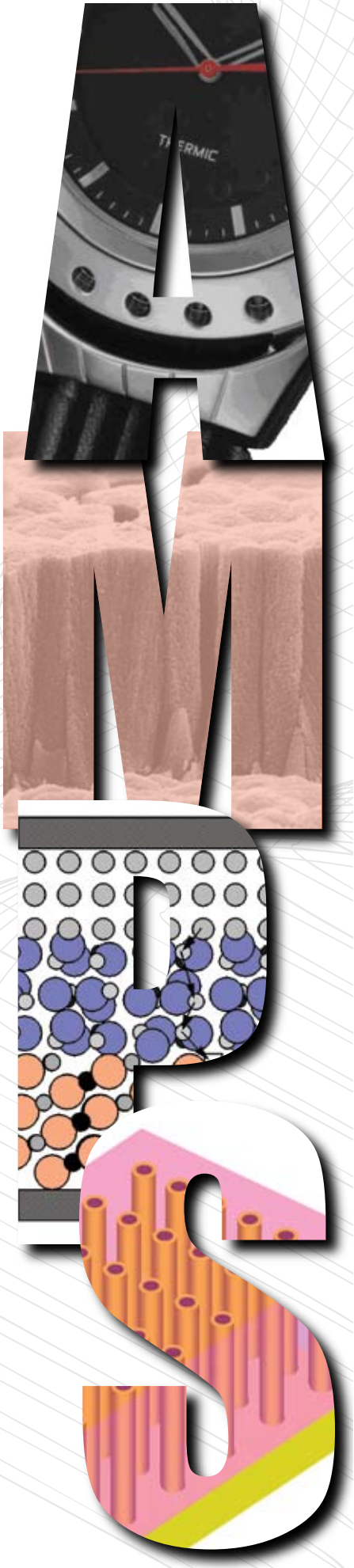

Size Does Matter

Autonomous Micro-Power Sources

by Esther Takeuchi

It is indeed a pleasure to be guest editor of this issue of *Interface* and have the opportunity to shed some light on the relationship of power and size. Remarkable advances have taken place in the ability to construct electronic devices, sensors, and even mechanical systems at the micro scale. However, the implementation of some of these new concepts is hampered by the lack of an appropriately sized power source. This issue considers several aspects of providing a long-lasting power source in a very small volume. There are multiple challenges including limited power due to small electrode size, decreased energy density due to increased packaging overhead, the need to extend power system lifetimes by increasing stability, and the need for efficient integration with ultra low maintenance drain rates. The articles in this issue present information about systems at various levels of maturity. Discussions on thin film solid state batteries, which have already reached the commercialization stage, are included, as well as future improvements in micro-batteries based on three-dimensional geometry, generating power from thermoelectric devices, and the benefits and challenges of utilizing hybrid systems as one integrated power unit.

It is clear that significant technical advances in micro-power generation and storage have and are being made. As with any complex problem, breakthroughs are realized when the issue gains attention. The challenge is then viewed from multiple perspectives and investigations can flourish using several approaches, often leading to complementary discoveries. Government targets for micro-power were noted at a government-sponsored power sources workshop in the spring of 2007, which was organized with the purpose of exploring the current state-of-the-art and technical challenges in attaining ultra-small long-lived power sources. Specific targets were defined as a power source of 1 mm^3 volume that could delivery energy for 10 to 15 years. An exemplary group of scientists assembled to discuss the challenges, the opportunities, and directions for future investigations. While the specific targets may not be fully attainable as yet, significant work is underway with more to follow. Solutions are certain to be forthcoming from the exceptional community involved in electrochemical science and technology.

About the Guest Editor

Esther Takeuchi is the Greatbatch Professor and Co-Director of the NYSTAR Center for Advanced Technology, in the Departments of Chemical and Biological Engineering, Electrical Engineering, and Chemistry at the University of Buffalo. She is a past Chair of the ECS Battery Division and was recently elected as third Vice-President of ECS. Her interests focus on materials, electrochemical power sources, and medical devices. She recently joined the University after a 22-year career at Greatbatch, Inc., where she was involved in power source research and development. She may be reached at et23@buffalo.edu.