Nanoscience Rising Up To Meet Energy Challenge, MIT Professor Says

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Tiny materials may bring about large-scale advances in a future hydrogen economy, MIT Professor Mildred S. Dresselhaus told audiences Wednesday, April 5, at MIT and at the Technion Israel Institute of Technology.

In a talk, "Addressing Grand Energy Challenges Through Nanoscience," simulcast at both institutions, Dresselhaus related how she became involved in 2003 in making hydrogen a more viable fuel source when she chaired a national study looking at the problem. President Bush's 2003 State of the Union announcement of a hydrogen fuel initiative substantially increased interest in the potential for hydrogen to play a major role in the nation's long-term energy future.

While hydrogen has advantages, it's "not a fuel. You can't mine it. We would have to make nine million tons a year, and eventually, 20 times more than that," Dresselhaus said. Because hydrogen is currently produced from fossil fuels, scientists would have to find a way to produce it from sustainable sources such as rainfall and ocean water.

"We need to develop the technology to convert hydrogen and water to free hydrogen, but we don't know how to do it cheaply and at a large scale," she said.

To make hydrogen that works as well as gasoline as an automotive fuel or to power the fuel cells that may replace internal combustion engines, researchers are depending on nanotechnology.

"By using new advanced materials now becoming available through nanoscience, scientists can take advantage of quantum phenomena that occur at this scale," she said.

Nanotechnology can help develop efficient, inexpensive catalysts for hydrogen production and storage. Several chemical species contain hydrogen in high concentrations, but the trick is to release hydrogen from its strong chemical bonds to make it usable in a system like a car that needs a steady flow of fuel.

Unfortunately, many promising avenues have drawbacks -- nasty by-products or high temperature requirements -- but Dresselhaus is confident that these will be eliminated in time. "Each one of these things we know how to do in principle, but we're far from knowing the details," she said.

Dresselhaus said significant change is unlikely to come about through incremental improvements to existing technology. Just as Edison's incandescent light bulb was not born from improving the candle, future technologies are likely to bear little resemblance to today's tried-and-true methods. For instance, Dresselhaus said advances in light-emitting diodes, twice as efficient as fluorescent lights, may soon become common as household lighting, although it's hard to imagine using the same source that lights up your watch to light your whole house.

The talk was part of a monthly lecture series sponsored by Hibur, an MIT-Hillel-sponsored program started by students last year. The program is designed to create a connection between MIT and the Technion Israel Institute of Technology in Haifa, Israel.

Source: MIT