Micro-scale Fuel Processor for Hydrogen Fuels (#3667)

A fuel processor and method for producing hydrogen gas

A Georgia Tech inventor has developed a fuel processor to produce hydrogen gas for use in fuel cells. The design is compact, lightweight, and portable, making it suitable for a variety of applications from portable electronics to automotive power. Liquid fuel is ejected from a storage tank through a micromachined atomizer system, creating droplets that are then impinge on a heated catalyst layer to flash evaporate and react to form the desired output product, such as hydrogen. This method may be used to extract hydrogen from high energy density liquid fuels, such methanol, ethanol, gasoline, diesel, or other liquid. The system can operate under a variety of conditions depending on the fluid, catalyst, product, and reaction. The fuel processor can be used in continuous-flow operations or in offline or single-use applications. The dimensions of the system can be adjusted based on the desired application, typically ranging from a few millimeters to several centimeters in length.

Benefits/Advantages

- **Scalability** — processor can be configured for a variety of processes
- **Ease of operation** — simple and robust
- **Compact** — overall design can be only a few millimeters to a few centimeters in size
- **Direct integration with fuel cells** — no additional piping or product collectors are required

Potential Commercial Applications

- Automotive fuel cells
- Small-scale portable fuel cells
- Industrial chemical production
- Distributed power generation

Background/Context for This Invention

Hydrogen fuel is a key ingredient in fuel cell and alternative energy applications. Hydrogen is typically stored via compression or as a liquid, then processed to release the hydrogen gas as needed. Portable fuel cells, such as those used in automotive applications or portable electronics, need an efficient method for hydrogen generation to enable their widespread use.

See other hydrogen fuel–related technologies by Dr. Fedorov. To see his entire portfolio of available technologies, click here.

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More Information

U.S. Patent Issued - US 8,603,205 B2

U.S. Patent Issued - US 7,909,897

Publications

Fuel Reformation and Hydrogen Generation with Direct Droplet Impingement Reactors: Parametric Study and Design Considerations for Portable Methanol Steam Reformers, Industrial & Engineering Chemistry Research, May 26, 2011

Fuel Reformation and Hydrogen Generation with Direct Droplet Impingement Reactors: Model Formulation and Validation, Industrial & Engineering Chemistry Research, May 26, 2011

An Integrated MEMS Infrastructure for Fuel Processing: Hydrogen Generation and Separation for Portable Power Generation, Journal of Micromechanics and Microengineering, August 31, 2007

In Search of Optimal Fuel Processing Strategy - CHAMP-DDIR: High Power Density Liquid Fuel Reformer, Two slides (PDF)

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/micro-scale-fuel-processor-hydrogen-fuels

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot