Chemists discover recipe to design a better type of fuel cell

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Fuel cells are often touted as one method to help decrease society's addiction to fossil fuels. But there is still a lot of work to be done before fuel cells will be ready for mass market to be used in transportation, home heating and portable power for emergencies.

U of C chemists Jeff Hurd and George Shimizu have taken the science behind a specific type of fuel cell towards a higher level of design. They have discovered a new material that allows a PEM fuel cell, known as a polymer electrolyte membrane fuel cell, to work at a higher temperature. This discovery is extremely important in terms of increasing the efficiency and decreasing the cost of PEM fuel cells.

"This research will alter the way researchers have to this point perceived candidate materials for fuel cell applications," says Shimizu a professor in the Department of Chemistry at the University of Calgary.

A research paper by Shimizu, Hurd, Ramanathan Vaidhyanathan and Venkataraman Thangadurai of the University of Calgary, and Christopher Ratcliffe and Igor Moudrakovski of the Steacie Institute for Molecular Sciences, National Research Council, has just been published in *Nature Chemistry* online. Shimizu filed a patent with the US patent office last year.

A fuel cell is an electrochemical energy conversion device which converts the chemicals hydrogen and oxygen into water and electrical energy. Water usually carries the ions (protons) in a hydrogen fuel cell

but this research uses higher boiling molecules trapped in a molecular scaffolding.

Currently, PEM fuel cells can produce energy from hydrogen below 90 °C, just under the boiling point of water. With Shimizu's material, energy can be produced at a higher temperature, up to 150 °C. This could ultimately make the fuel cell cheaper to produce because at a higher temperature less expensive metals can be used to convert hydrogen into energy. Currently, platinum is used which is extremely expensive. Also, reactions at a higher temperature would be faster thus increasing efficiency.

"Ours is an entirely new approach that strikes a balance between having a regular molecular structure and mobile components all while showing genuine promise of application," says co-author Hurd, a PhD candidate studying chemistry at the U of C.

Kevin Colbow, director of research and development at Ballard Power Systems, a company that designs and manufactures clean energy hydrogen fuel cells, calls the work significant. "We believe that further improvement on conductivity and robustness of these materials could provide next generation membranes for PEM fuel cells."

Source: University of Calgary (news : web)