals, provided due credit is given and that not more than one-sixth of any one paper is used in derivative works. Reproduction or replication of more than one-sixth of a paper is forbidden and illegal unless prior written authorization is obtained from ECS, along with permission from the author. Please use the Permission Request Form on the ECS Website (www.electrochem.org).

**Permission to Reproduce:** Reprographic copying beyond that permitted by the fair use provisions of the Copyright Act of 1976 is granted to libraries and other users registered with the Copyright Clearance Center provided that the fee (CCC Code 0013-465 1/97) is paid directly to: Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA; Tel: 978.750.8400; Fax: 978.750.4744; E-mail: info@copyright.com. Copying for other than internal or personal use without the express written permission of ECS is prohibited; please use the Permission Request Form on the ECS website (www.electrochem.org).

**Article Copies:** Single copies of articles are available from ECS to members at \$20 (US) per article, and to nonmembers at \$25 (US) per article. Orders may be placed via the ECS website.

**Single Issues:** ECS has available for sale a limited inventory of single issues of the *Journal*. Contact the ECS Circulation Department for more information. Positive microfilm copies of issues may also be obtained from ProQuest Information and Learning, 300 North Zeeb Road, Ann Arbor, MI 48106, USA; Tel: USA and Canada: 800.248.0360; all other countries 415.433.5500; Fax: 415.433.0100; E-mail: orders@infostore.com.

**Claims:** All claims for missing issues should be reported within 60 days of normal delivery date, and should be directed to the Circulation Department at the address given above.

**Address Changes:** Notice of a change in address should be sent to the Circulation Department at the address given above.

**Notice:** Statements and opinions given in articles and papers in the *Journal of The Electrochemical Society* are those of the contributors, and The Electrochemical Society, assumes no responsibility for them.

**Online Edition:** Full-text articles are available either through ECS membership, an institutional subscription, or by purchase, for all issues from 1948 (Vol. 93) and forward. The online edition is available at:

## Dynamic Modeling of Li-Ion Batteries Using an Equivalent Electrical Circuit

T. K. Dong, A. Kirchev, F. Mattera, J. Kowal, Y. Bultel ..... A326

## Electrolyte Additive in Support of 5 V Li Ion Chemistry

A. von Cresce, K. Xu ..... A337

## Identifying Capacity Limitations in the Li/Oxygen Battery Using Experiments and Modeling

P. Albertus, G. Girishkumar, B. McCloskey, R. S. Sánchez-Carrera, B. Kozinsky, J. Christensen, A. C. Luntz ..... A343

## Synthesis and Electrochemical Performance of a Lithium Titanium Phosphate Anode for Aqueous Lithium-Ion Batteries

C. Wessells, F. La Mantia, H. Desbazer, R. A. Huggins, Y. Cui ..... A352

## Fuel Cells and Energy Conversion

### Characterization of Anode-Supported Solid Oxide Fuel Cells with Composite LSM-YSZ and LSM-GDC Cathodes

Y.-C. Chang, M.-C. Lee, W.-X. Kao, C.-H. Wang, T.-N. Lin, J.-C. Chang, R.-J. Yang ..... B259

### CuCl Electrolysis for Hydrogen Production in the Cu-Cl Thermochemical Cycle

V. N. Balashov, R. S. Schatz, E. Chalkova, N. N. Akinfiev, M. V. Fedkin, S. N. Lvov ..... B266

### Layered LnBaCo<sub>2-x</sub>Cu<sub>x</sub>O<sub>5+δ</sub> (0 ≤ x ≤ 1.0) Perovskite Cathodes for Intermediate-Temperature Solid Oxide Fuel Cells

Y. N. Kim, A. Manthiram ..... B276

### Surface Exchange Coefficients of Composite Cathode Materials Using In Situ Isothermal Isotope Exchange

E. N. Armstrong, K. L. Duncan, E. D. Wachsman ..... B283

### Evaluation of Several Carbon-Supported Nanostructured Ni-Doped Manganese Oxide Materials for the Electrochemical Reduction of Oxygen

A. C. Garcia, A. D. Herrera, E. A. Ticianelli, M. Chatenet, C. Poinssignon ..... B290

### Polarization Losses under Accelerated Stress Test Using Multiwalled Carbon Nanotube Supported Pt Catalyst in PEM Fuel Cells

S. Park, Y. Shao, R. Kou, V. V. Viswanathan, S. A. Toune, P. C. Rieke, J. Liu, Y. Lin, Y. Wang ..... B297

### Water Transport Across a Polymer Electrolyte Membrane under Thermal Gradients

R. S. Fu, J. S. Preston, U. Pasaogullari, T. Shioimi, S. Miyazaki, Y. Tabuchi, D. S. Hussey, D. L. Jacobson ..... B303

### Anode Materials for Mitigating Hydrogen Starvation Effects in PEM Fuel Cells

I. C. Halalay, S. Swathirajan, B. Merzougui, M. P. Balogh, G. C. Garabedian, M. K. Carpenter ..... B313

### The Dynamics of Platinum Precipitation in an Ion Exchange Membrane

S. F. Burlatsky, M. Gummalla, V. V. Atrazhev, D. V. Dmitriev, N. Y. Kuzminykh, N. S. Erikbman ..... B322

### Fe-N/C Oxygen Reduction Catalysis Prepared by Covalent Attachment of 1,10-Phenanthroline to a Carbon Surface

A. D. Pauric, B. J. MacLean, E. B. Easton ..... B331

### Partial Conductivities and Chemical Diffusivities of Mixed Protonic-Electronic Conducting CaZr<sub>0.9</sub>Y<sub>0.1</sub>O<sub>3-δ</sub>

D.-K. Lim, M.-B. Choi, C.-N. Park, E. D. Wachsman, S.-J. Song ..... B337

### Locally Resolved Electrochemical Impedance Spectroscopy in Channel and Land Areas of a Differential Polymer Electrolyte Fuel Cell

I. A. Schneider, M. H. Bayer, S. von Dahlen ..... B343

## Corrosion, Passivation, and Anodic Films

- Wet- and Corrosive De-Adhesion Processes of Water-Borne Epoxy Film Coated Steel**  
**I. Interface Potentials and Characteristics of Ion Transport Processes**  
*R. Posner, M. Santa, G. Grundmeier* ..... C29
- Wet- and Corrosive De-Adhesion Processes of Water-Borne Epoxy Film Coated Steel**  
**II. The Influence of  $\gamma$ -Glycidoxypropyltrimethoxysilane as an Adhesion Promoting Additive**  
*M. Santa, R. Posner, G. Grundmeier* ..... C36
- Cut Edge Corrosion Inhibition by Chromate in Primer of Prepainted 55% Al-Zn Alloy Coated Steel**  
*A. Chiba, I. Muto, N. Hara* ..... C42
- The Effect of Tellurium on the Al-Zn-In Anode**  
*W. Xiong, G. T. Qi, X. P. Guo, Z. L. Lu* ..... C48
- A Photoelectrochemical Study of Highly Ordered TiO<sub>2</sub> Nanotube Arrays as the Photoanodes for Cathodic Protection of 304 Stainless Steel**  
*J. Li, C.-J. Lin, C.-G. Lin* ..... C55
- Studies on the Stability of Zn and Zn-TiO<sub>2</sub> Nanocomposite Coatings Prepared by Pulse Reverse Current**  
*T. Frade, A. Gomes, M. I. da Silva Pereira, D. Alberts, R. Pereira, B. Fernández* ..... C63
- Abnormal Anodic Aluminum Oxide Formation in Confined Structures for Lateral Pore Arrays**  
*J. Oh, C. V. Thompson* ..... C71
- Corrosion Performance of Carbon Steel in Simulated Pore Solution in the Presence of Micelles**  
*J. Hu, D. A. Koleva, J. H. W. de Wit, H. Kolev, K. van Breugel* ..... C76
- Characterization of Cerium-Based Conversion Coatings on Al 7075-T6 Deposited from Chloride and Nitrate Salt Solutions**  
*S. Joshi, B. L. Treu, M. J. O'Keefe, W. G. Fabrenholtz* ..... C88

## Electrochemical/Chemical Deposition and Etching

- Nickel Oxalate Nanowires Grown on Electrochemically Deposited Ni Thin Film**  
*I. Jung, Y. Lee, Y. Tak, J. Choi* ..... D123
- Chemistry of Wet Treatment of GaAs(111)B and GaAs(111)A in Hydrazine-Sulfide Solutions**  
*V. L. Berkovits, V. P. Ulin, O. E. Tereshchenko, D. Paget, A. C. H. Rowe, P. Chiaradia, B. P. Doyle, S. Nannarone* ..... D127
- Ultrahigh-Density  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>/N-doped  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Schottky and p-n Nanowire Junctions: Synthesis and Electrical Transport Properties**  
*L.-W. Chang, C.-F. Li, Y.-T. Hsieh, C.-M. Liu, Y.-T. Cheng, J.-W. Yeh, H. C. Shih* ..... D136
- NMR Spectral Studies of Interactions Between the Accelerants SPS and MPS and Copper Chlorides**  
*E. Garcia-Cardona, E. H. Wong, D. P. Barkey* ..... D143
- Underpotential Codeposition of Fe-Pt Alloys from an Alkaline Complexing Electrolyte: Electrochemical Studies**  
*D. Liang, J. J. Mallett, G. Zangari* ..... D149
- Atomic Layer Deposition of Ruthenium Films from (Ethylcyclopentadienyl)(pyrrolyl)ruthenium and Oxygen**  
*K. Kukli, M. Kemell, E. Puukilainen, J. Aarik, A. Aidla, T. Sajavaara, M. Laitinen, M. Tallarida, J. Sundqvist, M. Ritala, M. Leskelä* ..... D158
- Using Chelating Chitosan Nanobeads and a Microfluidic-Microelectric Trap to Sort Lead(II) in a Continuous Bloodstream Flow**  
*M.-W. Wang* ..... D166
- The Evolution of Pd/Sn Catalytic Surfaces in Electroless Copper Deposition**  
*X. Cui, D. A. Hutt, D. J. Scurr, P. P. Conway* ..... D172



The Electrochemical Society (ECS) is an educational, nonprofit 501(c)(3) organization with more than 8000 scientists and engineers in over 75 countries world-wide who hold individual membership. Founded in 1902, ECS has a long tradition in advancing the theory and practice of electrochemical and solid-state science by dissemination of information through its publications and international meetings.

## Society Officers

- President*  
**William D. Brown**  
University of Arkansas  
Fayetteville, Arkansas 72701, USA
- Vice-President*  
**Esther Takeuchi**  
University at Buffalo  
Buffalo, New York 14260, USA
- Vice-President*  
**Fernando H. Garzon**  
Los Alamos National Laboratory  
Los Alamos, New Mexico 87545, USA
- Vice-President*  
**Tetsuya Osaka**  
Waseda University  
Shinjyuku-ku, Tokyo 169-8555, JAPAN
- Secretary*  
**Johna Leddy**  
University of Iowa  
Iowa City, Iowa 52242, USA
- Treasurer*  
**Christina Bock**  
National Research Council - Canada  
Ottawa, ON K1A-0R6, CANADA
- Executive Director*  
**Roque J. Calvo**  
The Electrochemical Society  
65 South Main Street  
Pennington, New Jersey 08534-2839, USA  
Phone: 609 737 1902  
Fax: 609 737 2743  
E-mail: ecs@electrochem.org  
Web: www.electrochem.org

## Benefits of Membership

- **The Journal of The Electrochemical Society.** Society membership includes this top-quality, peer-reviewed monthly publication. Each issue includes some 70 or more original papers selected by a prestigious editorial board, on topics covering both electrochemical and solid-state science and technology. The electronic edition is available to members at:  
<http://ecsdl.org/JES/>
- **Electrochemical and Solid-State Letters.** This peer-reviewed, rapid publication electronic journal is available to members at:  
<http://ecsdl.org/ESL/>
- **Interface.** This quarterly publication features articles and news of general interest to those in the field.
- **Professional Development and Education.** Exchange technical ideas and advances at the Society's semi-annual international meetings or through the programs of the 19 local sections in the USA, Canada, Europe, Israel, Korea, and Japan.
- **Publications.** Stay aware of pertinent scientific advances through the Society's publications, including ECS Transactions, proceedings volumes, meeting abstracts, and monograph volumes.
- **Opportunity for Recognition.** Recognize the accomplishments of your peers through the Awards Program, which provides over two dozen ECS Awards annually.
- **Networking and Contacts.** Take advantage of the numerous opportunities to meet with your peers and expand your circle of valuable contacts.
- **Membership Directory.** Available only to members, the Directory provides easy reference to your colleagues throughout the world.
- **Money Savings.** Get exceptional discounts on all ECS publications, page charges, meetings, and short courses.

## Divisions

### Battery

Nancy J. Dudney, *Chair*  
Zempachi Ogumi, *Vice-Chair*  
Arumugam Manthiram, *Secretary*  
Bor Yann Liaw, *Treasurer*  
Curtis F. Holmes, *Advisor*

### Corrosion

Alison Davenport, *Chair*  
Douglas C. Hansen, *Vice-Chair*  
Shinji Fujimoto, *Secretary-Treasurer*  
David Lockwood, *Advisor*

### Dielectric Science and Technology

Kalpathy Sundaram, *Chair*  
Oana Leonte, *Vice-Chair*  
Hazara Rathore, *Secretary*  
Dolf Landheer, *Treasurer*  
John Flake, *Advisor*

### Electrodeposition

Christian Bonhote, *Chair*  
Hariklia Deligianni, *Vice-Chair*  
Giovanni Zangari, *Secretary*  
Elizabeth Podlaha-Murphy, *Treasurer*  
Patrik Schmuki, *Advisor*

### Electronics and Photonics

Yue Kuo, *Chair*  
Ping-Chih Chang, *First Vice-Chair*  
Bernd Kolbesen, *Second Vice-Chair*  
Andrew M. Hoff, *Secretary*  
Ren Fan, *Treasurer*  
M. Jamal Deen, *Advisor*

### Energy Technology

Sundar Narayanan, *Chair*  
Jean St-Pierre, *Vice-Chair*  
Jeremy P. Meyers, *Secretary*  
Adam Weber, *Treasurer*  
Alok Srivastava, *Advisor*

### Fullerenes, Nanotubes, and Carbon Nanostructures

Dirk Guldi, *Chair*  
R. Bruce Weisman, *Vice-Chair*  
Jean-Francois Nierengarten, *Secretary*  
Francis D'Souza, *Treasurer*  
Carl F. Holmes, *Advisor*

### High Temperature Materials

Enrico Traversa, *Chair*  
Jeffrey Fergus, *Senior Vice-Chair*  
Timothy Armstrong, *Junior Vice-Chair*  
Xiao-Dong Zhou, *Secretary-Treasurer*  
David Shifler, *Advisor*

### Industrial Electrochemistry and Electrochemical Engineering

John Weidner, *Chair*  
Vijay K. Ramani, *Vice-Chair*  
Gerardine Botte, *Secretary-Treasurer*  
David J. Lockwood, *Advisor*

### Luminescence and Display Materials

Kailash Mishra, *Chair*  
John Collins, *Vice-Chair*  
Holly Comanzo, *Secretary-Treasurer*  
Pablo Chang, *Advisor*

### Organic and Biological Electrochemistry

Albert Fry, *Chair*  
James D. Burgess, *Vice-Chair*  
Jun-ichi Yoshida, *Secretary-Treasurer*  
M. Jamal Deen, *Advisor*

### Physical and Analytical Electrochemistry

Paul Trulove, *Chair*  
Shelley D. Minteer, *Vice-Chair*  
Robert A. Mantz, *Secretary*  
Pawel J. Kulesza, *Treasurer*  
Patrik Schmuki, *Advisor*

### Sensor

Jing Li, *Chair*  
Zoraida P. Aguilar, *Vice-Chair*  
Michael T. Carter, *Secretary*  
Eric Brosha, *Treasurer*  
David Shifler, *Advisor*

### Characterization and Purification of Commercial SPS and MPS by Ion Chromatography and Mass Spectrometry

R. G. Brennan, M. M. Phillips, L.-Y. O. Yang, T. P. Moffat ..... D178

### Hot Wire Chemical Vapor Deposition of Ge<sub>2</sub>Sb<sub>2</sub>Te<sub>5</sub> Thin Films

D. Reso, M. Silinskas, B. Kalkofen, M. Lisker, E. P. Burte ..... D187

## Electrochemical Synthesis and Engineering

### Spontaneous Electrochemical Synthesis of Morphologically Controlled 1D ZnO Structure with O/Zn Composition Ratio Dependent Photoluminescences

Y.-H. Pai, G.-R. Lin ..... E27

### Characterization of Electrodeposited Technetium on Gold Foil

E. Mausolf, F. Poineau, T. Hartmann, J. Droessler, K. Czerwinski ..... E32

## Physical and Analytical Electrochemistry

### The Structure of Nickel Chloride in the Ionic Liquid 1-Ethyl-3-methyl Imidazolium Chloride/Aluminum Chloride: X-ray Absorption Spectroscopy

D. F. Roeper, K. I. Pandya, G. T. Cheek, W. E. O'Grady ..... F21

### The Oxidation of Hydroxylamine on Gold Electrodes in Mildly Acidic Aqueous Electrolytes: Electrochemical and In Situ Differential Reflectance Studies

Y. Chen, D. R. Martins de Godoi, D. Scherson ..... F29

### A First-Principles Model for Hydrogen Uptake Promoted by Sulfur on Ni(111)

C. D. Taylor, M. Neurock, J. R. Scully ..... F36

## Dielectric Science and Materials

### Electrically Benign Ru Wet Etching Method for Fabricating Ru/TiO<sub>2</sub>/Ru Capacitor

S. Y. Lee, S. K. Kim, K. M. Kim, G.-J. Choi, J. H. Han, C. S. Hwang ..... G47

### Effect of Curing on the Pore Size in the Low-*k* MSQ/SBS Hybrid Films

Y.-H. Chen, U.-S. Jeng, J. Leu ..... G52

### Ion Bombardment during the Deposition of SiO<sub>x</sub> by AC-Biasing in a Remote-Type Atmospheric Pressure Plasma System

E. Gil, J. B. Park, J. S. Oh, M. S. Jhon, G. Y. Yeom ..... G58

### Characterization of Traps in the Transition Region at the HfO<sub>2</sub>/SiO<sub>x</sub> Interface by Thermally Stimulated Currents

B. Raeissi, J. Piscator, Y. Y. Chen, O. Engström ..... G63

### Impedance Spectroscopic Characterization of Sm and Ho Doped Ni Ferrites

K. K. Bharathi, G. Markandeyulu, C. V. Ramana ..... G71

### Changes in Electronic Structure of La<sub>x</sub>Al<sub>1-x</sub>O Films as a Function of Postdeposition Annealing Temperature

J. W. Ma, W. J. Lee, M.-H. Cho, K. B. Chung, C.-H. An, H. Kim, Y. J. Cho, D. W. Moon, H. J. Cho ..... G79

## Semiconductor Devices, Materials, and Processing

### Ge Chemical Vapor Deposition on GaAs for Low Resistivity Contacts

B. Vincent, A. Firrincieli, W.-E. Wang, N. Waldron, A. Franquet, B. Douhard, W. Vandervorst, T. Clarysse, G. Brammertz, R. Loo, J. Dekoster, M. Meuris, M. Caymax ..... H203

### Rinsing Effects on Successive Ionic Layer Adsorption and Reaction Method for Deposition of ZnO Thin Films

S.-C. Shei, S.-J. Chang, P.-Y. Lee ..... H208

### Growth Kinetics and Oxidation Mechanism of ALD TiN Thin Films Monitored by In Situ Spectroscopic Ellipsometry

H. Van Bui, A. W. Groenland, A. A. I. Aarnink, R. A. M. Wolters, J. Schmitz, A. Y. Kovalgin ..... H214

<b>Thermal Stability Improvement via Cyclic D<sub>2</sub>O Radical Anneal Interposed in Atomic Layer Deposition Process</b> M. H. Lin, C. H. Hou, J. Y. Wu, T. B. Wu .....	H221
<b>Aqueous Solution Synthesis of Crystalline Anatase Nanocolloids for the Fabrication of DSC Photoanodes</b> C. Charbonneau, R. Gauvin, G. P. Demopoulos .....	H224
<b>Phase Change Random Access Memory Devices with Nickel Silicide and Platinum Silicide Electrode Contacts for Integration with CMOS Technology</b> L. W.-W. Fang, R. Zhao, E.-G. Yeo, K.-G. Lim, H. Yang, L. Shi, T.-C. Chong, Y.-C. Yeo .....	H232
<b>Modeling of the Effect of Wafer Topography on Chemical Mechanical Polishing Processes Based on 3D Analysis</b> L. Wu, C. Yan .....	H239
<b>Investigation of the Structural and Optical Properties of Ge-doped SbTe Films with Various Sb:Te Ratios</b> T. D. Kang, A. Sirenko, J.-W. Park, H. S. Lee, S. Lee, J.-b. Jeong, B.-k. Cheong, H. Lee .....	H249
<b>Direct Bonding of Silicon to Platinum</b> L. Dargent, Y. Bogumilowicz, O. Renault, B. Ghysselen, R. Madar, L. Clavelier .....	H255
<b>Improvement in Resistance Switching and Retention Properties of Pt/TiO<sub>2</sub> Schottky Junction Devices</b> S. Hirose, A. Nakayama, H. Nimi, K. Kageyama, H. Takagi .....	H261
<b>Antireflective and Radiation Resistant ZnO Thin Films for the Efficiency Enhancement of GaAs Photovoltaics</b> B.-Y. Su, Y.-K. Su, Z.-L. Tseng, M.-F. Shib, C.-Y. Cheng, T.-H. Wu, C.-S. Wu, J.-J. Yeh, P.-Y. Ho, Y.-D. Juang, S.-Y. Chu .....	H267
<b>Ruthenium Polishing Using Potassium Periodate as the Oxidizer and Silica Abrasives</b> B. C. Peethala, S. V. Babu .....	H271
<b>Organic Nonvolatile Memory Based on Low Voltage Organic Thin Film Transistors with Polymer Gate Electrets</b> B.-L. Yeh, Y.-H. Chen, L.-Y. Chiu, J.-W. Lin, W.-Y. Chen, J.-S. Chen, T.-H. Chou, W.-Y. Chou, F.-C. Tang, H.-L. Cheng .....	H277
<b>Single-Step RIE Fabrication Process of Low Loss InP Waveguide Using CH<sub>4</sub>/H<sub>2</sub> Chemistry</b> M. Lysevych, H. H. Tan, F. Karouta, C. Jagadisb .....	H281
<b>Highly Reflective Ag/La Bilayer Ohmic Contacts to p-Type GaN</b> I.-C. Chen, Y.-D. Chen, C.-C. Hsieh, C.-H. Kuo, L.-C. Chang .....	H285
<b>Quantitative Calculation of Oxygen Incorporation in Sputtered IGZO Films and the Impact on Transistor Properties</b> S. Kwon, J. H. Nob, J. Nob, P. D. Rack .....	H289
<b>High Performance AlGaIn/GaN HEMT with Lattice Matched ZnO Gate Interlayer</b> H.-C. Chiu, C.-K. Lin, C.-W. Lin, C.-W. Yang, C.-H. Chen, J. S. Fu .....	H294
<b>A Comparative Structure and Performance Study of La<sub>1-x</sub>Sr<sub>x</sub>CoO<sub>3-d</sub> and La<sub>1-x</sub>Sr<sub>x</sub>Co<sub>0.9</sub>Nb<sub>0.1</sub>O<sub>3-d</sub> (x = 0.5, 0.7, 0.9, and 1.0) Oxygen Permeable Mixed Conductors</b> J. Zhao, J. Sunarso, W. Zhou, Z. Shao, R. Ran, S. Liu .....	H299
<b>Effects of Selective and Nonselective Wet Gate Recess on InAlAs/InGaAs Metamorphic Field-Effect Transistors with Double Delta Doping in InGaAs Channels</b> Y.-S. Lin, Y.-C. Ma, Y.-T. Lin .....	H305
<b>Interface Characterization and Electrical Transport Mechanisms in a-Si:H/c-Si Heterojunction Solar Cells</b> V. A. Dao, Y. Lee, S. Kim, Y. Kim, N. Lakshminarayan, J. Yi .....	H312
<b>Effect of Ir<sup>3+</sup> Incorporation on the Luminescent Properties of ZnS:Cl Phosphors</b> M. Shirata, K. Shimizu, T. Koike, T. Komiyama, T. Matsui, Y. Nakanishi, K. Hara .....	H318
<b>Properties of Silicon Oxynitride Films Annealed under Enhanced Hydrostatic Pressure</b> C. K. Wong, H. Wong, J. Liu, A. Misiuk .....	H322

## Sections

### Arizona

Don Gervasio, *Chair*  
gervasio@email.arizona.edu

### Brazilian

Luís Frederico P. Dick, *Chair*  
lflick@ufrgs.br

### Canadian

Sylvie Morin, *Chair*  
smorin@yorku.ca

### Chicago

Giselle Sandi, *Chair*  
gsandi@anl.gov

### China

Lin Zhuang, *Chair*  
lzhuang@whu.edu.cn

### Cleveland

Irina Serebrennikova, *Chair*  
Irina.Serebrennikova@energizer.com

### Detroit

Xia Wang, *Chair*

### European

Pawel Kulesza, *Chair*  
pkulesza@chem.uw.edu.pl

### Georgia

Peter Hesketh, *Chair*  
peter.hesketh@me.gatech.edu

### India

Ashok Shukla, *Chair*  
akshukla2006@gmail.com

### Israel

Doron Aurbach, *Chair*  
aurbach@mail.biu.ac.il

### Japan

Toshio Fuchigami, *Chair*  
fuchi@echem.titech.ac.jp

### Korea

Kwang Bum Kim, *Chair*  
kbbkim@yonsei.ac.kr

### Mexican

Ignacio Gonzalez, *Chair*  
igm@xanum.uam.mx

### National Capital

Paul Natishan, *Chair*  
natishan@nrl.navy.mil

### New England

Kevin White, *Chair*  
kwhite@exponent.com

### Pittsburgh

Konstantin Pimenov, *Chair*  
konstantinpimenov@consolenergy.com

### San Francisco

Ken Lux, *Chair*  
ken@altextech.com

### Taiwan

Jing-Yih Cherng, *Chair*  
amitajim@yahoo.com

### Texas

Harovel G. Wheat, *Chair*  
hwheat@mail.utexas.edu

### Twin Cities

Francis Guillaume, *Chair*  
guill001@tc.umn.edu

# The Electrochemical Society MONOGRAPH SERIES

The following volumes are sponsored by ECS, and published by John Wiley & Sons, Inc. They should be ordered from: ECS, 65 South Main St., Pennington, NJ 08534-2839, USA or [www.electrochem.org/dl/bookstore.htm](http://www.electrochem.org/dl/bookstore.htm)

## NEW!

**Modern Electroplating (5<sup>th</sup> Edition)**  
by M. Schlesinger and M. Paunovic  
(2010) 736 pages  
ISBN 978-0-470-16778-6

**Fuel Cells: Problems and Solutions**  
by V. Bagotsky  
(2009) 320 pages  
ISBN 978-0-470-23289-7

**Electrochemical Impedance Spectroscopy**  
by M. E. Orazem and B. Tribollet  
(2008) 524 pages  
ISBN 978-0-470-04140-6

**Fundamentals of Electrochemical Deposition (2<sup>nd</sup> Edition)**  
by M. Paunovic and M. Schlesinger  
(2006) 373 pages  
ISBN 978-0-471-71221-3

**Fundamentals of Electrochemistry (2<sup>nd</sup> Edition)**  
Edited by V. S. Bagotsky  
(2005) 722 pages  
ISBN 978-0-471-70058-6

**Electrochemical Systems (3<sup>rd</sup> Edition)**  
by John Newman and Karen E. Thomas-Alyea  
(2004) 647 pages  
ISBN 978-0-471-47756-3

**Modern Electroplating (4<sup>th</sup> Edition)**  
Edited by M. Schlesinger and M. Paunovic  
(2000) 888 pages  
ISBN 978-0-471-16824-9

**Atmospheric Corrosion**  
by C. Leygraf and T. Graedel  
(2000) 3684 pages  
ISBN 978-0-471-37219-6

**Uhlig's Corrosion Handbook (2<sup>nd</sup> Edition)**  
by R. Winston Revie  
(2000) paperback, 1340 pages  
ISBN 978-0-471-78494-4

ECS Members will receive a discount. All prices are subject to change without notice.



[www.electrochem.org](http://www.electrochem.org)

## Growth and Characterization of Thick Polycrystalline AlN

### Layers by HTCVD

A. Claudel, E. Blanquet, D. Chausse, R. Boicbot, R. Martin, H. Mank, A. Crisci, B. Doisneau, P. Chaudouet, S. Coindeau, D. Pique, M. Pons ..... H328

## Analysis of Chemical and Mechanical Factors in CMP Processes for Improving Material Removal Rate

K. Tamai, H. Morinaga, T. K. Doi, S. Kurokawa, O. Ohnishi ..... H333

## Effect of Annealing on the Microstructure and Electrical Property of RuN Thin Films

C.-Y. Wu, W.-H. Lee, S.-C. Chang, Y.-L. Cheng, Y.-L. Wang ..... H338

## Sensors and Displays: Principles, Materials, and Processing

### Increasing the PLED Luminescence Efficiency by Exploiting the Surface Plasmon Resonance Effect

S.-H. Chen, S.-T. Yu, Y.-Y. Liou, C.-F. Yu, C.-F. Lin, P.-C. Kao ..... J53

### Properties of Mn<sup>4+</sup>-Activated Hexafluorotitanate Phosphors

Y. K. Xu, S. Adachi ..... J58

### Tuning the Optical Properties of (Sr,Ba)<sub>3</sub>Si<sub>6</sub>O<sub>3</sub>N<sub>8</sub>:Eu Phosphor for LED Application

H. J. Lee, K. P. Kim, D. W. Suh, J. S. Yoo ..... J66

### Performances of Fuel-Cell-Type CO Sensors Using Each of Polybenzimidazole and Nafion Membranes

K. Mochizuki, T. Kikuchi, M. Sudoh, Y. Ishiguro, T. Suzuki ..... J71

### Carbon Interdigitated Array Nanoelectrodes for Electrochemical Applications

J. I. Heo, D. S. Shim, G. T. Teixidor, S. Oh, M. J. Madou, H. Shin ..... J76

### Photoluminescent Properties of K<sub>2</sub>SnF<sub>6</sub>·H<sub>2</sub>O:Mn<sup>4+</sup> Hydrate Phosphor

Y. Arai, S. Adachi ..... J81

### A Single-Phase White-Emitting SrGa<sub>2</sub>S<sub>4</sub>:Ce,Na,Pb Phosphor with Tailored Color Temperature and Color Rendering Index

R. Yu, J. Wang, J. Zhang, Q. Su ..... J86

## Nanostructured Materials, Carbon Nanotubes, and Fullerenes

### Electrochemistry and Photocurrent Response from Vertically-Aligned Chemically-Functionalized Single-Walled Carbon Nanotube Arrays

M. A. Bissett, J. G. Shapter ..... K53

### Growth Mechanism of TiO<sub>2</sub> Nanotube Arrays in Nanopores of Anodic Aluminum Oxide on Si Substrates by Atomic Layer Deposition

C.-M. Liu, C. Chen, H.-E. Cheng ..... K58

### Field Emission and Magnetic Properties of Free-Standing Gd Silicide Nanowires Prepared by Reacting Ultrahigh Vacuum Deposited Gd Films with Well-Aligned Si Nanowires

L.-W. Chu, S.-W. Hung, C. Y. Wang, Y.-H. Chen, J. Tang, K. L. Wang, L.-J. Chen ..... K64

### Synthesis of Size- and Shape-Controlled CuO Assemblies

G. Gao, H. Wu, M. Chen, L. Zhang, B. Yu, L. Xiang ..... K69

### Self-Assembly and Photoluminescence Characterization of CaMoO<sub>4</sub>:Eu<sup>3+</sup>,Na<sup>+</sup> Superstructure via a Facile Surfactant-Free Hydrothermal Method

Y. Zhou, J. Liu, X. Yang, X. Yu, L. Wang ..... K74

### Microstructure and Composition of TiO<sub>2</sub> Nanotube Arrays Fabricated with HF and NH<sub>4</sub>F Electrolytes and Their Evolution during Annealing

M.-Y. Hsu, W.-C. Yang, H. Teng, J. Leu ..... K81

### Improved Performance of Polymer Solar Cells Featuring One-Dimensional PEDOT Nanorods in a Modified Buffer Layer

Y.-K. Han, M.-Y. Chang, W.-Y. Huang, H.-Y. Pan, K.-S. Ho, T.-H. Hsieh, S.-Y. Pan ..... K88

## Interdisciplinary Topics

### Effect of Crystallinity on the Optical Reflectance of Cylindrical Colloidal Crystals

C.-H. Lai, Y.-L. Yang, L.-Y. Chen, Y.-J. Huang, J.-Y. Chen, P.-W. Wu, Y.-T. Cheng, Y.-T. Huang ..... P37

## Reviews

### Critical Reviews in Electrochemistry and Solid-State Science and Technology CRES3T

#### A Critical Review of Thermal Issues in Lithium-Ion Batteries

T. M. Bandbauer, S. Garimella, T. F. Fuller ..... R1

## Miscellaneous

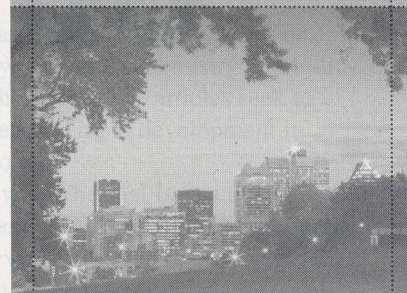
### Publisher's Note: Comparing Charge Transport Predictions for a Ternary Electrolyte Using the Maxwell–Stefan and Nernst–Planck Equations [J. Electrochem. Soc., 158, A33 (2011)]

S. T. P. Psaltis, T. W. Farrell ..... S5

### Comment on "Influence of Additives and the Effect of Aging in Modifying Surface Topography of Electrodeposited Copper" [J. Electrochem. Soc., 156, D215 (2009)]

W. Sha ..... S6

# Future Technical Meetings



## 2011 Spring Meeting Montréal, QC, Canada

May 6-6, 2011  
Technical Exhibit: May 2-4

## 2011 Fall Meeting Boston, Massachusetts

October 9-14, 2011  
Technical Exhibit: October 10-12

## 2012 Spring Meeting Seattle, Washington

May 6-11, 2012  
Technical Exhibit: May 7-9

## 2012 PRIME Fall Meeting Honolulu, Hawaii

October 7-12, 2012  
Technical Exhibit: October 8-10



For more information  
on these future  
meetings, contact ECS.

Tel: 609.737.1902  
Fax: 609.737.2743

[www.electrochem.org](http://www.electrochem.org)