QUANTUM SPHERE™
Energetics and Power for Advanced Applications

QSI-Nano™ Science Chat

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Why Fuel Cells?

Unlike the internal combustion engine (ICE) that we have in our cars, fuel cells have the potential to be far more efficient. An ICE converts the chemical energy in petrol to physical energy, which moves the engine pistons. Unfortunately, this also produces a great deal of heat and friction which contribute to a loss in efficiency. The theoretical efficiency of an ICE is roughly 30%. In addition, the byproducts of petrol combustion are the pollutants carbon dioxide, carbon monoxide, sulfur oxides, and nitrogen oxides, which many believe has made a significant contribution to global warming.

On the other hand, the hydrogen fuel cell converts the chemical energy in hydrogen directly into electrical energy. By eliminating the physical movement of parts, the theoretical efficiency of these fuel cells is upwards of 90% depending on operating conditions. Another advantage of the hydrogen fuel cell is that it only has one byproduct: WATER. Imagine steam coming out of your tailpipe, instead of black toxic smoke!

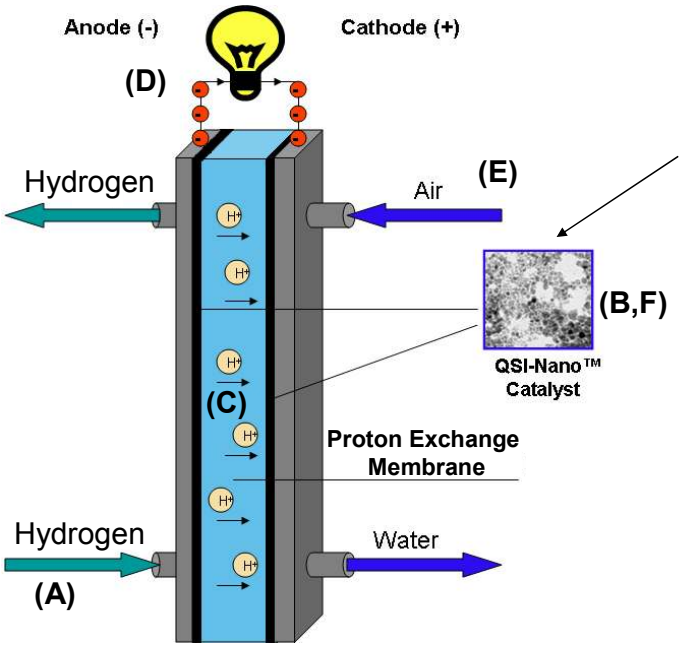
The hydrogen fuel cell is also known as a proton exchange membrane (PEM) fuel cell. Inside the cell, there is a membrane which acts to move hydrogen ions. On each side of the membrane is catalyst, which is responsible for converting the fuel into energy. At the negative terminal of the fuel cell, hydrogen gas (H_2) reacts on a catalyst surface to produce electrons and protons. As these electrons flow through the circuit, electricity is produced. The electrons move through an external circuit and the protons move through the membrane. At the positive terminal, the protons and electrons, and oxygen gas (O_2) from air react on the other catalyst surface, producing water.

So if fuel cells are so clean and efficient, why aren't they supplying all of our power to reduce or dependency on oil?

In reality, fuel cell technology is still too expensive to replace our conventional energy sources. Research is being conducted around the globe to design more efficient fuel cells and reduce the cost of components.

One of the largest issues of commercializing the hydrogen fuel cell is the cost of platinum catalyst inside the PEM. This cost can be alleviated to using non-precious metals, such as cobalt, nickel, and iron. QSI-Nano™ metals and alloys are 80% cheaper than platinum catalyst, and, by virtue of their tiny size and increased surface area and catalytic activity, can potentially increase the amount of power produced by a hydrogen fuel cell.

Here's how the process works:



QSI-NANO™-catalyst powder

How a Hydrogen Fuel Cell Works

A) Hydrogen is fed into the anode side of the fuel cell
B) Hydrogen reacts on the anode catalyst surface
C) Protons move through the PEM
D) Electrons move through the external circuit, producing energy
E) Air is fed into the cathode side of the fuel cell
F) Air reacts on the cathode catalyst surface, recombines with protons and electrons.