Symp A6

Effect of Operating Conditions on the Performance of Li/Na MCFC

Ramkumar Perumal · 류보현 · 한종희 · 윤성필 · 남석우 · 임태훈 · 홍성안
한국과학기술연구원 연료전지연구센터

Commercial application of the molten carbonate fuel cell (MCFC) technology for power generation in the range several hundred kW to several MW equires, among other factors, enhancement of operating time.Among various factors limiting the life-time of MCFC cells are the dissolution of NiO from the cathode into the electrolyte and gradual loss of electrolyte due to evaporation. In order to address these problems, one of the approaches adopted has been to employ alternative electrolyte materials. The use of a lithium carbonate-sodium carbonate (Li/Na) eutectic has been receiving increasing attention, although large scale stack tests to date have generally involved the use of the more common lithium carbonate-potassium carbonate (Li/K) eutectic as the electrolyte.

In this paper, we present some of our results of operation of MCFC single cells using the Li/Na electrolyte. The cells used had an electrode area of 100 cm2, and were operated at both atmospheric pressure and slightly elevated pressure (3-bar). Initial results indicate that Li/Na eutectic could be used as an alternative electrolyte in MCFC. Analyzing the performance of Li/Na single cells at different operating conditions such as various gas compositions, fuel and oxidant utilization levels, temperatures and pressures would help in optimizing the design as well as operating conditions for larger area cells and stacks.

Some of the variables used for this purpose are anode and cathode gas composition, humidification levels of anode and cathode gases, utilization of fuel and oxidant and operating temperature. In addition, the flow of gases in the anode and cathode chambers was also varied by employing co-flow and counter-flow configurations. Monitoring of cell performance involved the measurement of current-voltage (I-V) curves, composition of anode outlet gas, the internal resistance of the cell, measured using a milliohm meter and EIS spectra. Additionally, post-test analysis of the cell components was also carried out to detect changes in porosity of the electrodes, electrode microstructure and composition of the electrolyte that occurred during operation.