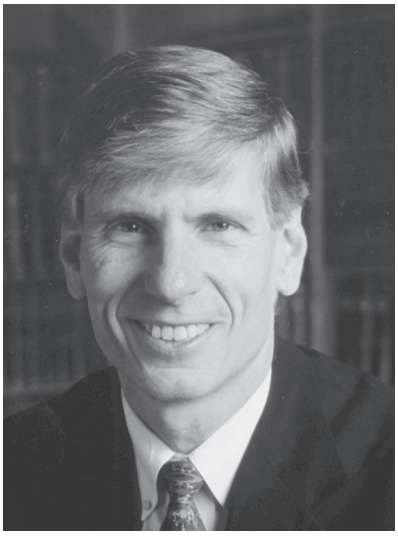

Energy Conversion and Storage

We are pleased to welcome Professor Martin Winter as an Associate Editor for the *Journal of The Electrochemical Society* (JES). Martin is from the Graz University of Technology (Graz, Austria) and will primarily handle manuscripts dealing with electrochemical energy storage and conversion — batteries and fuel cells. Energy storage and conversion continue to be rich areas for scientific and engineering studies. Batteries, especially lithium-ion technologies, have been an integral part of the advances in portable electronic devices, such as cell phones, computers, and cameras. Lithium-ion cells provide compact, safe, high energy density power for many small electronic devices. Current advances in electrodes, electrolytes, and cell design will lead to higher energy and power densities, and lower cost. New materials will make the electrodes more environmentally friendly. Although lithium-ion batteries are relatively low power, their high capacity is the required attribute needed for the low-power portable electronics. Each issue of JES documents the rapid progress being made in lithium-ion and other energy storage devices.

Energy conversion, especially fuel cells, is also an important area of research reported in JES. The global consumption and supply of energy has again become out of kilter. Energy independence and alternate energy sources have been added to the environmental concerns of fossil fuel based heat engines. Fuel cells may be an integral part of energy sustainability and a cleaner environment. Going directly from chemical to electrical energy avoids the entropy penalty of converting heat into mechanical work. The efficient fuel cell could change the world by providing low-cost, (nearly) pollution-free power. However, unlike batteries, fuel cells are used in only a few niches, premium-power applications which can afford the high cost. The problem is that some existing energy-conversion devices excel in power-density and the low-power aspect of fuel cells is not yet competitive. For example, low-temperature liquid-based fuel cells (near ambient temperature) are convenient to operate but the poor kinetics for the air-breathing cathode and liquid fuel anode lower the efficiency and power, and raise the cost. Using hydrogen as the fuel improves the electrochemical reaction but hydrogen's availability, cost of production, and safety are major issues. High-temperature fuel cells overcome many kinetic problems, but the materials and operating conditions limit their use. Thus, low-power fuel cells tend to compete against lithium and other batteries, based on longer mission lift, or against high-power heat engines (Rankine, Brayton, Otto, or Diesel cycles) based on potentially higher efficiency and lower pollution. Both areas are challenging for fuel cells. The market for low-power, short distance transportation vehicles is slow to evolve.

There is a clear and urgent need for improvements to the energy infrastructure in all areas where fuel cells compete: stationary, traction, and portable power sources. The challenges are also clear: better electrolytes, catalysts, fuels, and cell designs. I hope that someday soon, fuel cells will appear on the drugstore shelf (in a plastic wrapper next to the batteries), or tucked under the hood of a "mini". A quieter, more efficient, lower power-density world would be a welcome change. Perhaps one of the breakthroughs needed is contained in this issue of JES.

Paul A. Kohl
Editor