FROM THE EDITOR

Making Active Materials for Renewable Energy

Much has been said and written, including in these magazine pages, about the daunting hurdles associated with optimizing the efficiency and hence the cost-effectiveness of renewable energy production systems. The late professor and Nobel Laureate Richard Smalley used to talk about the "Terawatt Challenge" facing us and future generations for replacing fossil fuel-based energy and thus mitigating greenhouse gas emissions. History is certainly on our side in meeting this challenge. Although the thirst for energy was of a vastly lower magnitude then, many early civilizations used the Sun, water, and the wind to meet basic needs. Even geothermal heat was used by North American Indians some 10,000 years ago for cooking. The ancient Greeks used hydro power to grind flour and the Persians used windmills to pump water in the first millennium. So what has changed since then? Power plants can certainly run on nuclear energy (or even wind or sunlight) and the transportation sector continues to burn highly-subsidized and thus cheaply-available liquid fuels drawn predominantly from carbon-based feedstock. Ultimately, however, there is a price to be paid as brought home by the recent Gulf oil spill or the Fukushima Daiichi nuclear disaster in Japan.

Other than safety concerns, energy cost is always going to be a driver, and no amount of civic sense is going to render the renewable energy economy practically realizable if it does not make sense to the consumer's pocketbook. It is true that the Sun is an inexhaustible energy source and solar photovoltaic (PV) power systems do not require finite energy sources for their operation like their fossil-based or nuclear counterparts do. However, there are hidden environmental and energy issues associated with solar PV power generation. As with financial considerations, an energy payback time (EPBT) can be defined for a solar PV system as the length of deployment required for the system to generate an amount of energy equal to the *total* energy that went into its production. Thus the first-generation crystalline Si-based PV modules achieve a break-even point in a little over three years. The value of EPBT is dependent on several factors (that need not concern us here) except for one pertinent to the theme of this particular issue of the magazine: the manufacturing technology used to make the PV active material.

Mild methods for preparing thin films are relevant to shrinking the EPBT. In this respect, semiconductors are generally prepared by high-temperature methods or by the use of vapor phase and ultra-high vacuum environments. Milder temperatures coupled with the use of condensed media, using water or other solvents (organic compounds or ionic liquids), represent interesting and economic alternatives for the growth of semiconductors in either bulk or thin film form. Electrodeposition is one such preparative methodology in this category, which has already seen wide-spread acceptance in the metallurgical and microelectronics sectors. On the other hand, electrodeposition of semiconductors has a relatively recent history dating back only to the 1970s. This method is attractive from both fundamental and practical perspectives in terms of applicability to large and irregular device areas and the ability to prepare composite (e.g., metal/semiconductor) structures and unique semiconductor morphologies (e.g., nanotubes, nanodots).

The recently concluded spring meeting of ECS in Montréal featured a successful symposium on Electrodeposition for Energy Applications. I happened to be a co-organizer of this symposium that featured 36 talks and 19 posters spread over two and a half days of the meeting. In this issue featuring the Electrodeposition Division, we present three feature articles describing the use of electrodeposition for preparing active materials for polymer electrolyte fuel cells, batteries, and solar cells. I thank Giovanni Zangari (University of Virginia) for spearheading the technical contents of this issue as the Guest Editor. Stay tuned.

Raj K.

Krishnan Rajeshwar
Editor

The Electrochemical Society

INTERFACE

Published by:
The Electrochemical Society (ECS)
65 South Main Street
Pennington, NJ 08534-2839, USA
Tel 609.737.1902
Fax 609.737.2743
www.electrochem.org

Editor: Krishnan Rajeshwar, rajeshwar@uta.edu

Guest Editor: Giovanni Zangari, gz3e@virginia.edu

Contributing Editors: Donald Pile, donald.pile@gmail.com; Zoltan Nagy, nagyz@email.unc.edu

Managing Editor: Mary E. Yess, mary.yess@electrochem.org

Production & Advertising Manager:
Dinia Agrawala, interface@electrochem.org

Advisory Board: Arumugam Manthiram *(Battery)*, Barbara Shaw *(Corrosion)*, Durga Misra *(Dielectric Science and Technology)*, Giovanni Zangari *(Electrodeposition)*, Andrew Hoff *(Electronics and Photonics)*, Mani Manivannan *(Energy Technology)*, Prashant V. Kamat *(Fullerenes, Nanotubes, and Carbon Nanostructures)*, Tim Armstrong *(High Temperature Materials)*, John Staser *(Industrial Electrochemistry and Electrochemical Engineering)*, Uwe Happek *(Luminescence and Display Materials)*, Albert Fry *(Organic and Biological Electrochemistry)*, Wesley Henderson *(Physical and Analytical Electrochemistry)*, Peter Hesketh *(Sensor)*

Publications Subcommittee Chair: Tetsuya Osaka

Society Officers: Esther Takeuchi, *President;* Fernando Garzon, *Vice-President;* Tetsuya Osaka, *Vice-President;* Paul Kohl, *Vice-President;* Johna Leddy, *Secretary*; Christina Bock, *Treasurer*; Roque J. Calvo, *Executive Director*

Canada Post:
Publications Mail Agreement #40612608
Canada Returns to be sent to:
Pitney Bowes International, P.O. Box 25542, London, ON N6C 6B2

ISSN
Print: 1064-8208
Online: 1944-8783

The Electrochemical Society Interface is published quarterly by The Electrochemical Society (ECS), at 65 South Main Street, Pennington, NJ 08534-2839 USA. Subscription to members as part of membership service; subscription to nonmembers is available; see the ECS website. Single copies $9.00 to members; $17.00 to nonmembers. © Copyright 2011 by The Electrochemical Society. Periodicals postage paid at Pennington, New Jersey, and at additional mailing offices. POSTMASTER: Send address changes to The Electrochemical Society, 65 South Main Street, Pennington, NJ 08534-2839.

The Electrochemical Society is an educational, nonprofit 501(c)(3) organization with more than 8000 scientists and engineers in over 70 countries worldwide who hold individual membership. Founded in 1902, the Society 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.

PRINTED WITH SOY INK
All recycled paper. Printed in USA.