Automotive Fuel Cell Corporation

Hydrocarbon Membrane Fuels the Success of Future Generation Vehicles

While every car manufacturer, such as GM and Ford, has developed their own hydrogen fuel cell vehicle, the systems are complex and costly. For example, fuel cell vehicles run optimally when the air and hydrogen fuel is humidified, which requires high pressures and additional systems controls. Hydrogen is normally recirculated in the fuel loop, and nitrogen buildup due to crossover from the air side causes unwanted purging of fuel which affects overall vehicle range.

At Sandia National Laboratory (SNL), researcher Cy Fujimoto, in partnership with Automotive Fuel Cell Cooperation (AFCC), is developing a polymer electrolyte membrane (PEM) that can operate optimally with minimum on-board humidification and low gas crossover.

The work of Fujimoto and other SNL researchers is part of a Cooperative Research and Development Agreement (CRADA) with AFCC, a private joint venture company in Canada, formed by combining the automotive fuel cell business of Ballard Power Systems with the fuel cell stack development departments of Daimler and Ford.

AFCC is striving to make automotive fuel cells an affordable and reliable alternative solution to address energy and climate change issues. Their mission is to deliver fuel cell stacks to Daimler and Ford's fuel cell vehicle programs that provide the best balance of reliability, quality, and functionality while meeting cost targets.

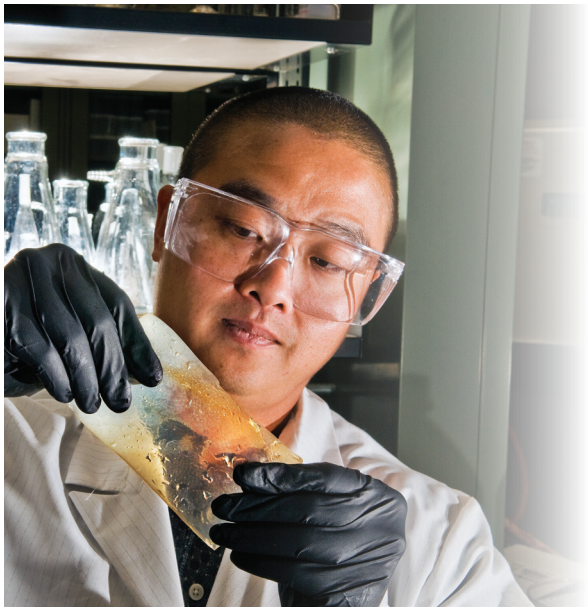
Fuel cells use hydrogen fuel and oxygen from the air to produce electricity. PEM material allows only the positive hydrogen ions (protons) to pass through it to the cathode. That's why PEM fuel cells are also known as proton exchange membrane fuel cells. A single cell cannot provide enough to power a vehicle, so cells are assembled into fuel cell stacks.

SNL's research into a hydrocarbon membrane for automotive use is now focusing on automakers' needs, which include high proton conductivity with low water content and reduced gas crossover. With the type of membrane used in automotive fuel cells currently, pathways for the protons shrink as the material dehydrates. This results in increased internal cell resistance and diminished function of the fuel cell in cars operating in dry climates without humidification.

The SNL hydrocarbon PEM material allows for larger pathways for proton movement, even in low humidity climates. It can perform well in both dry and wet environments. This means one of the obstacles to widespread use of fuel cell systems in vehicles, their durability and performance, especially in some temperature and humidity ranges, can be overcome.

Another major challenge is to get the cost of manufacturing the membrane low enough to be practical for mass production, something SNL researchers are working on with AFCC. Efforts are underway to "scale up the chemistry" to lower costs.

Developing a fuel cell membrane that can meet the automotive targets set out by automakers and the U.S. DOE can have a very positive impact on the U.S. economy. An improved hydrocarbon membrane developed at SNL has a good chance to be the material of choice for future generation fuel cell vehicles.



SNL researcher Cy Fujimoto demonstrates his new flexible hydrocarbon polymer electrolyte membrane, which could be a key factor in realizing a hydrogen car.

The close partnership between Sandia and AFCC has resulted in a very unique and promising technology for future automotive applications.

Dr. Rajeev Vohra
Manager R&D
AFCC