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Challenges in the Fuel Cell Vehicle

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During the last few decades, the application of fossil fuels has brought prosperity to human society and a boom in economic development. However, the vast exploitation of fossil fuels has worsened the problem of the greenhouse effect, while causing a shortage in conventional energy. This has led the development of new energy, such as solar energy, nuclear energy, fuel cells, wind-power, hydropower, tidal energy, geothermal energy, biomass energy and so forth. Since the CO_2 produced by the conventional vehicles is the main cause of the greenhouse effect, green cars that have less influence on the environment have drawn much attention from the research world and the auto manufacturing industry.

Fuel Cell Vehicle (FCV) is a kind of new energy vehicle utilizing fuel cell as its principal power system. Hydrogen serves as the carrier, and the hydrogen gas is produced to replace traditional energy source through oxy-hydrogen reaction, which is conducted within the fuel cell as a new energy system. Since the electrode reaction of the fuel cell produces water only, fuel cell electric vehicle is viewed as the most ideal supplement to ICEV (Internal Combustion Engine Vehicle) in the 21st Century, characterized by its zero pollution, high efficiency, low noise, module structure and so forth.

Due to the technology breakthrough of the proton exchange membrane in the 1980s, more and more researchers and auto manufacturing industries have joined in the research and development of the fuel cell vehicles. Many auto manufacturing industries have already developed their own fuel cell vehicles, such as FCX-Clarity (Honda), B-Classic F-cell (Daimler), FCHV-adv (Toyota), Explorer (Ford) and so on. One of the challenges of a fuel cell vehicle is its lifetime, which has great influence on the commercialization of the fuel cell vehicle. Other challenges are the high price and the corresponding hydrogen infrastructures.

Through the improvement of the fuel cell stack and the optimization of power system control strategy, the lifetime of a fuel cell vehicle has improved a lot, while in contrast with the traditional vehicle, we still have space to improve. The current FCV durability target for 2015 (US) is 5,000 hours, or 150,000 miles [1]. In addition, due to the catalyst precious metal Pt being used in the fuel cell stack and the price of the proton exchange membrane is so high, researchers proposed several methods by reducing the quantity to 0.05 mg/cm^2 of Pt and improving the utilization rate of the catalyst to reduce the cost. Utilization of the non-precious metal catalyst, which is still in the development, is another important way to reduce the cost greatly. With the rising production of the fuel cell vehicle, general public will afford to buy it soon. Another challenge that restricts the development of the fuel cell vehicle is the hydrogen infrastructures. Nowadays, many countries have raised a broad range of government incentives to promote the new energy vehicle, including the hydrogen infrastructures. Recently, Japan's Ministry of Economy, Trade and Industry (METI) demand a budget of 30 billion yen (approximately $400 million USD) for the 2013 fiscal year budget. METI intends to construct about 100 hydrogen refueling stations and the budget appropriation would also be used to fund development of a cheap hydrogen supply system [2].

In sum, it is a critical moment for the development of the fuel cell vehicle, especially its commercialization. Within the next decade, the research community and the manufacturers will perfect the fuel cell vehicle and bring down the price so that general public can afford it. The Journal of Advances in Automobile Engineering published by OMICS Group has made it flexible to discuss broader topics regarding various issues in this field. Hopefully, more and more researchers from various disciplines would pay attention to the fuel cell vehicle which would be the future vehicle.

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