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Micro-Channel Heat Exchanger for Metal Hydride Hydrogen Storage

A highly efficient micro-channel heat exchanger enables solid-state hydrogen storage systems to achieve a five-minute fuel tank fill time, significantly surpassing industry standards.

There is great interest in developing hydrogen powered devices, especially hydrogen powered automobiles. One prerequisite for this application is that there is enough hydrogen to give comparable driving ranges as conventionally fueled automobiles. However, hydrogen poses the problem of very low density. To overcome this obstacle, solid-state hydrogen storage techniques that use metal hydrides (both high pressure and complex metal hydrides) have been developed. However, large quantities of heat are released from the reaction of hydrogen with the metal hydride once the hydrogen gas is charged into the vehicle's storage system, making the heat exchanger the most crucial component of the hydrogen storage system.

Researchers at Purdue University have developed a unique micro-channel heat exchanger for solid-state hydrogen storage. The internal micro-channel design optimizes both powder/pellet contact area for increased heat transfer and hydride powder/pellet capacity. This highly efficient heat exchanger provides the necessary cooling power to meet the Department of Energy's fill time target of less than five minutes. This is the only design to achieve this target. No other metal hydride storage system have been demonstrated to cross the five minute fill time mark. In fact, published values range from 10 to as high as 100 minutes.

Advantages:

-Five minute fill time for hydrogen fuel tank

-Micro-channel design

Potential Applications:

-Green Technology

Technology ID

65007

Category

Automotive & Mobility
Tech/Battery Management & Charging Technologies
Energy & Power Systems/Hydrogen & Fuel Cell Systems
Materials Science & Nanotechnology/Thermal Management Materials & Solutions

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Intellectual Property:

Provisional-Patent, 2009-02-04, United States | Provisional-Patent, 2009-06-05, United States | NATL-Patent, 2010-02-04, Republic of Korea | NATL-Patent, 2010-02-04, Japan | PCT-Patent, 2010-02-04, WO | NATL-Patent, 2011-07-29, United States

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