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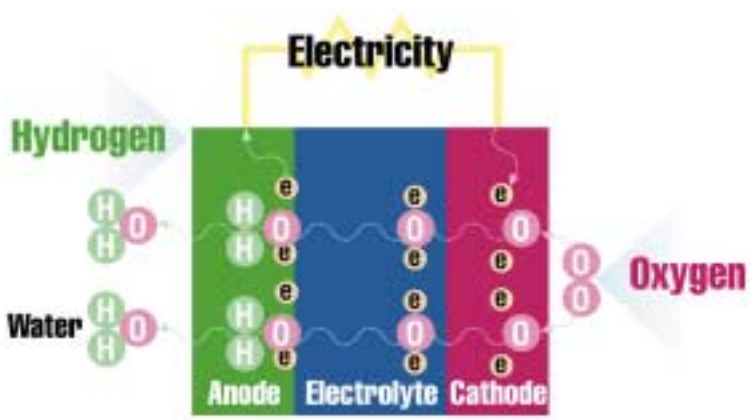
MATERIAL CHANGES

As an ASM member for nearly a half-century, I have seen many changes in our society and the profession it serves. Over the years, ASM has evolved from traditional structural material processing, and the study of microstructure and property relationships, to embrace many new technological challenges.

However, we have always remained highly focused on the needs of ASM's membership. Traditionally, that meant the metallic materials domain was our society's strength: collecting and disseminating information about designing metals and alloys with tailored properties for specific structural needs.



Pacific Northwest National Laboratory is developing hydrogen-based solid oxide fuel cells (SOFC) for military applications, commercial power plants, distributed generation for residential and commercial use, and auxiliary power units for public and personal transportation. Also, SOFCs may be used for large-scale stationary power generation.

A new era

Now we have entered a new era of materials. Today's materials scientists and engineers embrace ceramics, polymers, and composites, as well as metals and their alloys. We are involved in superconductive materials with high critical temperatures, new classes of magnetic and semiconducting materials, materials for medical devices, materials designed at the micro- and nano-levels, materials for new sources of power, and the fabrication of materials and composites to mimic human skin, muscles, bones — even neurons. These are the new frontiers of our world, and the materials scientist and engineer occupy the central position in this fast and furious evolution.

ASM must move quickly to continue to serve the needs of our membership while staying abreast of these new evolutions. Let me cite an example:

The energy resources that our children and grandchildren use will be quite different from those available today. This is not a new idea: From the time of President Eisenhower, we have been aware that we are depleting our domestic reserves of energy too rapidly, causing our dependence on foreign countries, particularly the Middle East. Recognizing the troublesome area upon which we are dependent for our life's blood, we have taken steps to develop various energy policies and to implement new technologies since then. However, over the better part of the past five decades, none of these policies had taken any definite shape to find a real solution to our energy needs.

Summary of key drivers and how they affect hydrogen energy development

Support	Inhibit	Both support and inhibit
• National security and the need to reduce oil imports. • Global climate change and the need to reduce and ultimately stabilize greenhouse gas emissions and pollution. • Global population and economic growth. • The need for new, clean energy supplies at affordable prices. • Air quality and the need to reduce emissions from vehicles and power plants.	• The difficulties in building and sustaining national consensus on long term energy policy priorities. • Lack of a hydrogen infrastructure and the substantial costs of building one. • Lack of commercially available, low-cost hydrogen production, storage, and conversion devices. • Hydrogen safety issues. • The need for additional demonstrations of carbon sequestration and lower-cost sequestration methods.	• Rapid pace of technology developments supporting hydrogen and competing energy carriers. • The current availability of relatively low-cost fossil fuels exacerbating the inevitable depletion of these resources. • Simultaneous consumer preferences for both a clean environment and affordable energy supplies.

Source: The National Hydrogen Energy Roadmap, www.fossil.energy.gov.

Then came the bold pronouncement by President Bush, who during his State of the Union address in 2003, said that America would begin to convert our economy from oil-based to hydrogen-based within 20 years. ***Twenty years!***

There is historical precedent for such a culture-altering shift. What was the conventional fuel source of the 18th century? Wood. The 19th century? Coal. But we cannot wait another century for a solution: The liquid petroleum upon which we have relied during the last century is being rapidly depleted. By as early as 2015, and certainly not long after that, we will face a serious crisis.

Have you seen recent headlines? The price of crude oil surpassed $50 per barrel, a historic record price that has doubled during the last year. Are we seeing the preamble to the predicted peak of new oil discovery and production?

Who holds the key?

Materials scientists and engineers hold the key to the future. ASM must take a leadership role as a society to focus on addressing this challenge, and other challenges of similar importance, before they wreck our domestic and international economies.

To achieve a hydrogen-based economy, the challenges are enormous, some would say overwhelming. Most reside in the development of structures for the extraction of hydrogen by electrolytic means, for transportation and distribution at various centers, for safe storage with controlled delivery on demand, and for the utilization of hydrogen in our vehicles, as well as the development of new materials for fuel cells.

For example, on the issue of storage, how can we design materials to store hydrogen safely, without the danger of an explosion? Think of how a sponge soaks up water. It is entirely possible to develop an alloy system that will soak up hydrogen in large quantities and hold it in a stable condition, then release it with a slight change in temperature, providing safety and efficiency in a single package.

Our nation has made a commitment of $1.2 billion to convert our economy so that when today's children become of driving age, they can go to an energy pump station and pump hydrogen, not petroleum. The European Union has released two billion euros in support of the hydrogen economy. But we face tremendous technological challenges. (If it took as long as 40 years to achieve our goal, it would still be a monumental accomplishment!)

What do all of these challenges have in common?

These are all materials-related issues. As a materials scientist or engineer, are you up to the challenge? In the past, whenever we were confronted by a danger that threatened the way we lived, it was always the materials scientists and engineers who rose to the occasion, providing the underpinning technology that made solutions possible. Building on that proud tradition, it is today's materials scientists and engineers who will enable us to meet these new challenges to ensure our future prosperity and security.

While facing these new technological challenges, we are maintaining a vigorous effort in our traditional areas of expertise in structural materials. We will continue to serve the ASM membership with the information required in these areas, while addressing emerging technologies, to face the challenges that stand before us as a society and as a civilization.

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See "Industry Insider" on p. 99 for news of progress in the hydrogen economy.