Title: **Fuel Cells Revisited: Lost in Space or finally down to earth?**

Author: Dominic F. Gervasio, Ph. D., Associate Professor
Department of Chemical and Environmental Engineering
The University of Arizona
1133 E. James E. Rogers Way
Tucson, AZ 85721-0011

Office: Room 146A Harshbarger Building (11)
Office phone: (520) 621-4870 FAX: (520) 621-6048
Cell phone: (267) 230-5563
Email: gervasio@email.arizona.edu

Abstract

Since the 1960s, fuel cells have been reliably providing electrical power in space craft orbiting the earth and on the moon. When OPEC (the organization of petroleum exporting countries) disrupted global oil markets in 1973, fuel cells were touted as *the* way to provide clean efficient automotive power to extend the life of petroleum reserves by roughly a factor of 4, that is, roughly the ratio of fuel cell efficiency to internal combustion engine efficiency. However, the fuel cells used in spacecraft are not suitable for use on earth, because their designs permit the use of pure oxygen and hydrogen available from rocket fuel as well as the use of high loadings of expensive precious metal catalysts. So now, over 46 years after the OPEC disruption, automobile engines are still burning gasoline, and urban air pollution remains a big problem -perhaps pollution may be a bigger problem than oil supply. Yet a practical terrestrial fuel cell power source still has not materialized, and, at the same time, it has also become clear that a battery as the sole power-source is not the answer for automobile power. So, where do we stand?

A new phase of fuel cell research is on the horizon. With new smarter materials, process-design and product-design, we can finally have practical terrestrial fuel cells for clean and efficient power in automobiles, and other applications, like: emergency power, remote residential power, communication relay power, load levelers, etc. An overview of required fuel cell developments will be presented telling the evolution of prior fuel cell technology, and how fuel cells can finally be brought down to earth, which is mainly by developing membranes which conduct only protons at temperatures well above 100^{o}C, because such a membrane allows the use of air oxidant, requires no hydration and offers compact waste-heat rejection. These feature lead to practical designs for earth-bound fuel-cell power-sources.

Bio

Dr. Don Gervasio is an associate professor of Chemical Engineering in the Department of Chemical and Environmental Engineering at the University of Arizona in Tucson, Arizona USA. Don has been engaged in fuel cell research for over 35 years, mainly concentrating on new electrolyte membranes, that conduct only protons, because these can give new designs for making practical fuel cell power sources. Other research interests are physical electrochemistry, fuel processing reactors, corrosion, sensors, material processing and electrochemical reactors using molten-salts.