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## G-4 15 min

**ICEM16-A-0491 Contributed**

**Glow Temperature Sintering of NASICON Solid Electrolyte with Na3BO3 Additive**

Koukou NO1, Kenji SUZUKI1, Akito YAYASHI1, Masahiro TATSUMISAGO1

1Osaka Prefecture University, Japan

**Corresponding author:** hayashi@chem.osakafu-u.ac.jp

**+Presenter**

Na2Zr2Si8O20 (NASICON) is a promising candidate as a solid electrolyte for all-solid-state sodium batteries with high safety and low cost because of its high Na+ ion conductivity, chemical stability, and lack of rare elements. The dense NASICON ceramics that show the high room temperature conductivities of about 10⁻² S cm⁻¹ are usually prepared by sintering at over 1200°C. However, the sintering at such high temperatures promotes the volatilization of sodium contents. Protection such as covering a green compact in its mother powder of NASICON during sintering. Moreover, undesirable side reactions with electrode materials at the high temperatures are concerned when batteries are fabricated through a co-sintering process in order to form close solid-solid interfaces. Hence it is necessary to decrease the sintering temperature of the NASICON ceramics.
In the present research, highly conducting NASICON solid electrolytes were prepared by the liquid phase sintering at lower temperatures. The low melting glass of Na3B2O5 (680°C of melting point) was used as a sintering additive. The NASICON based ceramics were prepared by sintering at 900°C without mother powder. The obtained ceramic with 5 wt% of Na3BO3 showed the ambient temperature conductivity of 1.0×10⁻³ S cm⁻¹, which was comparable to that of the pure NASICON ceramic sintered at 1220°C. The high relative density of 95% was achieved for the sintered body. SEM observation demonstrated the highly dense microstructure of the ceramic. The XRD pattern for the sintered body showed that the dominant phase was Na2Zr2B3O12 and any crystalline boron compounds were not detected. Consequently, these results suggest that Na3B2O5 acts as a liquid sintering additive without a harmful reaction to NASICON and that sodium borates, which remain as an amorphous phase, do not adversely affect the conductivity of the sintered body.

15 min

G-6

Synthesis, Characterization and Conductivity Investigation of Ce1-x-yDyx-yCayO1.90/ (Li0.52Na0.48)2CO3 (CDC/INCO) for Their Use as a Solid Electrolyte in Li-SOFCs

Zhen Feng YOW1, Wenyi GU1, Stefan ADAMS1#

#Corresponding author: mseasn@nus.edu.sg +Presenter

Solid oxide fuel cell nanocomposite electrolyte with high ionic conductivity at low temperature has been prepared by mixing CDC and eutectic mixture of lithium carbonate and sodium carbonates in electrolyte has been confirmed by SEM analysis. The total conductivity of composite electrolyte found to be enhanced of two orders with compare to the pure CDC electrolyte.

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G-7

Piezoelectricity and Electrostriction in Gd-Doped CeO2 Bulk Ceramics Studied by Laser Interferometry

Andrei KHOLKIN1,2#, Andrey USHAKOV2, Denis ALIKIN2, Ivan BATURIN2

#Corresponding author: oprakash.cer@itbhu.ac.in +Presenter

In the present work, the novel CeO2–YSZ nano-composites were synthesized and tested with the aim to develop a higher ionic conductive electrolyte materials for SOFCs. Spark plasma sintering (SPS) method was utilized to synthesize nano-composites of YSZ with different CeO2 contents (5, 10, and 15 wt. %). The SPS was performed on the powder mixtures of YSZ and CeO2 under 30 MPa at 1200°C and with the soaking time of 5 min. Densities of all the sintered samples were estimated to be 96% of theoretical density or above. The XRD profiles collected at room temperature suggest dissolution of CeO2 in YSZ matrix, whereas TEM investigation shows isolated CeO2 rich regions indicating the formation of composite. The ionic conductivity measurement was performed using AC impedance spectroscopy in air from 300°C to 450°C. The effect of CeO2 addition on the structure and ionic conductivity of YSZ will be discussed.

G-8

Ionic Conductivity Behaviour of Ceria Reinforced Yttria Stabilized Zirconia (8YSZ) Nanocomposite Electrolyte for Solid Oxide Fuel Cell Application

Aiko GUPTA1,2#, Karthik BALAKH1

#Corresponding author: gusta.aikag@gmail.com +Presenter

Solid oxide fuel cells (SOFCs) based on 8 mol.% Y2O3 – ZrO2 (8YSZ) require high working temperatures (800-1000°C) to render a reasonable power density. Most of the research and development work on SOFCs worldwide has been devoted on lowering its high operational temperature to intermediate temperature range (400-600°C). In the present work, the novel CeO2–YSZ nano-composites were synthesized and tested with the aim to develop a higher ionic conductive electrocatalyst materials for SOFCs. Spark plasma sintering (SPS) method was utilized to synthesize nano-composites of YSZ with different CeO2 contents (0, 5, and 10 wt. %). The SPS was performed on the powder mixtures of YSZ and CeO2 under 30 MPa at 1200°C and with the soaking time of 5 min. Densities of all the sintered samples were estimated to be 96% of theoretical density or above. The XRD profiles collected at room temperature suggest dissolution of CeO2 in YSZ matrix, whereas TEM investigation shows isolated CeO2 rich regions indicating the formation of composite. The ionic conductivity measurement was performed using AC impedance spectroscopy in air from 300°C to 450°C. The effect of CeO2 addition on the structure and ionic conductivity of YSZ will be discussed.