ALKALINE FUEL CELLS

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Summary

Alkaline fuel cells use potassium hydroxide as the electrolyte. This type of fuel cell is the first generation fuel cell system that was employed as power sources in space vehicles. However, because the presence of carbon dioxide degrades the cell performance, the stationary application using hydrocarbon fuels is limited.

1. Introduction

Alkaline fuel cells, or AFCs, use as the electrolyte, potassium hydroxide (KOH) or some other alkaline aqueous solution, and usually operate at temperatures below 100 °C, and its operating principle can be shown in Figure 1. Electrode reactions take place upon supplying hydrogen to the fuel electrode and oxygen to the air electrode, and thus an electric current can be obtained. The fuel used is pure hydrogen, and the oxidizing agent is either pure oxygen, or air. Since the presence of carbon dioxide results in deterioration of the aqueous electrolyte, reactant gases should not have carbon dioxide as a component.

Depending on the application, the electrolyte concentration, operating temperature and pressure of AFCs all vary. In the early stages of research, an aqueous solution of sodium hydroxide was sometimes used as the electrolyte, but at present an aqueous solution of potassium hydroxide is employed.

The higher the electrolyte concentration, the more the activity of the water is reduced, and the more easily the reaction proceeds, so that the electrolyte characteristics are improved. However, the water vapor pressure is also lowered, and it becomes difficult to evaporate and remove the water produced in the reaction; hence the actual

concentration used is determined according to the operating conditions and cell characteristics.

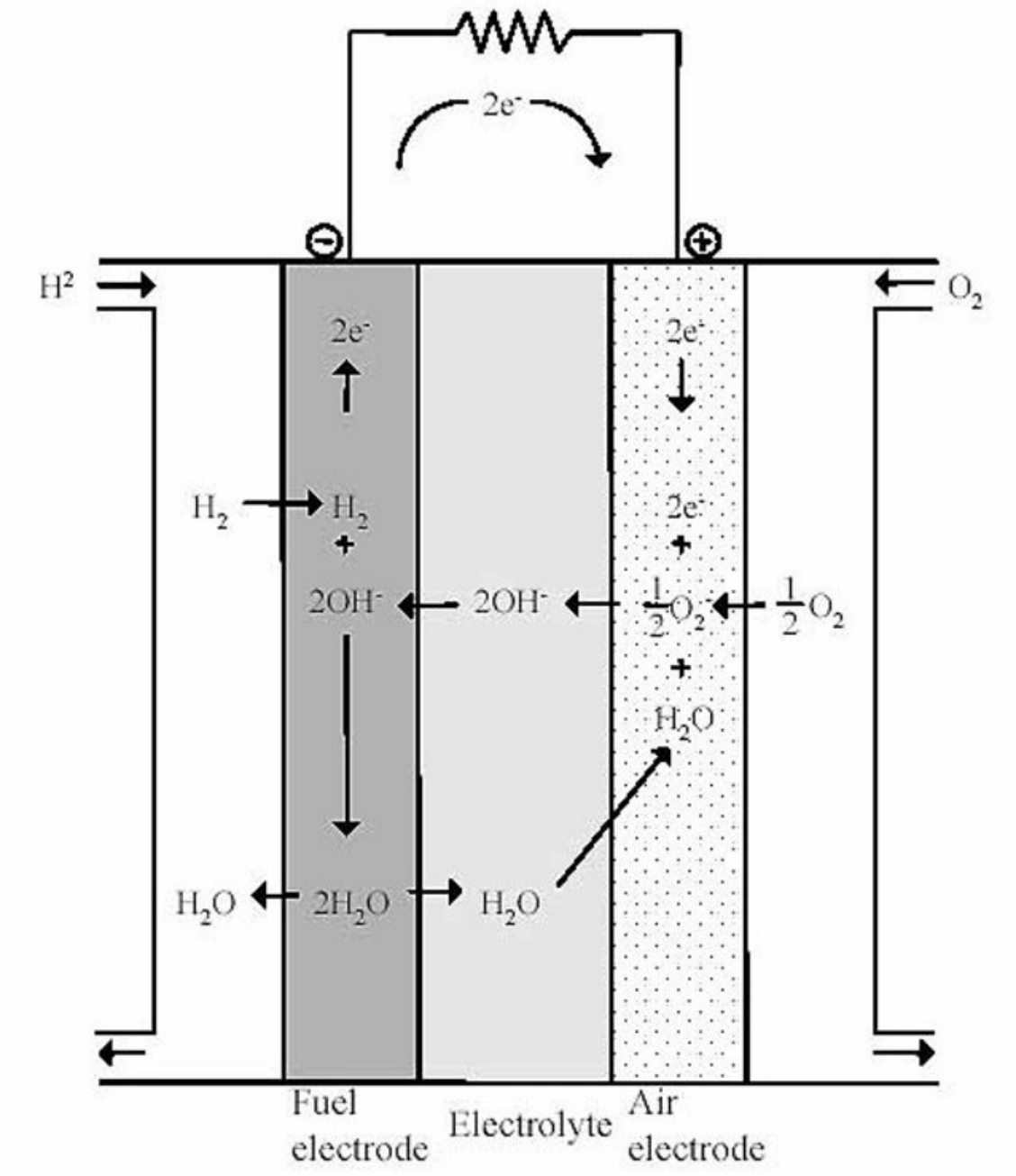

Figure 1. Principle of Operation of Alkaline Fuel Cells

2. Background

Research on AFCs began in the 1920s. Because of their excellent reaction characteristics at low temperatures, much development took place in the 1950s and 1960s, and alkaline fuel cells using pure hydrogen and oxygen were initially employed as power sources with high energy densities in American space vehicles. As general-use power supplies, however, because their characteristics are degraded by the presence of

carbon dioxide, they are not suitable for use with modification in systems employing crude hydrogen obtained by reforming fossil fuels, and an economical method needs to be found for removing carbon dioxide.

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Biographical Sketch

Hiroko Sotouchi was born on 26 February 1965, in Japan, and received a bachelor's degree in the Department of Applied Chemistry, Keio University.