Surface modification of SYT anode for direct utilization of hydrocarbon fuel in solid oxide fuel cells

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Solid oxide fuel cells(SOFCs) can operate with direct hydrocarbon fuel without the need of external reforming process. However, conventional Ni-based anodes show unstable properties for utilization hydrocarbon fuel due to the carbon formation and poisoning by impurity (ex, H_2S, NOx, SOx, etc.)

In recent years, the conducting ceramic has studied much attention as alternative anode for solid oxide fuel cells(SOFCs). The ceramics usually are stable chemically, similar thermo-expansion coefficient and shrinkage properties for electrolyte. Among several ceramic materials, we have investigated the yttria-doped strontium titanium oxide ($Sr_{0.92}Y_{0.08}TiO_{3-\delta}$; SYT) in SOFC anode. SYT show high sulfur/carbon resistance, good electronic/ionic conductivity and phase stability in typical SOFC anode operating conditions. However, SYT has exhibited the poor electro-catalytic activity toward fuel (i.e. H_2 or hydrocarbon) oxidation. Thus, it is very essential to enhancement the surface activity of SYT anode for electrochemical reaction with hydrocarbon fuel.

In this study, we will discuss about the modification effects by the rare-earth-doped ceria on SYT anode backbone. The polarization resistance clearly reduced and the electrochemical reaction was accelerated by surface modification. In addition, we will present some recent theoretical (Density Functional Theory; DFT) and experimental results about material modification by substitute on Ti site of SYT. We have on the role of oxygen vacancy formation energy at surface in determining the reactivity.

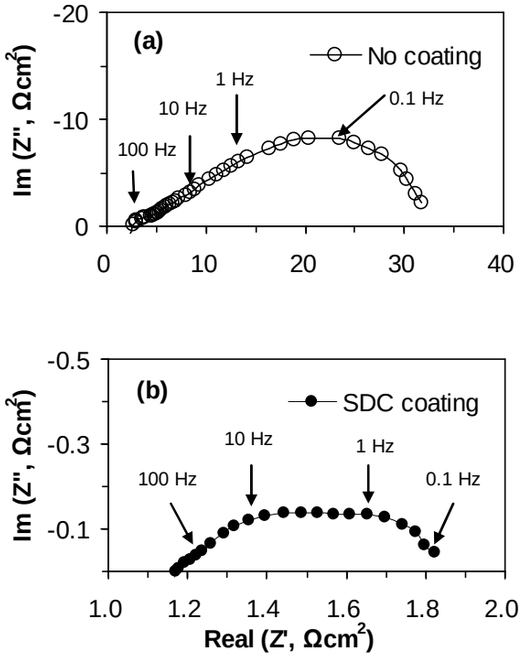

Figure 1. Impedance spectra scope of (a) SYT anode and (b) SDC-coated SYT anode under OCV condition at 900 ^oC

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