Characteristics of thin film Yttria-stabilized Zirconia electrolyte by atomic layer deposition for thin film solid oxide fuel cells

Gu Young Cho, Jun Yeol Paek, Joonho Park, Taehyun Park, Yoon Ho Lee, and Suk Won Cha

School of Mechanical and Aerospace Engineering,
Seoul National University,
599 Gwanak-ro, Gwanak-gu, Seoul
151-744, Republic of Korea

Solid oxide fuel cells (SOFCs) were regarded as the promising solution of the energy generation. SOFCs had high efficiency, fuel flexibility, no CO poisoning, and no requirement of high cost noble catalyst due to its high operation temperature (800°C~1000°C). However, this high operation temperature also caused many problems. Thermal degradation, long-term stability problems, slow start-up and expensive thermal resistant materials for components were typical drawbacks of SOFCs due to high operation temperature. [1]

There were many researches to lower the operation temperature of SOFCs to overcome aforementioned problems. [2-5] Among many investigations, thin film SOFCs (TF-SOFCs) composed of thin film electrolyte and electrodes showed most noticeable results to lower the operation temperature and maximize the performance by reducing the thickness of oxide electrolyte. [2-3]

TF-SOFCs were prepared by vacuum thin film technique i.e. sputter, pulsed laser deposition (PLD), chemical vapor deposition (CVD), and atomic layer deposition (ALD). Among above techniques, ALD was advanced thin film technique. ALD showed excellent step coverage, film uniformity, and thickness control by using its self-limited reaction. Thin film yttria-stabilized zirconia (YSZ) electrolyte which was the most typical materials for electrolyte of SOFCs was fabricated by ALD and applied to the TF-SOFCs successfully. [2,3]

In this research, characteristics of ALD-prepared thin film YSZ electrolyte and TF-SOFCs which had ALD-prepared thin film YSZ electrolyte were analyzed and investigated. Chemical and physical characteristics of thin film YSZ which was fabricated by ALD with different deposition condition were investigated by using various methods i.e. XPS, FESEM, and AFM. Commercial nano-porous anodic alumina oxide template (Synkera Co.,) was used as the substrate of TF-SOFCs. Platinum (Pt) was prepared for both anode and cathode catalyst by sputter to minimize the activation voltage loss. Performance, open circuit voltage, electrochemical impedance spectroscopy and other characteristics were measured and studied.

Acknowledgement

This research was supported by National Research Foundation of Korea (Grant No. 2010-0019241) contracted through the Institute of Advanced Machinery and Design at Seoul National University. Brain Korea 21 program should also be acknowledged for their partial support

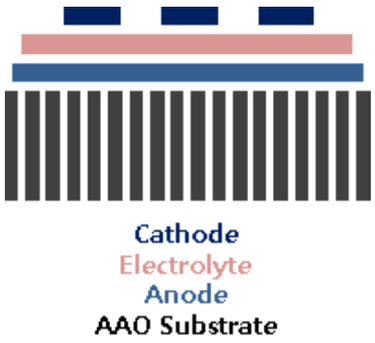

Figure 1. Schematics of nano-porous AAO supported TF-SOFCs.

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