Compact Microchannel Fuel Vaporizer

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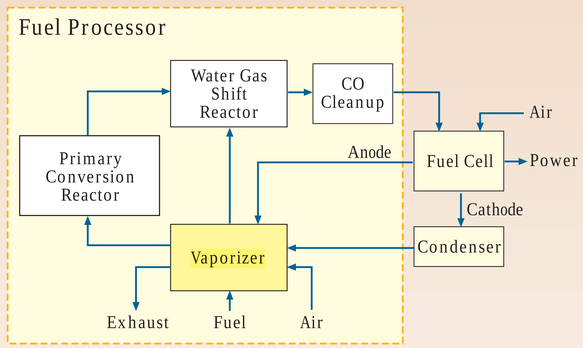
Operated by Battelle for the U.S. Department of Energy

Overview

Battelle has designed, built, and demonstrated a compact microchannel fuel vaporizer (CMFV). This 0.35 liter, 1.8 kg device is capable of vaporizing gasoline for a "full-scale" 50-kW_e fuel cell automobile.

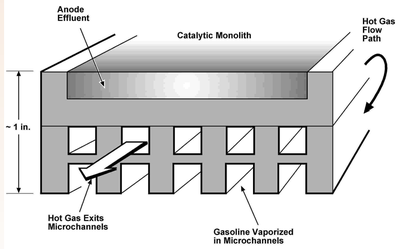
Why?



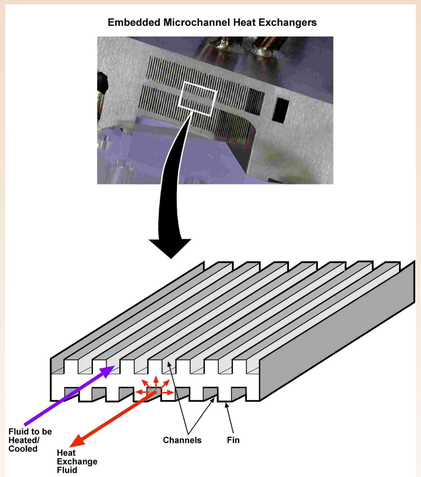
Fuel cells are a clean, efficient alternative to the internal combustion engine. To be economical, the existing gasoline infrastructure must be utilized. Gasoline must undergo a multi-step process to extract hydrogen for the fuel cell (fuel processing). The gasoline vaporizer is one component of the fuel processor.

CMFV Design

Photo of CMFV

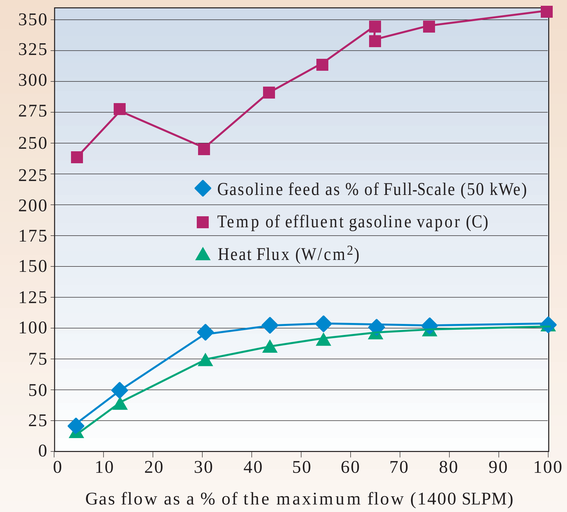


Schematic of CMFV Operation



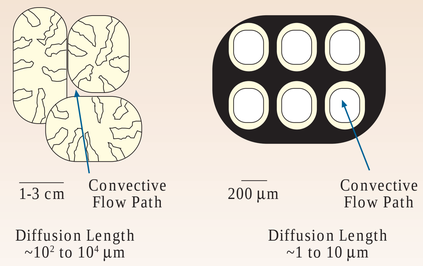
Schematic of Microchannel Heat Exchanger Design

CMFV Performance



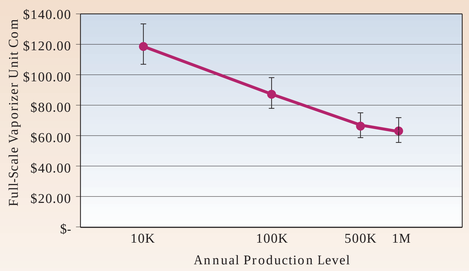
Gasoline vaporized: ~300 mL/Min
Feed gas (anode effluent + air): 1400 slpm

Catalysts



Conventional vs. Engineered Catalyst Structures

Economy of mass production not economy of scale



A manufacturing study for the CMFV suggests that a microchannel fuel processor will meet DOE cost targets for automotive fuel cells systems.

Competitive Advantage

Feature	CMFV	Other Emerging Technologies[a]	Conventional Boiler Technology	Competitive Advantage
Hardware Volume	0.35 liters	3 liters	>10 liters	One-tenth the size
Weight	1.8 kg (4 lb)	>10 lb	>50 lb	Lightweight—twice as light as nearest competitor; portable
Operation Under Varying Load	Response time of seconds	Response time of minutes	Response time of minutes	Responsive to variable automotive load requirements
Heat Flux per Unit Hardware Volume (W/cm^3)	11.5	~1.2	0.1 to 1.0	10 times more heat per unit hardware volume
Development Stage	Demonstrated full-scale[b] device, two units shipped[c]	Under development	In use	Innovative new technology
Fabrication Method	Low-cost laminate fabrication	Conventional extrusion, machining, and welding	Conventional extrusion, machining, and welding	Low labor cost, consistent quality

(a) All work is in the development stage; information is proprietary; estimates are provided where possible based on our knowledge of research activities.
(b) Supports a 50-kW fuel processor/fuel cell.
(c) The CMFV is currently being integrated within the automotive fuel processor systems under development by two companies.