

ORLANDO

Meeting Highlights

The Society's 204th meeting was held in the theme park capital of the world, with 1,815 attending over 36 symposia. While not out visiting Mickey Mouse at Disney World, attendees had the opportunity to choose from 1,491 technical papers on a broad range of topics – from nanostructured materials to sensors and actuating materials. In addition to the technical papers, four short courses were held: Basics of Cleaning Processes for Integrated Circuit Manufacturing, taught by K. Reinhardt, J. Butterbaugh, J. Farber, and R. Small; Battery Design and Simulation, taught by R. Spotnitz; Impedance Spectroscopy: Theory and Applications, taught by M. E. Orazem; and Principles of PEM Fuel Cell Engineering I: Water Management and Flow Field Plate Design, taught by E. Stuve. It wasn't all business, and attendees had the opportunity to participate in a number of social functions, such as the Sunday Evening Get-Together, the Monday Evening Mixer, and the Technical Exhibit. Coffee breaks, one of which was sponsored by FMC Lithium, were scheduled throughout the week, and the student poster sessions engendered lively discussions.

The Hidden Treasures of Impedance Spectroscopy

On Sunday evening, Bernard Tribollet, of the Laboratoire Interfaces et Systemes Electrochimiques of the CNRS in Paris, presented a talk as part of the ongoing educational "XYZ for the Rest of Us" lecture series. Approximately 200 people attended his presentation. Following the theme of a search for buried treasure; Dr. Tribollet



FRITZ KALHAMMER presented the ECS plenary lecture on Monday morning to open the Society's 204th meeting. Dr. Kalhammer (right) received a commemorative scroll from ECS president BRUNO SCROSATI.



The 2003 ECS Class of Fellows were welcomed by ECS president Bruno Scrosati (front row, far right). The inductees were (front row, left to right): ROBIN A. SUSKO, PETER S. FEDKIW, OSAMU YAMAMOTO, (Scrosati); (back row, left to right): CHARLES L. HUSSEY, DAVID J. DUQUETTE, FRANK R. MCLARNON, RICHARD L. MCCREERY, and DARREL F. UNTEREKER.

emphasized the unique understanding of electrochemical systems that can be attained by synergy among well-designed experiments, models that describe the relevant physics, and proper regression strategies.

Dr. Tribollet challenged his audience to think of impedance spectroscopy not only as a current-voltage measurement, but also as a generalized transfer function technique in which any relevant state variable can be modulated and any relevant response can be followed. From experiences in his laboratory, Dr. Tribollet drew examples of hidden treasures uncovered by impedance spectroscopy. He showed that impedance was able to reveal the unexpected transition of a passive valve metal surface from a two-dimensional to a three-dimensional character. Electrohydrodynamic impedance measurements showed clearly that, contrary to the usual assumption, electrolyte viscosity is not uniform during electro-dissolution of iron. The coupling of electrogravimetric impedance with the usual electrochemical impedance spectroscopy revealed ion and solvent insertion into polypyrrole electro-active polymers. In an example relevant to distribution networks for potable water, quantification of very low rates of corrosion was made possible by use of impedance spectroscopy.

Dr. Tribollet advised his audience to think first and, if possible, add a generalized impedance technique to the classical impedance spectroscopy methods.

When Will We Be Able to Buy and Drive Fuel Cell Electric Vehicles?

Fritz Kalhammer, formerly of the Electric Power Research Institute (EPRI) and now an independent consultant in energy and process technology, gave the plenary lecture (with the above title) on Monday morning. If the packed fuel cell sessions that followed were anything to go by, the topic of this lecture could not have been more relevant and timely. Dr. Kalhammer discussed the possibility of fuel cell-powered vehicles that would be available at an affordable price and with a performance at par with gasoline-powered internal combustion (IC) engines. He pointed out that auto companies had “promised” the consumers that this technology will arrive in 2004 and had invested billions of dollars into the R&D effort. In fact, more dollars have been put into electric vehicles than any electrochemical technology over a 30 year time span. Yet it appears that we will not be able to buy these vehicles even by the end of this decade. An examination of the underlying factors in this dilemma constituted the crux of his lecture.

Dr. Kalhammer first charted the historical development of fuel cell powered vehicles starting with the General Motors Electrovan of 1967 and Kordesch’s Austin A40 of 1970. However both these prototypes paled in performance against their IC engine counterparts along with other problems coupled to high costs and short fuel cell stack life—challenges that remain to this day. For example, fuel cell cars cost \$1,000/kW as compared to \$30/kW for a conventional vehicle equipped with an IC engine. However other key developments have occurred since these early years

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ELIEZER GILEADI (right) received the 2003 Olin Palladium Award and Medal from ECS President Bruno Scrosati. Prof. Gileadi delivered the award address to the Honors and Awards session on Wednesday morning; it is reproduced on page 10 of this issue.



RICHARD M. CROOKS (right) received the 2003 Carl Wagner Memorial Award from ECS President Bruno Scrosati. The award is given for significant achievement in research in the guidance and development of students or colleagues in education, industry, or government.

Meeting Highlights was prepared by Krishnan Rajeshwar and Mary Yess, Interface’s Editor and Managing Editor, respectively. Thanks also to Mark Orazem (University of Florida, Gainesville), for contributing text about Bernard Tribollet’s talk.

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The Society had the pleasure of naming three distinguished Society members as Honorary Members. This honor is not conferred every year and is only given for outstanding contributions to the Society. ECS President Bruno Scrosati (far left) presented the new Honorary Members to the Society; they are (from left to right): (Scrosati), **ROBERT P. FRANKENTHAL**, **LUBOMYR T. ROMANKIW**, and **LARRY R. FAULKNER**.

including the Los Alamos work on polymer electrolyte membrane (PEM) fuel cells and optimization of the Pt catalyst loading, the seven-layer membrane electrode assembly (MEA) developed by 3M Corporation, and demonstration of high-performance PEM stacks and modules by Ballard Engineering in Canada. All these accomplishments presage a bright future for fuel cell powered vehicles. In fact several major auto companies in Germany, Japan, and the U.S. have entered the fray and Dr. Kalhammer pointed out that their prototype vehicles are now undergoing field tests under the California Partnership for Clean Air program.

The next part of Dr. Kalhammer's talk focused on fuel cell cost issues and what could be done to bring cost down to commercially viable levels. He mentioned that while government subsidies and tax credits could well prove to be vital to continued development of this technology, the car makers did not particularly like them in terms of reliability concerns. The other major issue was the fuel cost; clearly any new fuel cannot cost too much more than gasoline notwithstanding the advantages of electric vehicles in terms of clean emissions. The prospects of methanol as a fuel and fuel processing (reformate) approaches were then discussed. Hydrogen was

discussed as the clear long term winner as a fuel candidate and associated issues with a hydrogen fuel economy were presented.

Dr. Kalhammer moved toward the end of his lecture by saying that we needed to break out of a Catch-22 situation in terms of realization of the fuel cell vehicle concept. The break out factors were identified as severely escalating gasoline costs, increasing global climate change awareness, new financial incentives along with a series of major cost and technology breakthroughs. In his crystal ball we are perhaps 15-20 years away from commercial realization of fuel cell electric vehicles.

This was a well-crafted talk from a veteran with his pulse close to the fuel cell and electric vehicle technologies. It was very well received by a packed audience and it set the right tone for the many sessions that followed on fuel cells (including an exceedingly popular tutorial session) the rest of the week.

Olin Palladium Award Address

Dr. Eliezer Gileadi delivered his award address entitled: "Some Observations on Conducting Research in the Digital Era" during the Honors and Awards session on Wednesday. The awardee was introduced by Dr. Barry MacDougall, who reminisced about their days together in the Conway group at the University of Ottawa. Dr. Gileadi's work on the role of adsorbates in electrochemistry and the adsorption supercapacitance, which culminated in the classic volume entitled *Electrosorption* in 1967, was mentioned in the introductory remarks, as was the awardee's pioneering work on electroplating of aluminum from non-aqueous baths. Dr. Gileadi's contributions also extend to humanitarian efforts on behalf of Soviet emigrant scientists to Israel.

Dr. Gileadi began his award address by acknowledging his mentors and colleagues in the U.S., Canada, and Israel. He then revisited our present understanding of electron transfer models within the context of metal deposition and dissolution processes. His ideas are elaborated in the full text of the award lecture that is reproduced in these magazine pages (see page 10). Also described in this text is a synopsis of his current interest in liquid-like layers and surface pre-melting. These aspects have practical significance in variant phenomena such as glacier sliding, hail storms, frosting of aircraft wings, and ice formation on power transmission lines.

All in all, this award lecture was informative, fast-paced, and entertaining. Judging by the prolonged applause he received at the end of his lecture, Dr. Gileadi was entirely correct in his humorous assessment (which he made at the outset of the address) that during the past 40 years as an electrochemist, "I must have made more friends than enemies" to have won the Palladium Award! ■



The Electronics Division of the American Ceramic Society (ACerS) was a co-sponsor of some of the technical symposia at the Orlando meeting. **BRUCE TUTTLE** (left), chairman of the ACerS Electronics Division was on hand to participate in the technical program. Meeting with Tuttle after the plenary session was Bruno Scrosati.