Sandia National Laboratories

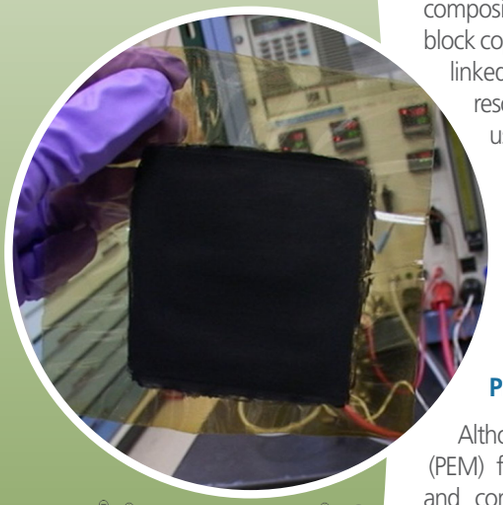
Energy, Climate & Infrastructure Security

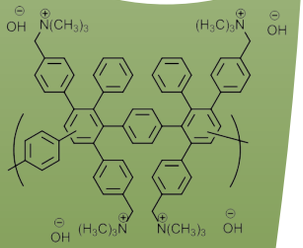
Electrify the Vehicle Fleet

Fuel Cell Membranes Open New Doors for Power

Sandia's work in Fuel cell membrane research examines several organic polymer platforms tailored as ion exchange membranes in both proton exchange membrane (PEM) and anion exchange membrane (AEM) fuel cells.

The optimization of fuel cell performance will enable new and improved technologies in markets including transportation and portable power electronics.





Using Fuel Cell Membranes to Improve Power

As part of its Sustainable Energy Program, Sandia National Laboratories works to find new ways to use fuel cell membranes to improve energy generation and storage. Work in this area explores elements of fuel cell membrane composition and behavior including synthesis of block copolymers for improved separation, cross-linked membranes for greater stability and resonance-stabilized ionic groups that are used in a number of other applications.

While Sandia performs much of the fuel cell membrane research and development (R&D), it relies on industrial partners to perform the testing and assessments required to bring the technology to market.

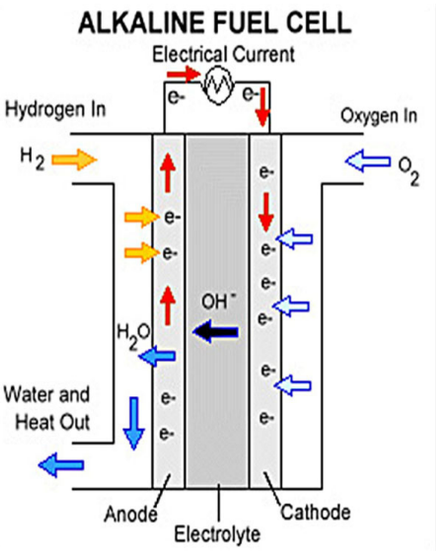
Proton Exchange Membranes (PEM)

Although proton exchange membrane (PEM) fuel cells are widely studied, scaled-up and commercialized by industry, they remain difficult to make, and are consequently expensive to manufacture due to their fluorine content. Because fluorine is traditionally difficult to work with and requires a complicated manufacturing process, new materials needed to be examined as substitutes in order to make PEM fuel cells a more viable and realistic alternative power source.

Sandia researchers replaced fluorine with hydrocarbon in PEM fuel cells. The resulting cells operate more efficiently by functioning at higher temperatures, are more efficient to cool, and avoid catalyst poisoning, which can be a problem in traditional fuel cell designs. These cells enable a host of new technologies and provide new opportunities for members of industry to commercialize and manufacture increasingly efficient, robust products.

Anion Exchange Membranes (AEM)

Although PEM fuel cells are generally considered to be the more advanced fuel cell membrane



technology, anion exchange membrane (AEM) fuel cells offer advantages over PEM designs. At high pH, the electrochemical reactions of interest take place more readily, so AEM fuel cells operate in an increasingly efficient way. Most notably, AEM fuel cells do not require the use of precious metal catalysts, unlike their PEM counterparts. As a result, much cheaper metals can be used as catalysts, providing a cost-effective alternative to other fuel cell technologies.

Sandia has developed highly stable membranes for AEM fuel cells with conductivities that match the state-of-the-art. In addition, Sandia has improved the transport of fuel and water within the fuel cell's electrodes through the use of novel ionomers and adapted fabrication techniques. This technology can be applied to a variety of markets including electrodialysis, alkaline fuel cells, electrolysis, and the automotive industry.

Partnership Opportunities

Sandia is looking to develop strategic partnerships for responding to future DOE funding opportunities. Contact Anthony Martino, manager of Sandia's Materials, Devices, and Technologies group, for more information.

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U.S. DEPARTMENT OF ENERGY

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