Study on Solid Oxide Fuel Cell with Porous Scaffold Electrode Manufactured By Tape Casting Process

Tuesday, 31 May 2016
Exhibit Hall H (San Diego Convention Center)

J. Bae and Y. H. Jang (Korea Advanced Institute of Science and Technology)

Solid oxide fuel cell (SOFC) is energy conversion device which can converts chemical energy of hydrogen and oxygen to electrical energy. Conventional SOFC is fabricated by preparing anode support and coating electrolyte and cathode by spin coating or screen printing. One alternative way to fabricating SOFC is making porous scaffold on electrolyte support by same material with electrolyte and infiltrating electrode catalyst in porous scaffold. By this procedure, nano-sized catalyst network can be distributed in electrode and microstructure of electrode become easy to control and gas diffusion in electrode can be enhanced. However, conventional scaffold type SOFC has high ohmic resistance because of thick electrolyte support. To enhancing the performance of scaffold type SOFC, electrolyte thickness should be reduced. Moreover, there is problem that connectivity of electrolyte support and porous backbones is increased but porosity of scaffold is decreased as sintering temperature is increased. For solving these problems, tape casting process was applied to fabricate SOFC. By laminating tapes of each layers and co-sintering process, both connectivity and porosity can be obtained in high temperature sintering process.

In this study, performance of scaffold electrode was compared with thick film electrode and SOFC single cell with porous scaffold electrode was fabricated by tape casting process. First, performance of scaffold electrode was compared with thick film electrode by electrochemical impedance spectroscopy analysis. $La_{0.4}Sr_{0.6}Ti_{0.4}Mn_{0.6}O_{3-\delta}$ was infiltrated to porous scaffold as electrode catalyst and symmetric cells of scaffold electrode and thick film electrode were prepared. Area specific resistance (ASR) of scaffold electrode was 0.6 $\Omega \cdot cm^2$ and ASR of thick film electrode was 3.4 $\Omega \cdot cm^2$ at 800℃. SOFC single cell with porous scaffold electrode was fabricated by tape casting process. 8 mol % Yttria-stabilized Zirnocia (8YSZ) was used as electrolyte material. Electrolyte slurry and porous scaffold slurry with pore former were prepared and sequentially casted to make thin electrolyte and anode support. Cathode backbone tape was laminated on the sample by hot pressing. By sintering at 1400℃, thin electrolyte and porous scaffold were fabricated. $La_{0.4}Sr_{0.6}Ti_{0.4}Mn_{0.6}O_{3-\delta}$ and $La_{0.8}Sr_{0.2}MnO_3$ were infiltrated as anode catalyst and cathode catalyst, respectively. Open circuit voltage of the sample was 1.09V at 800℃, indicating that thin and dense electrolyte was formed. And the effects of porous scaffold were also investigated with respect to different porosity and different catalyst loading amount.

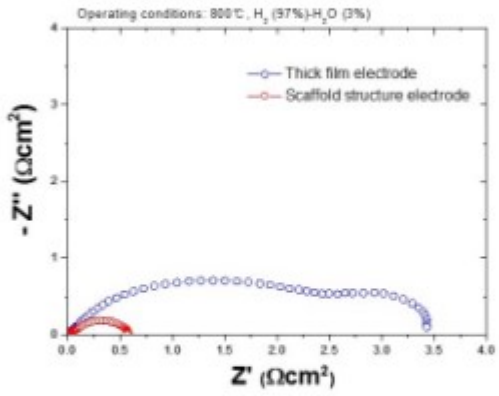

Fig. 1. Impedance results of scaffold electrode and thick film electrode

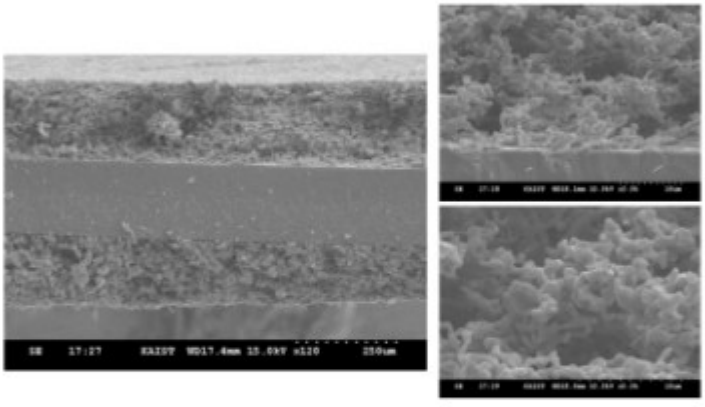

Fig. 2. SEM images of laminated cell after heat treatment

See more of: I04 Poster Session
See more of: I04: Mechano-Electro-Chemical Coupling in Energy Related Materials and Devices 2
See more of: Fuel Cells, Electrolyzers, and Energy Conversion

<< Previous Abstract | *Next Abstract*