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氏名／専攻・学年 Name / Department	Hong, Hyun-Jin / Graduate school of environmental studies
学会名 Conference's name	The 22th Symposium on Solid Oxide Fuel Cells
開催地 Venue (Name of the facility, city & country)	Tokyo, Japan
日程 Conference period	19^{th}-20^{th} December, 2013
発表タイトル Presentation Title	Defect Chemistry and Conductivity Characterization of Sc-doped $CaTiO_3$

【発表概要　Brief summary of your presentation】

$CaTiO_3$, calcium titanates has been considered as high ionic conductivity material among perovskite-type oxides. Additionally, low material cost is another attractive point of this system. However their clear n- and p-type electric conductivities were pointed out as a drawback.

In this research, Sc was selected as dopant into $CaTiO_3$ to improve ionic domain region. Their defect conduction properties were investigated temperature and oxygen partial pressure, $P(O_2)$ to confirm potential as an electrolyte. Ionic transference number was estimated based on the defect chemical analysis.

Since Iwahara et al. already reported potential of perovskite structure as electrolyte, Ishihara et al. reported possibility of $LaGaO_3$-based oxides exhibiting extremely high ionic conductivity by Sr and Mg doping but their high cost of starting material also limit application to commercial products.

$CaTiO_3$-based oxides could be a qualified material among the perovskite structure material due to their high ionic conductivity and inexpensive material. In previous research, Hashimoto et al. reported $CaTiO_3$-based oxides especially Sc doping showed comparable conductivity with YSZ at 800ºC but to make sure possibility of as electrolyte it is required not only conductivity but also ionic transference behavior based on defect chemistry.

In this research, material properties and electrical property were investigated systemically investigated depending on various temperatures (500ºC-1000ºC) as a function of $P(O_2)$. Moreover, fitting process was carried out to separate conductivity factor such as σ_{ion}, $\sigma_{eletron}$, σ_{hole} and their ionic transference behavior also calculated by Wagner-Schmalzried equation.

【他の講演等から得られた知見、感想等。What you learned from other presentations, general impression you had, etc.】

In this conference, I learned systematical knowledge especially ‘Defect Chemistry’ consisted of vacancy in ceramic matrix.

First of all, presentation that using reactive molecular dynamics simulation, Ni/YSZ interface for solid oxide fuel cell (SOFC) anode at operating temperature was useful for understand surface mechanism of Ni/YSZ. Their simulation demonstrated that NiO is formed in the Ni/YSZ interface. Moreover, experimentally it is difficult to predict how reactions take place in the Ni/YSZ interface. Combined potential model of them to understand interaction between Ni and YSZ and for designing stable Ni/YSZ interface for SOFCs.

Secondly, to investigate power generation in SOFC also attractive theme because their group successfully increased power density in metal-supported solid oxide fuel cell by inserting doped ceria dense film between LSGM electrolyte and Ni-Fe substrate. However, role of dense thin film was not clearly defined. Therefore, their group fabricated thin film with various thickness on LSGM electrolyte substrate and measure the power generation property of the cell with dense film anode, which is highly tolerance against sintering. Furthermore, thin film of anode was prepared in the metal supported cell. And the power density has been measured for confirming influence of film shape anode.

Lastly, I had chance to discuss about new electrolyte system that I am researching now. Among transition metals, addition of Co as sintering aid improved densification and electrical conductivity of LDC as buffer layer for LSGM electrolyte. It was expected that using Co-LDC as buffer layer could decrease the co-sintering temperature of the electrolyte films. So influence of decreasing the sintering temperature was investigated on electrochemical performance of anode supported solid oxide fuel cells applying LSGM electrolyte and Co-LDC buffer layers prepared by screen printing method. This implies that Co-LDC shows no detrimental effect after sintering and thus is a promising buffer layer for LSGM electrolyte film prepared by sintering at lower temperatures.

From their results, I could accept new approach for SOFCs system by several methods and processing step. Especially, buffer layer system for LSGM electrolyte research was attractive topic for me because my target of research was also same application.