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Fuel Cell Technology Update – Special Report on National Laboratories’ Transportation Fuel Cell Programs

Fuel cell research at the U.S. National Laboratories should yield cheaper, more rugged fuel cell engines. At the U.S. Department of Energy’s Office of Transportation Technologies (OTT) review meeting this month, the U.S. National Laboratories reported on their advances in fuel cell and fuel processing technologies.

The following are highlights from the Laboratory review:

Fuel Cell Systems

Scale-up of Direct-Methanol Fuel Cell Delivered – Los Alamos National Laboratory has scaled up its direct-methanol fuel cell (DMFC) from a 5-cell to a 30-cell stack that has been delivered to Ball Aerospace for system integration on a DARPA project. LANL also successfully met its goal of demonstrating a DMFC with 5 g/kW of platinum load in a 50cm² cell. A test of DMFC performance on both commercial and analytical grade methanol found that DMFCs do not seem to require a special “fuel cell grade” methanol.

Fuel Cell Stack Components

Reconfigured MEA Has Higher CO Tolerance, Less Precious Metal Load – Los Alamos National Laboratory researchers have developed a reconfigured Membrane Electrode Assembly that tolerates 100 ppm CO in reformate, with only 0.1 mg/cm² of catalyst. Tests of the newly reconfigured anode showed full tolerance to 500 ppm CO in reformate using 0.3 mg/cm² anode catalyst, with <5% air bleed. LANL researchers want to focus next on improving start-up time.

Fuel Reforming Technology

Alternative “Water-Gas Shift” Catalysts Found – Argonne National Laboratory’s R&D on catalysts for “water-gas shift” reactors (part of the fuel reforming process) has resulted in alternatives that could reduce both size and costs of the reactor. Researchers were able to use a new method of producing the catalyst that would reduce the platinum load while

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retaining activity. In just two years, ANL has reduced the amount of platinum required for a 50-kWe reactor by 93 percent. Researchers have also identified a non-precious metal/mixed oxide that is a potential alternative to the current platinum/mixed oxide. The cost of the non-precious metal catalyst would be just 1% of that of the platinum catalyst.

Fuel Cell Vehicle Analysis

Fuel Economy of Three Fuel Cell Vehicles Analyzed – Argonne National Laboratory’s Electrochemical Technology Program has modeled and analyzed three fuel cell vehicles to estimate fuel economy. The vehicles analyzed were the Ford P2000, the GM Precept, and the Precept-Light, developed to further reduce vehicle weight. The modeling and analysis found that all three vehicles had a “highway” fuel economy of more than 80 mpg. Analysis of the Precept-Light vehicle showed a highway fuel economy of over 100 mpg.

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Research and development activities at the Laboratories are focused on Technical Targets set by the Partnership for a New Generation of Vehicles. The Technical Targets aim to achieve a variety of benchmarks by 2004, including:

- Fuel cell system – 48% fuel cell system electrical efficiency, with a power density of 300-watts per kilogram, and 300-watts per liter.
- Fuel processor – 80% efficiency, cost of $10/kW, <0.5 minute start-up time, 10 ppm CO, 0 sulfur, >5000 hour life, and a power density of 750-watts per kilogram and 750-watts per liter.
- Stack sub-system – Membrane electrode assembly (MEA) cost of $10/kW, bipolar plate cost of $10/kW, whole sub-system cost of $40/kW, 60% efficiency, 0.2-grams per kilowatt of Platinum, 100 ppm CO tolerance, >5000 hour life, and a power density of 500-watts per kilogram, and 500-watts per liter.

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Fuel cells generate electricity without combustion by harnessing the energy created when hydrogen and oxygen are chemically combined. Fuel Cells 2000 is an independent, nonprofit activity dedicated to the commercialization of fuel cell technologies.