

복합 박막 증착 공정을 이용한 중저온 고체산화물 연료전지용 전해질 증착

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Deposition of Electrolyte for Intermediate Temperature Solid Oxide Fuel Cells by Combined Thin Film Deposition Techniques

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Typical solid oxide fuel cells (SOFCs) have limited applications because they operate at high temperature due to low ionic conductivity of electrolyte. Thin film solid oxide fuel cell with yttria stabilized zirconia (YSZ) electrolyte is developed to decrease operating temperature. Pt/YSZ/Pt thin film SOFC was fabricated on anodic aluminum oxide (AAO). The crystalline structure of YSZ electrolyte by sputter is heavily depends on the roughness of porous Pt layer, which results in pinholes. To deposit YSZ electrolyte without pinholes and electrical shortage, it is necessary to deposit smoother and denser layer between Pt anode layer and YSZ layer by sputter. Atomic Layer Deposition (ALD) technique is used to deposit pre-YSZ layer, and it improved electrolyte quality. 300nm thick Bi-layered YSZ electrolyte was successfully deposited without electrical shortage.

Key words : Thin film(박막), Electrolyte(전해질), Intermediate Temperature(중저온), SOFCs(고체산화물 연료전지), Atomic Layer Deposition(원자막 증착), Sputter(스퍼터)

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원자층 증착법과 스퍼터링을 이용한 고체산화물 연료전지용 YSZ 전해질에 관한 연구

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Comparison of Yttria Stabilized Zirconia Electrolytes(YSZ) for Thin Film Solid Oxide Fuel Cell by Atomic Layer Deposition and Sputtering

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In this research, two thin film deposition techniques, Atomic Layer Deposition and Sputtering are carried out for the fabrication of Yttria Stabilized Zirconia electrolyte for thin film Solid Oxide Fuel Cell. Zirconium to Yttrium ratio for both cases is about 1/8. Scanning Electron Microscope(SEM) image shows that the growth rate per hour for Atomic Layer Deposition is faster than for sputtering. X-ray Photo-electron Spectroscopy(XPS) shows that the peaks of both Zirconia and Yttria shift towards higher bending energy for the case of Atomic Layer deposition and thus are more strongly attached to the substrate. Later, Nyquist plot was used to compare the conductivity of Yttria Stabilized Electrolyte for both cases. The conductivity at 300°C for Atomic Layer Deposited Yttria Stabilized Zirconia is found to be 5×10^{-4} S/cm while that for sputtered Yttria Stabilized Zirconia is 2×10^{-5} S/cm at the same temperature. The reason for better performance for Atomic Layered YSZ is believed to be the Nano-structured layer fabrication that aids in along the plane conduction as compared to the columnarly structured Sputtered YSZ.

Key words : Atomic Layer Deposition, Yttria Stabilized Zirconia(YSZ), thin film Solid Oxide Fuel Cell, Scanning Electron Microscope(SEM), X-Ray Photo-electron Spectroscopy(XPS).

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