PURDUE INNOVATES | Office of Technology Commercialization

Ammonia Removal for Hydrogen PEM Fuel Cells

A dual system combining water absorption and activated carbon adsorption effectively purifies hydrogen for fuel cells, minimizing system weight and maintaining ultrahigh purity for extended operation.

Hydrogen is a potential clean and environmentally-friendly energy carrier because when it combines with oxygen in fuel cells to generate electricity, its only product is water. However, a major obstacle for the development of hydrogen-powered vehicles is the lack of safe, lightweight, energy-efficient means for onboard hydrogen storage. Over the last five years, ammonia borane (AB) has attracted interest as a hydrogen storage material because of its relatively large amount of hydrogen by weight. However, current proposed methods of hydrogen release from AB exhibit an undesirable conversion of AB to ammonia gas, which results in a degradation of fuel cell performance.

Researchers at Purdue University have developed a novel process for ammonia/hydrogen separation in vehicular proton exchange membrane (PEM) fuel cell applications. Through a dual process of ammonia absorption using recycled water from the fuel cell and adsorption through activated carbon, the weight penalty of the hydrogen purification system can be minimized. In addition, the combination of absorption and adsorption allows this technique to remain effective for a much longer time before ammonia concentrations rise above acceptable levels as compared to either absorption or adsorption alone. This allows for the continued delivery of ultrahigh purity hydrogen with minimal purification system weight.

Advantages:

-High hydrogen capacity

-Minimal extra weight

-Remains effective for long time

Potential Applications:

Technology ID

65888

Category

Energy & Power Systems/Energy Storage

Energy & Power Systems/Hydrogen & Fuel Cell Systems

Authors

Ahmad Al-Kukhun

Hyun-Tae Hwang

Arvind Varma

Further information

Will Buchanan

wdbuchanan@prf.org

View online

-Green Technology

-Hydrogen Storage

TRL: 3

Intellectual Property:

Provisional-Patent, 2011-09-02, United States | PCT-Patent, 2012-09-02, WO | NATL-Patent, 2014-05-08, United States | DIV-Patent, 2016-08-04, United States

Keywords: Hydrogen storage, ammonia borane, AB, hydrogen purification, ammonia separation, PEM fuel cell, proton exchange membrane, ammonia absorption, activated carbon, green technology, Chemical Engineering, Clean Energy, Fuel Cells, Green Technology, Hydrogen Storage