



Recent Advance in Direct Ethanol Fuel Cell for Sustainable Energy Production

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INTRODUCTION

Direct Ethanol Fuel Cells (DEFC), which promise to be a clean and efficient energy production technology, have recently attracted worldwide attention, primarily because ethanol is a carbon-neutral, sustainable fuel and possesses many unique physicochemical properties including high energy density and ease of transportation, storage as well as handling. However, conventional DEFCs, which use acid proton exchange membranes and precious metal catalysts, result in rather low performance. In our research, we use alkaline anion exchange membranes as the solid electrolyte in DEFCs. It is demonstrated that the change from the acid membrane to an alkaline one leads to a significant performance boost. Recent developments into technology of Proton exchange Membrane Fuel Cells (PEMFC) now allow serious consideration to be given to a Direct Alcohol Fuel Cell (DAFC) based on a PEMFC, in which alcohol is used directly as the fuel. This is particularly advantageous for mobile applications, since this will avoid the use of a bulky and expensive reformer. However, the relatively complex reaction mechanism, leading to a low electroactivity of most alcohols, even methanol, needs the investigation of new platinum-based electrocatalysts, particularly active for breaking the C-C bond when alcohols other than methanol are to be used. Moreover, in order to overcome the deleterious effect of alcohol crossover through the proton exchange membrane, it is necessary to develop new oxygen reduction electrocatalysts insensitive to the presence of alcohols. An overview of recent advancement in fuel cell technology and its applications was presented.

Different type of fuel cells namely Solid Polymer Fuel Cell (SPFC), Direct Methanol Fuel Cell (DMFC), Phosphoric Acid Fuel Cell (PAFC), solid oxide fuel cell (SOFC) and Molten Carbonate Fuel Cell (MCFC) were also described. The choice of fuel and fuel infrastructure for the fuel cell powered buses and light duty vehicles were also discussed. Fuel cell functions to efficiently convert oxidant and chemical energy accumulated in the fuel directly into DC electric, with the by-products of heat and water. Fuel cells, which are known as effective electrochemical converters, and electricity generation technology has gained attention due to the need for clean energy, the limitation of fossil fuel resources and the capability of a fuel cell to generate electricity without involving any moving mechanical part. It was predicted that using the fuel cells zero emission vehicles could be developed in near future. Biomass is one of the most abundant renewable energy resources on the earth, which is also considered as one of the most promising alternatives to traditional fuel energy. In recent years, Microbial Fuel Cell (MFC) which can directly convert the chemical energy from organic compounds into electric energy has been developed. By using MFC, biomass energy could be directly harvested with the form of electricity, the most convenient, widespread, and clean energy. It was predicted that using the fuel cells zero emission vehicles could be developed in near future. Biomass is one of the most abundant renewable energy resources on the earth, which is also considered as one of the most promising alternatives to traditional fuel energy. In recent years, Microbial Fuel Cell (MFC) which can directly convert the chemical energy from organic compounds into electric energy has been developed.

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