Consiglio Nazionale delle Ricerche
Istituto di Chimica dei Composti OrganoMetallici

Venerdì 29 giugno 2018
alle ore 11.00

presso Aula 1 dell'Edificio F
Area della Ricerca CNR
Via Madonna del Piano, 10 Sesto Fiorentino (Firenze)

il Dr. Noboru Taniguchi
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terrà il seguente seminario:

"Development of proton conductive ceramics fuel cell for high reliability and low cost"

Dr. Gianna Reginato
Prof. Francesca Cardona
(Dipartimento di Chimica "Ugo Schiff")

Dr. Francesco Vizza
Direttore ICCOM

Abstract:

In recent years, commercialization of residential fuel cell "Ene-Farm" has begun in Japan, and SOFC using zirconia as electrolyte is also being introduced into the market. However, in order to disseminate residential and commercial cogeneration systems or mono-generation systems, a more reliable and lower cost system is required, which is considered the key to widespread use. We have been researching and developing fuel cell systems that can realize high reliability and low cost with SOFC since 1989. As an SOFC concept that realizes high reliability and low cost, we consider an SOFC that operates at 600 ° C, which can use inexpensive and highly durable metal materials, and while maintaining high efficiency of SOFC, We aimed to develop SOFC that realizes reliability and low cost. In order to construct an SOFC operating at low temperature, an electrolyte which is sufficiently functional at low temperature and which is chemically and physically stable is required. Proton conductors found by Iwahara et al in the 1980s had low ionic conductivity and no chemical stability was also investigated. However, it was expected that ionic conduction activation energy is low, ionic conduction occurs even at a relatively low temperature, and fuel utilization rate as SOFC can be improved.

Therefore, we focused on development of perovskite type proton conductors with high ion conductivity and high durability, and developed them. The target ionic conductivity was 1.0 × 10 -2 S / cm or more, and the chemical stability was aimed not to cause composition and phase change in a fuel gas atmosphere containing water vapor, hydrogen, carbon dioxide gas. Results of examining the moisture resistance, carbon dioxide resistance and conductivity of samples of 348 kinds of BaCe1-xMxO3-α, SrCe1-xMxO3-α, BaZr1-x MxO3-α, CaZr1-x MxO3-α, BaZr1-x-y CexMyO3-α , Finally BaZr 0.8 M 0.2 O 3 - α was found as the best proton conductor from the viewpoint of durability and conductivity. Also, in the cell using BaZr 0.8 M 0.2 O 3 - αproton conductor as the electrolyte, Ni cermet as the anode and LaSrMnO 3 as the cathode, the maximum output of 0.42 W / cm 2 at 600 ° C. could be obtained.

Biographic sketch:

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Educational background

'87 Masters degree in Osaka University, Graduate School of Engineering, Division of Applied Chemistry

'99 Doctoral degree in Tokyo University, Graduate School of Engineering, Department of Chemical System Engineering

Employment history

’87 Joined matsushita Electric Industry Co., Ltd. (currently Panasonic)

‘18 To the present

Official member

Japan Science and Technology Agency,
Member review committee for low carbon society strategy center
Secretary of Kinki branch of The Chemical Society of Japan
Japan Ceramic Association Publication Committee Expert Committee

My research interests

Ion conductor (Proton, Oxide ion, Li), SOFC, SOEC, Sensor, Photocatalyst

My expertise

Inorganic chemistry, Electrochemistry, ceramics synthesis

List of publications (paper) Leading only

1) "Research of Occurrence Conditions for Cold Nuclear Fusion", Nihonkagakukai-shi,9,992(1990)
2) "Proton conductive properties of gadolinium-doped barium cerates at high temperatures," Solid State Ionics, 53-56, 998-1003, (1992)
3) "Operating properties of SOFCs using BaCe0.8Gd0.2O3 electrolyte, JECS 143(6), 1886-1890, (1996).
4) "Sensing properties of an oxygen sensor using BaCe0.8Gd0.2O3 Ceramics as electrolytes, JECS, 145(5), 1744-1748, (1998).
5) "Long-term stability of metal electrodes for the limiting-current type oxygen sensor using BaCe0.8Gd0.2O3, Denki Kagagku, 66 (4), 405-410, (1998).
6) "Endurance against moisture for protonic conductors of perovskite-type ceramics and preparation of practical conductors," Solid State Ionics, 145, 349-355, (2001)
7)” Analysis of the Anodic Reaction Mechanism for Solid Oxide Fuel Cell Using BaCeO3 Electrolyte” , Kagaku Kougaku, 129(2),214,(2003)
8) "Characteristics of novel BaZr0.4Ce0.4In0.2O3 proton conducting ceramics and their application to hydrogen sensors," Solid State Ionics, 176, 2979-2983, (2005)
9)” Taking advantage of open innovation in the actual spot of material development” , Seisan & Gijutsu, 62(1),1-3,(2010)

10)” Taking advantage of open innovation in the actual spot of maker” , Chemistry & Chemical Industry, Seisan & Gijutsu, 66(5),399(2012)

List of publication (BOOK)

Writing

1)” Books of Tokoton yasashii Ceramics” Edited by The Ceramic Society of Japan, Published by Nikkan Kogyo Shimbun, 2009

2) "Science life", edited by The Ceramic Society of Japan, Journal of Publication, 2015

Edit

1) "Environmentally Conscious New Material Series thermoelectric conversion material", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2005

2) "Environmentally Conscious New Material Series Solar Cell Materials", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2006

3) "Environmentally Harmonized New Material Series Fuel Cell Materials", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2007

4) "Environmentally Harmonized New Material Series Catalyst Material", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2007

5) "Environmentally Harmonized New Material Series Biomaterial", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2008

6) "Environmentally Harmonized New Materials Light Emitting / Lighting Materials", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2010

7) "Environmentally Harmonized New Material Series Display Material", edited by The Ceramic Society of Japan, published by Nikkan Kogyo Shimbun, 2013