ESTD
Engineering Science & Technology Division

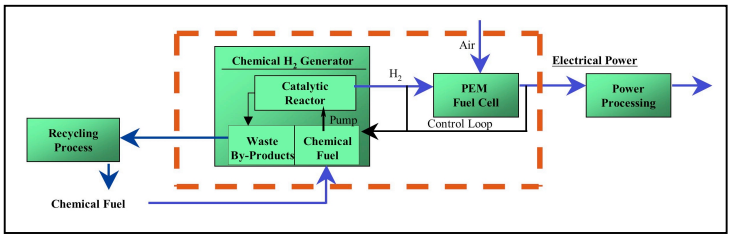
ROBOTICS AND ENERGETIC SYSTEMS GROUP
RESG

Scalable Portable Power System

Based on Chemical H_2 Generation/Fuel Cell

Silent, Low Signature Power for Portable/Remote Applications

There are a variety of power systems for remote and portable applications, including internal combustion engines, batteries, fuel cells and hybrid combinations of multiple sources. The PEM fuel cell, in combination with chemical-based hydrogen generation is a power source that provides a number of key advantages including power generation on demand (no-idling cost), that its scalable over a wide range of power levels (10 W to 3 kW and above), and an inherently low signature (quiet, low temperature, exhaust of air + water), that makes it ideal for applications requiring an unobtrusive or stealthy power source or one that is well suited for indoor use (no emissions). The potential for high system energy densities (the fuel itself has an energy density of up to 3 kWh/kg) makes the system a logical option for portable and remote applications. Major activities involve advanced controls techniques for the high-response hydrogen generation on-demand and the design, development, and controls for the combined pressure, temperature, concentration, thermal and water management to achieve high effective energy densities and efficiencies.

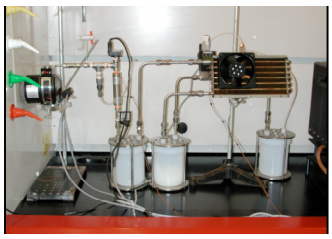


Schematic of H_2 generation fuel cell power system.

Advantages of chemical based hydrogen generation:

- No transport issues, non-toxic, non-explosive, non-flammable
- Suitable for highly varying electric loads (with proper controls and transient handler)
- No emission of harmful compounds or greenhouse gases
- Inert by-products
- Reaction viable at low temperatures (<0°C)
- Scalable processes: suitable for various power levels
- No Idling cost, generate hydrogen and power on demand
- Controllability of H_2 generation process demonstrated
- Fuel (chemical) has specific energy > 3 kWh/kg
- Potentially dramatic increase in H_2 storage density (≤ 21% Wt)

ORNL H_2 generators.



ORNL feasibility tests.

Disadvantages of chemical based hydrogen generation:

- Specialty chemicals are currently relatively expensive
- On-going efforts investigating recycling to address cost issues

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