Development of metal-supported solid oxide fuel cell (MS-SOFC) and thin-film solid oxide fuel cell in KAIST

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Solid oxide fuel cell (SOFC) is an energy conversion device which can generate electricity from hydrogen energy. SOFC is composed of ceramic materials such as Yttria-stabilized Zirconia (YSZ), Gd-doped CeO_2 (GDC), and $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_3$ (LSCF). However, for this reason, SOFC is brittle and has low mechanical strength. To overcome this limitation, metal-supported SOFC (MS-SOFC) has been developed recently. MS-SOFC is composed of metal substrate for higher mechanical strength. In my research group, sinter-joining method for the fabrication of MS-SOFC was developed and 15 X 15 cm^2 unit cells were successfully fabricated. Based on sinter-joining method, 3-layer short stack was also developed and tested for more than 130 hrs. Currently, auxiliary power unit (APU) system based on MS-SOFC is being developed. In addition, interconnect-coating based MS-SOFC fabrication method was recently developed in my group. This novel MS-SOFC is fabricated by only heat-treated under air atmosphere and conventional wet-chemical coating processes. It is believed that this new fabrication method can reduce manufacturing cost considerably.

SOFC is usually operated at high temperature of 600-800 °C. However, operating at high temperature can cause high degradation of electrochemical performance, oxidation of interconnects, and high cost by oxidation-resistant materials. Therefore, low-temperature SOFC is attracting attentions. To operate SOFC at low temperature, thin electrolyte layer is required because of low ionic conductivity of electrolyte materials at low temperature. For this reason, thin-film coating method of sputtering is successfully applied for anode-supported SOFC with thin-film electrolyte layer in my group.

To facilitate commercialization of SOFC using the advantage of fuel flexibility, development of fuel processing technology and its commercialization efforts will be also briefly introduced.

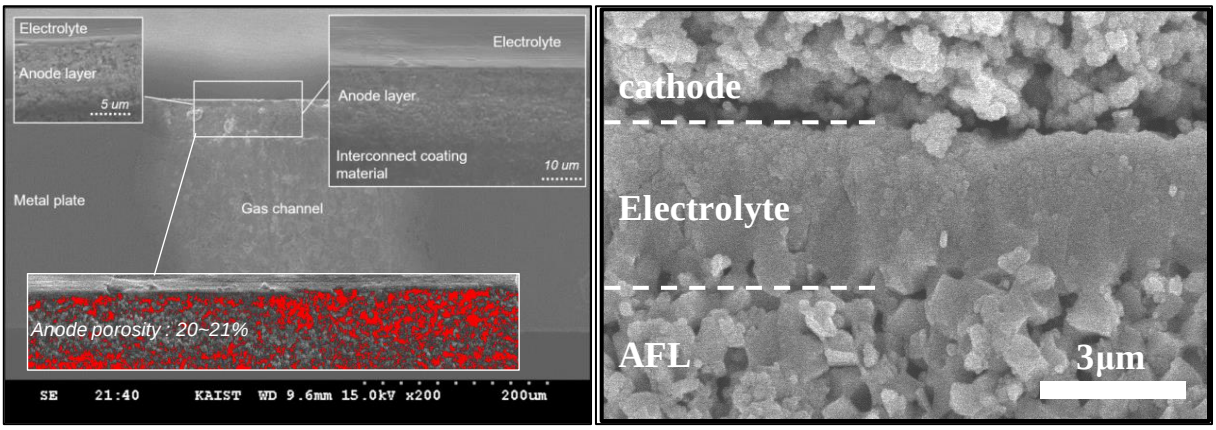

Fig. Cross-section images of MS-SOFC fabricated by interconnect-coating method and thin-film anode-supported SOFC fabricated by sputtering