DEVELOPMENT OF A 300 W DIRECT METHANOL FUEL CELL BASED POWER SOURCE

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Introduction

Fuel cell systems based on direct methanol fuel cell (DMFC) technology developed by DARPA have been fabricated [1]. The US army is presently developing DMFC based fuel cell systems into field usable power sources. A 300W auxiliary power source based on DMFC technology is currently being fabricated at the Jet Propulsion Laboratory (JPL) for the US army. The goals for the power source development are; instant startup at temperatures above 5 ^oC, "in-field" refueling for extended operation, and operation in a military environment. The target system mass, including fuel for 100 hr of continuous operation, is 36 kg. A CAD model of the DMFC based power source is shown as figure 1.

The focus of this paper is on the design and demonstration of the 300W DMFC based power source. The performance of an 80-cm^2, 80-cell low airflow DMFC stack, the power source for the fuel cell system, will be presented. Five-cell stack performance for this stack design with respect to stack operating parameters has been previously reported [2]. The performance of the 80-cell stack with respect to stack operating conditions will be highlighted.

Results and Discussion

The impact of stack operating parameters, such as air stoichiometry, on fuel cell system design has been discussed [2-4]. For a DMFC based fuel cell system to operate in elevated temperatures (>40 ^oC) and dry air (0% RH) requires DMFC membrane electrode assemblies (MEAs) that can operate at low air stoichiometry (~1.7 stoic). MEAs that operate at low air stoichiometry have been fabricated by the JPL direct deposit technique [5]. The voltage-current performance for an 80-cm^2 five-cell stack at various airflows is shown as figure 2. The five-cell stack outputs 22.4 W under an applied load of 125 mA/cm^2.

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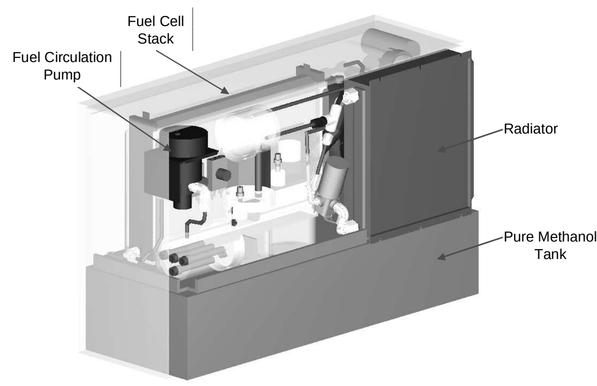

Figure 1. CAD model of the 300 W DMFC power source being developed.

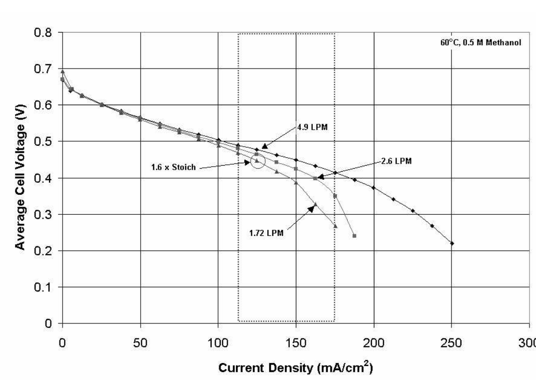

Figure 2. Voltage-current performance for an 80-cm^2 five cell DMFC fuel cell stack operating at various airflow rates.