

Corrosion Resistant LiteCell™ Metal Separator Plates for PEMFC & DMFC Fuel Cells



Pivotal Technologies for the Hydrogen Economy

Providing Power at Half the Weight and Volume at Lower Cost

Fuel Cell Market

The fuel cell market is growing rapidly. In 2006 alone, the number of installed fuel cell systems increased by a “staggering” 67%, according to Fuel Cell Today's 2006 World Survey. Among all installed systems, over 80% are PEMFC and DMFC based power systems. *TreadStone's LiteCell Technology exploits this rapidly growing market with a lighter weight, lower cost fuel cell stack.*

With this dramatic growth, the preferred technology across the broad fuel cell market is Proton Exchange Membrane Fuel Cells (PEMFC) including Direct-Methanol Fuel Cells (DMFC). TreadStone's PEMFC and DMFC power source component technologies have flexibility demanded by the small portable power source markets (<25W) through the large transportation market (>100kW). PEMFC is the technology of choice for the automotive market.

As part of the Hydrogen Economy, the *FreedomCar Initiative supports the development of the fuel cell power systems and associated components that will meet the strategic objectives to reduce our dependence on foreign oil and promote a “green” economy.* The goal of the FreedomCar Initiative is to promote and accelerated the

TreadStone's LiteCell Metal Plates Offer Unique Benefits to Fuel Cell OEM's	
Features	Benefits
45 - 55% Reduction in Weight and Volume of the “Fuel Cell Stack”	Corrosion Resistant Metal Plates Replacing Graphite Plates
Coating Process Used on Commercially Available Metals	Readily Available, Low Cost Materials and Simplified Manufacturing Process
Corrosion Protection Over 5000 Hours Life Stability Testing	5000 Hours of Corrosion Protection “Meeting Industry Benchmarks”
Metal Versus Graphite Plates	Enhanced Durability – Ease of Manufacturing
Core Technology Developed	Can be Customized for All PEMFC or DMFC Applications

development of a fuel cell power system for automotive use, meeting specific objectives established for 2010.

Hydrogen is an important industrial chemical feedstock that is used in synthesis production of methanol, ammonia, urea, hydrochloric acid and other chemical products. Currently, about 50 million tons/yr of H₂ is produced worldwide.

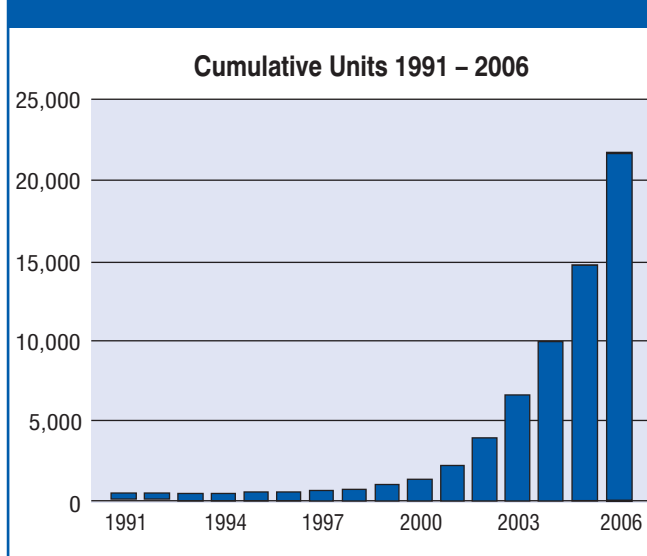
Hydrogen has been identified as the most promising intermediate energy carrier for energy conversion to produce electricity for the portable, stationary and transportation markets

TreadStone's Innovation

TreadStone's LiteCell corrosion resistant metal plate technology addresses a key fuel cell challenge by protecting inexpensive metal bipolar plates, providing long-life operation at competitive prices.

In August 2005, The US DOE published the revised “Fuel Cell Technologies Roadmap” highlighting the status of product and technical challenges/ achievements. *One of the key product development challenges identified in the commercialization of the fuel cell power systems was the “bipolar plate”. The bipolar plate is a critical component of the fuel cell power system.* The fuel cell industry recognizes the benefits in weight and volume reduction gained by switching from graphite to metal bipolar plates.

67% Growth of Fuel Cell Market in 2006



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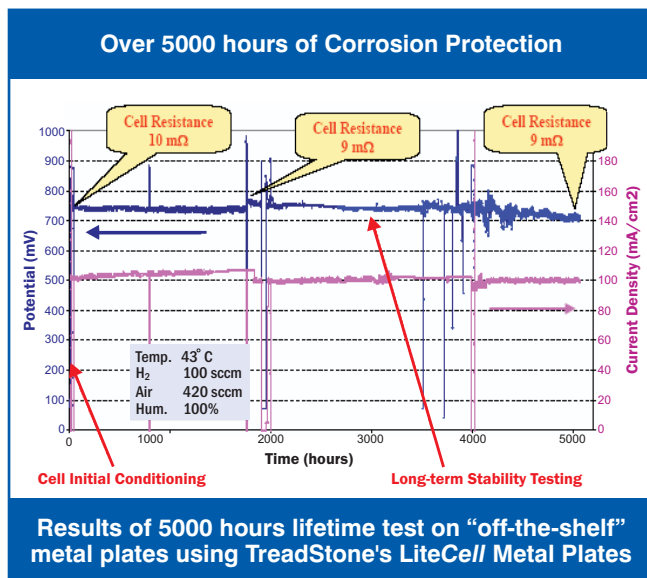
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LiteCell Technology: Lighter Weight, Maximum Performance, Lowest Cost

TreadStone's LiteCell Technology for lighter weight, high performance, low cost fuel cell stacks is based on an innovative and unique design for metal corrosion protection. This technique enables the use of low cost metals and inexpensive fabrication processes to make bipolar plates that meet the life, cost and weight/volume DOE targets required to commercialize fuel cells for automobile power. Fuel cell stacks employing LiteCell Technology are 40-50% lighter than the heavy graphite fuel stacks currently used, which also suffer from poor thermal management.

Because of LiteCell's anti-corrosion protection, the fuel cell maintains its high level of performance and low-contact plate resistance. This innovative approach enables the fuel cell system integrator to use metal separate plates made from low cost, commercially available metal substrates and low cost processing techniques.



LiteCell Feasibility Studies

TreadStone demonstrated the feasibility of its LiteCell Technology on metal plates used in a Soldier Portable Power application for the US Army. This work proved the ability of TreadStone's corrosion protection technology to meet the DOE requirements for PEM fuel cell.

LiteCell Technology achieved over 5000 hrs of corrosion protection using "off the shelf" metal. There was no increase in cell internal resistance and no degradation in output power, which indicates that there was **no plate deterioration due to corrosion**.

Cost Study:

TreadStone prepared a manufacturing cost comparison study on a 10-cell stack ($\approx 50W$) having a 2 cm X 2 cm active area using graphite plates versus the same stack built using the company's innovative LiteCell metal plates. All components were normalized with the variable being the metal versus graphite plates.

Based on the results of the study, we met and exceeded the cost targets established by the US DOE (\$6/kW) while having 52% less volume and 40% less weight.

About TreadStone Technologies

TreadStone Technologies, located in Princeton, New Jersey, was founded in March 2006 as a spin off from the world renowned Sarnoff Corporation, "the birthplace" of technologies that have changed the world. TreadStone quickly emerged as a leading innovator of pivotal technologies for the hydrogen economy. The company's patented LiteCell and HydroOSP technologies optimize the development, performance and output of fuel cell systems and hydrogen processing. TreadStone innovations speed the market adoption and application of more efficient fuel cell power systems and faster, lower-cost, efficient processing of hydrogen. TreadStone Technologies is a participating company with the Applied Communication and Information Networking (ACIN) Camden Center for Entrepreneurship and Technology.

Dr. Conghua Wang - The Principal Investigator for this work is Dr. Conghua Wang, Vice President, Chief Technology Officer and co-founder of TreadStone Technologies. Dr. Wang has over 15 years of experience in alternative energy systems including PEM and SOFC fuel cells, battery sciences and material science technology. Dr. Wang received his PhD in Physical Chemistry from the University of Science and Technology, Beijing, China and was a Research Associate at the University of Pennsylvania. Dr. Wang has authored numerous scientific papers and holds several US and international patents. Prior to forming TreadStone, Dr. Wang was a Senior Research Associate at the Sarnoff Corporation.



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