A little background about Fuel Cells

Fuel cells have the potential to revolutionise the energy market by bringing high efficiency, low carbon solutions for transport, residential, portable and premium power applications. The pace of installation is accelerating rapidly as the technology nears commercialisation and countries commit to being Carbon Neutral as recently announced by the UK and Norway

Although hydrogen is still in its infancy as a fuel source, its future is incredibly bright. It is in plentiful supply and often a waste/ by-product so quite cheap. The technology behind hydrogen fuel cells is improving daily and its viability as a replacement to the internal combustion engine seems likely. Hydrogen is already being used in specialty vehicles such as forklifts and buses, and it's only a matter of time before infrastructure is in place to serve the consumer automotive and stationary generator markets.

Why do hydrogen fuel cells have such great appeal? Because their only by-products are heat and water vapour, making hydrogen fuel cells a truly zero-emission technology improving Urban air quality and improving health to the wider population, adding to the global low carbon economy and sustainable growth for the global economy.

They can create energy from a few Watts to MW, being highly efficient, quiet low maintenance and with Zero emissions

About fuel cells

A fuel cell is a device that directly converts the chemical energy of a fuel into electrical energy in a constant temperature process. In some ways analogous to a battery, it possesses the advantage of being constantly recharged with fresh reactant. Unlike batteries, fuel cell reactants are stored outside the cell. They are fed to the cell only when power generation is required. Therefore, a fuel cell does not consume materials that form an integral part of, or are stored within, its own structure.

There are a number of different types of fuel cells, with the various technologies being suited to different applications. The best-known types are:

AFC - alkaline fuel cell
PEMFC * - proton exchange membrane fuel cell
DMFC * - direct methanol fuel cell
MCFC * - molten carbonate fuel cell
PAFC - phosphoric acid fuel cell
SOFC * - solid oxide fuel cell

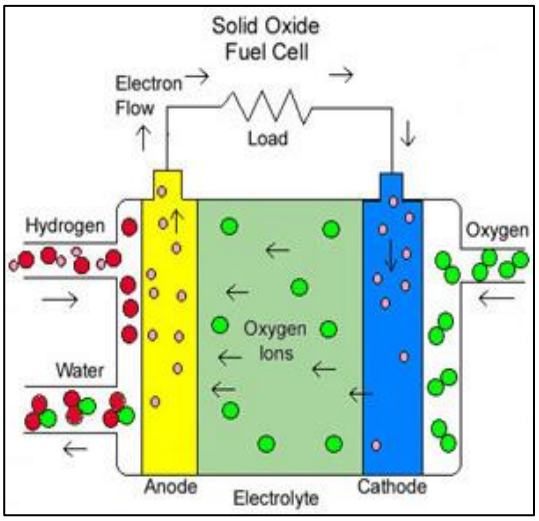
* VINATech activities

VINATech produces Activated Carbon MEAs (Membrane Electrode Assembies) for PEMFC and DMFC fuel cell stacks and developing for MCFC and SOFC.

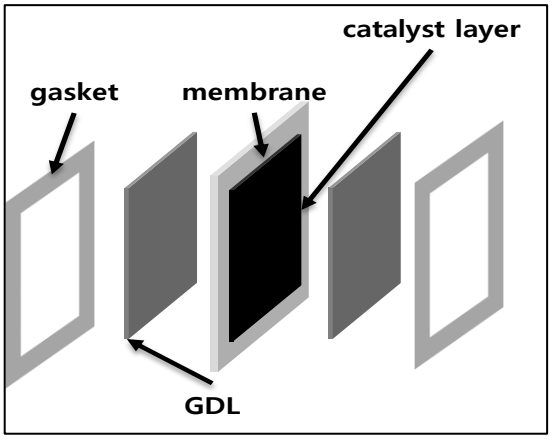
VINATech is the only producer in the world of catalyst support and catalysts for fuel cells and MEA. All of these products are based on the company's patented CNF materials technology. Competitors are Gore and Johnson Matthey - we can be more flexible.

How does a fuel cell work?

A fuel cell is a device that generates electrical power through a chemical reaction by converting a fuel (hydrogen) into electricity. Although fuel cells and batteries are both considered electrochemical cells and consist of similar structure, fuel cells require a continuous source of fuel and oxygen to run; similar to how an internal combustion engine needs a continuous flow of gasoline or diesel.



A fuel cell needs three main components to create the chemical reaction: an anode**,** cathode and an electrolyte. First, a hydrogen fuel is channeled to the anode via flow fields. Hydrogen atoms become ionized (stripped of electrons), and now carry only a positive charge. Then, oxygen enters the fuel cell at the cathode at a force, where it combines with electrons returning from the electrical circuit and the ionized hydrogen atoms. Next, after the oxygen atom picks up the electrons, it then travels through the electrolyte to combine with the hydrogen ion. The combination of oxygen and ionized hydrogen serve as the basis for the chemical reaction.



A polymer electrolyte membrane (PEM) permits the appropriate ions to pass between the anode and the cathode. If the electrolyte gave free control for all electrons or ions to pass freely, it would disrupt the chemical reaction. At the end of the process the positively charged hydrogen atoms react with the oxygen to form both water and heat while creating an electrical charge.

Within the fuel market there are many different applications with different power requirements. In order to provide adequate power, individual fuel cells can be assembled together forming a stack. A fuel cell stack (Made from MEAs made by VINATech amongst others), can be sized for just the right amount of energy for the application. Stacks can be various sizes and can reach up to 96 stacks placed side by side.

Fuel Cells are used in both stationary and motive power applications for:

- Cars, taxis, trucks, buses, Drones, and recreational vehicles
- Material handling equipment
- Act as a primary power source (Generators) for high-volume data centers or commercial, Building management (industrial, and residential buildings)
- Backup power source to critical computer and communications networks
- Generating power on-site

Thanks to Setra.com and fuelcell.com for most of the explanation