The 6th students' associated seminar

Amezawa Lab.

Ichitsubo Lab.

Kawada Lab.

Kawamura Lab.

Omata Lab.

Takamura Lab.

23-24 Aug. 2017

Zao Onsen

Time Table

1st day (Thursday, 23, Aug., 2018)
08:40 Meeting time (Sakura hall in Katahira)
09:00 Bus departure time
10:30 Arrive
11:00 Opening ceremony @Dining Zen
11:10 Short presentation I @Dining Zen
12:30 Lunch @Suehiro
13:30 Poster session I @Awayuki
14:20 Break time
14:40 Short presentation II @Dining Zen
15:50 Break time
16:10 Poster session II @Awayuki
17:00 Free time
18:30 Dinner @Suehiro
20:30 Banquet @Awayuki

2nd day (Friday, 24, Aug., 2018)
08:00 Breakfast / Check out
09:00 Lecture I (Prof. Nakamura) @Dining Zen
10:10 Lecture II (Prof. Kishimoto) @Dining Zen
11:30 Bas departure time
13:00 Arrival (Sakura hall in Katahira)

Registration fee : 12,000 yen

About place

Zao onsen meitoya so(蔵王温泉名湯舎 -創-)
〒990-2301 山形県山形市蔵王温泉 48
Tel.023-666-6531

Presentation schedule

Short presentation for poster session Ⅰ (1st day 11:10-)

No.	Presentation title	Presenter	Grade	Lab.
A-1	Develop New Ionic Conductor Using Mixed Anion Compound	Kota Motohashi	D1	Amezawa Lab
A-2	Evaluating thermal properties of materials	Ryoichi Tahara	M2	Kawada/Yashiro Lab
A-3	Contraction of porous nickel during low temperature oxidation	Yutaro Morishita	M1	Kawada/Yashiro Lab
A-4	Oxygen storage capacity and surface exchange reaction of CoFe2O4-added CeO2-ZrO2	Yoko Sugawara	M2	Takamura Lab
A-5	Influence of Electrode Reaction on Cr-Poisoning in SOFC MIEC Cathodes	Shota Kageyama	M1	Amezawa Lab
A-6	Analysis of Reaction Pathway in SOFC Composite Cathode	Takaaki Imaizumi	B4	Amezawa Lab
A-7	Fabrication and performance evaluation of nanoscale La0.6Sr0.4CoO3 cathode derived from Metal Organic Deposition	Yuki Amano	M2	Kawada/Yashiro Lab
A-8	Evaluation of mechanical properties of proton conducting oxides	Chikara Sekizawa	M1	Kawada/Yashiro Lab
A-9	High-pressure synthesis of Perovskite-type $BaScO_2OH$ and its proton conductive property	Hiroaki Kawamori	M2	Takamura Lab
A-10	Facilitating solid-phase diffusion of multivalent ions utilizing concerted interactions in dual-ion battery systems	Hongyi Li	D3	Ichitsubo
A-11	Feasibility of Electrochemical Mg Extraction from MgMn2O4 Cathodes for Mg Rechargeable Batteries	Takuya Hatakeyama	M2	Ichitsubo
A-12	*Operando* Evaluation of Reaction Distribution in Composite Electrode for Bulk Type All-Solid Li-ion Battery with CT-XAFS	Aina Tomura	M1	Amezawa Lab

A-13	Lithium diffusion coefficient in LiMn2O4 measured by SIMS and MD simulation	Masakatsu Nakane	D2	Kawamura Lab
A-14	Electrode reaction of Protonic Ceramic Fuel Cell	Kotaro Okuyama	M1	Kawada/Yashiro Lab
A-15	Degradation Study of Tape Casted Metal Supported Solid Oxide Fuel Cell	Zaka Ruhma	D2	Kawada/Yashiro Lab
A-16	Influence of oxygen partial pressure on electrical and optical properties of sputtered Al-doped ZnO thin films	Tomohiro Aoyagi	M1	Omata
A-17	Preparation of Ti-O-N thin films by Ion-Beam-Assisted Pulsed Laser Deposition Method	Mina Yamaguchi	M1	Takamura Lab
A-18	Fabrication of β-NaGaO2 thin film by Mist-CVD method	Sayuri Takemura	M2	Omata

Presentation schedule

Short presentation for poster session Ⅱ (1st day 14:40-)

No.	Presentation title	Presenter	Grade	Lab.
B-1	Composition dependence of Li self-diffusion coefficient in LixCoO2 thin films measured by secondary ion mass spectrometry II	Gen Hasegawa	D1	Kawamura Lab
B-2	Local structure of 5-V-class cathode LiCoMnO4 thin film by hard X-ray absorption fine structure	Norikazu Ishigaki	D3	Kawamura Lab
B-3	The Change of a Chemical Potential in an Electrode Material Under Stress	Takaya Oide	M2	Amezawa Lab
B-4	Reactions Evaluation between Oxygen Loss and Battery Characteristic about Li-rich Positive Electrode Material Using Electrochemical Oxygen Control	Kento Ohta	M1	Amezawa Lab
B-5	Development of detection method of deteriorated position in SOFC by observing potential distribution	Takashi Tuchikura	M1	Kawada/Yashiro Lab
B-6	Effect of Impurities on Mechanical Properties of Yittria stabilized Zirconia	Hitomi Umemura	M1	Kawada/Yashiro Lab
B-7	Defect structure analysis of Y_2O_3 doped CeO_2-ZrO_2 based oxygen storage materials by using NMR Spectroscopy	Akihiro Fujimaki	M1	Takamura Lab
B-8	Thermodynamic analysis of oxygen vacancy formation in perovskite type oxides for solar thermochemical carbon dioxide splitting cycle	Ryo Hishinuma	M2	Kawada/Yashiro Lab
B-9	Evaluating surface diffusion of La0.6Sr0.4CoO3-δ for SOFC cathode	Toshiki Takasu	M1	Kawada/Yashiro Lab
B-10	Evaluating Oxygen Reduction Reaction on La0.6Sr0.4CoO3-δ (LSC64)	Emi Takahashi	M2	Kawada/Yashiro Lab
B-11	Exploration for mixed proton-hole conductors for PC-SOFC cathode	Hiroki Uehara	D1	Takamura Lab

B-12	Elucidation of the Electrochemical Reaction Pathway in PCFC Cathode by Using Model Patterned Electrode	Katsuya Nishidate	B4	Amezawa Lab
B-13	Thinning the proton conducting phosphate glass by hot-pressing	Masataka Tashiro	M1	Omata
B-14	Model Patterned Thin Film Electrode for Investigation on Electrochemical Reaction in SOFC Mixed Conducting Cathodes	Keita Mizuno	M2	Amezawa Lab
B-15	Simulation of AC response of electrode electrolyte interface by unsteady	Kota Watanabe	M2	Kawada/Yashiro Lab
B-16	Relationship between ionic conductivity and magnetic property of hydrated β''-ferrite	Kanako Chiba	M2	Takamura Lab
B-17	Designing Spinel-Oxide Cathodes for High-Potential Magnesium Rechargeable Batteries	Kohei Shimokawa	D2	Ichitsubo
B-18	Li diffuseion coefficient in $LiCoMnO_4$ thin film by measured by secondary ion mass spectrometry(SIMS)	Tsuyoshi Yamamoto	B4	Kawamura Lab

Lecture Abstract

ドイツ在外研究体験記

Takashi Nakamura

Tohoku University

講演者は2017年8月より1年間、ドイツ Justus Liebig University Giessen の Jürgen Janek 教授のグループにて在外研究に従事した。初めての海外長期滞在および海外研究グループに加わっての研究だったということもあり、日々、驚きと発見の連続で、大変貴重な経験を積むことができた。滞在中は主に固体電解質界面におけるイオン整流特性について研究した。これは先行研究例がほとんど無く、固体電解質界面で整流性が本当に発現するかどうかもわからないという極めて挑戦的なテーマだったが、酸化物イオン伝導体界面にてイオン整流性の実証に成功した。幸いにも、ドイツ滞在中に研究の第一歩目と言える成果を挙げることができたが、整流性発現メカニズムは明らかになっておらず、また固体イオニクスデバイスへの応用も未検討のままである。裏を返すと、本研究は更なる発展・深化が期待できる魅力的なテーマであるとも言える。講演では、ドイツ滞在中に感じた日々の生活や研究に関する類似点・相違点、また現地で取り組んだ固体電解質に関連した研究内容について発表する。

固体酸化物形電気化学セルとエネルギーキャリア

Haruo Kishimoto

National Institute of Advanced Industrial Science and Technology (AIST)

CO_2 などの地球温暖化ガス排出量の削減に向けて、エネルギーミックスにおける再生可能エネルギーの割合の大幅な増加が目指されている。一方、自然任せ、偏在している、といった再生可能エネルギーの持つ「特徴」を有効に活用するには、【電力―化学エネルギー】間の変換技術が重要であり、固体酸化物形燃料電池(SOFC)や固体酸化物形電解セル(SOEC)は高効率な変換を可能とする電気化学デバイスとして重要な役割を担う…ことになってほしいと思い筆者は研究に取り組んでいる。本講演では、産総研て何？というところから、現在取り組んでいる「水と二酸化炭素から高効率にメタンを製造する」技術での固体酸化物形電気化学セルの活用について紹介したい。この技術では、二酸化炭素と水を同時に還元して合成ガス($CO+H_2$)とするプロセスと、その後段に配置する合成ガスからメタンに変換するプロセスの両方で、酸化物イオン電導体を電解質とする電気化学セルを用いており、計算上では、投入電力の約 90%のエネルギーをメタンとして回収可能である。この技術における電気化学セルの役割について、一部よくわからない現象を含めて紹介する。

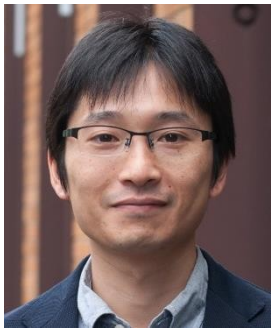
Self-introduction & Poster abstract

Amezawa Lab.

Name : Koji AMEZAWA
Laboratory : AMEZAWA
Course : IMRAM & Mech. System Eng.
Hometown : Yokkaichi, Mie
Hobby : Running, Muscle training, Mineral collecting, Making sweets, Fishing,,, more

The last three or four reps is what makes the muscle grow. This area of pain divides the champion from someone else who is not a champion. That's what most people lack, having the guts to go on and just say they'll go through the pain no matter what happens.

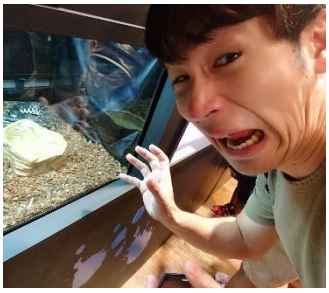
Arnold Schwarzenegger



Name : Takashi Nakamura
Laboratory : Amezawa lab.
Job : Assistant Professor
Hometown : Sapporo
Hobby : Running, Cooking, Eating

Experiences in Germany

I am an assistant professor in Amezawa Lab. since 2012. Last year, I worked at Prof. Jürgen Janek's group in Justus Liebig University in Giessen, Germany for a year as a visiting researcher. In the seminar, I'm going to talk about a life in a country-town in Germany and a little bit about research achievements during the stay. I hope my talk encourages some of you to work on the development of solid State Ionics and to be a professional researcher.



Name : Yuta Kimura
Laboratory : Amezawa lab.
Job : Assistant Professor
Hometown : Niigata
Hobby : Running, Reading

Self-introduction

1987 Born in Niigata
2010 Graduated at Tohoku University, Faculty of Engineering
2012 Graduated at Graduate School of Environmental Studies, Tohoku University (Kawada and Amezawa lab.)
2015 Got PhD degree from Graduate School of Environmental Studies, Tohoku University (Kawada lab.)
2015 Became a Post-doc. at IMRAM Tohoku University (Amezawa lab.)
2016 Became an Assistant Professor at IMRAM Tohoku University (Amezawa lab.)
2018 Got Married.

Name：Kota MOTOHASHI
Laboratory：Amezawa lab.
Course：Grad. Sch. Engineering, D1
Hometown：Urawa, Saitama
Hobby：Soccer

Develop New Ionic Conductor Using Mixed Anion Compound

Recently, mixed anion compounds have been attracting attentions because of their potential for new functions. In this study, we investigated the ionic conductivity of mixed anion compounds using yttrium oxyfluoride (YOF) as a model material. In this material, two anions are regularly or irregularly lined up depending on temperature. Moreover, it is assumed that various defect structures of YOF are taken by doping materials. In this presentation, we discuss the relationship between these features and the ionic conductivity.

Name : Keita Mizuno
Laboratory : Amezawa Lab.
Course : Mechanical Engineering, M2
Hometown : Tokyo
Hobby : Rabbit forever

Model Patterned Thin Film Electrode for Investigation on Electrochemical Reaction in SOFC Mixed Conducting Cathodes

Geometrically well-defined thin film model electrodes such as microelectrodes have been extensively employed to evaluate the cathodic reaction in SOFC. Unlike a practical porous electrode, this types of electrodes allow us to examine the electrode reaction without the effect of the complicated electrode microstructure. On the other hand, these electrodes implicitly prevent us from investigating the electrode reaction pathways in a practical, porous-electrode-like situation owing to their extreme aspect ratio of the double/triple phase boundary. Here we proposed a new type of model patterned electrode to clarify the reaction pathways in a practical situation. In the poster, some examples of the use of this electrode will be also discussed.

Name : Takaya Oide
Laboratory : Amezawa laboratory
Course : Master 2nd
Hometown : Imaichi, Nikko-shi, Tochigi
Hobby : Touring, Hot spring hopping

The change of a chemical potential in an electrode material under stress

In order to fabricate good performance batteries, the development of all-solid-state storage batteries using solid-state ion conductors have been advanced. However, an influence of internal stress based on solid materials is not ignored as compared all-solid-state batteries with liquid type ones. In past research, the change of physical properties under stress was reported. Especially, we focus on the change of a chemical potential in an electrode material under stress and the change of an output accompanying that. So, we are doing the quantitative evaluation of this phenomenon. We use this research results for development and design of good performance all-solid-state ion batteries.

Name : Ohta Kento
Laboratory : Amezawa Lab.
Course : Grad. Sch. Engineering, M1
Hometown : Hokkaido
Hobby : Listening music

Relations Evaluation between Oxygen Loss and Battery Characteristic about Li-rich Positive Electrode Material Using Electrochemical Oxygen Control

Li ion batteries have been used various applications and its demand have been increased. Li-rich positive electrode materials have been noted as it has high capacity. According to past studies this series materials are influenced by oxygen loss, but oxygen loss effect has not been evaluated in detail because it is difficult to control oxygen loss amount. In my research, by using electrochemical oxygen control, a relation evaluation between oxygen loss and battery characteristic are carry out.

Name : Aina Tomura
Laboratory : Amezawa Laboratory
Course : Mechanical Engineering, M1
Hometown : Shiroishi, Miyagi
Hobby : Reading books

***Operando* Evaluation of Reaction Distribution in Composite Electrode for Bulk Type All-Solid Li-ion Battery with CT-XAFS**

In recent years, bulk type all solid state lithium ion batteries are expected to have higher safety and energy density than conventional lithium ion batteries. However, focusing on the positive electrode of the all solid lithium ion battery, it is thought that the grain boundary resistance of the active material and the electrolyte particles is high, a complex reaction distribution is formed, and thereby the capacity and power of the battery are lowered. In this study, reaction distribution is observed by applying computed tomography x-ray absorption fine structure (CT-XAFS) on the inside of the positive electrode while charging and discharging the battery.

Name : Shota Kageyama
Laboratory : Amezawa Lab.
Course : Mechanical Engineering, M1
Hometown : Hanamaki, Iwate
Hobby : Soccer

Influence of Electrode Reaction on Cr-Poisoning in SOFC MIEC Cathodes

Chromium poisoning is one of the main causes of the degradation in SOFC cathodes. It has been reported that some types of Cr-compounds deposit depending on cathode materials, however, the detailed mechanism of Cr-poisoning has not been revealed yet.
In porous electrodes which are typically used, it is difficult to elucidate the relationship between the electrode reaction and Cr-deposition near the electrode/electrolyte interface because of the effect of its complicated microstructure. In this work, we aimed to investigate the influence of the electrode reaction on Cr-poisoning in lanthanum strontium cobaltite (LSC) cathode by using model patterned thin film electrode, which simplified the microstructure of porous electrode.

Name : Katsuya Nishidate
Laboratory : Amezawa Lab.
Course : Mechanical Engineering, B4
Hometown : Iwate
Hobby : Touring by motorcycle

Elucidation of the electrochemical reaction pathway in PCFC cathode by using model patterned electrode

Recently, proton-conducting ceramic-electrolyte fuel cell (PCFC) has been developed as intermediate temperature operating solid oxide fuel cell (SOFC). Large polarization resistance in the PCFC cathode is one of the biggest challenges for improvement of the performance, so using mixed ionic and electronic conductor (MIEC) has been considered for the cathode, but the detailed reactions are not understood well. In order to elucidate the mechanism of electrode reaction in the cathode, we are performing the electrochemical measurement by distinguishing the reaction via double phase boundary (DPB) and triple phase boundary (TPB) by using the patterned model electrode which simplify the microstructure of the practical electrode, the porous electrode.

Name : Takaaki Imaizumi
Laboratory : Amezawa Lab.
Course : Mechanical Engineering, B4
Hometown : Narita, Chiba
Hobby : Cooking, Travel, Doraemon

Analysis of reaction pathway in SOFC composite cathode

In SOFC cathode, it is known that the composited cathode by electrode and electrolyte is better performance than the normal cathode. We consider it mainly for two reasons; Diffusion resistance in the composite is much lower than in the normal because of the existence of electrolyte in composite cathode: Decreased diffusion resistance is contributed to the amount of triple phase boundary (TPB) (gas/electrolyte/electrode) pathway in the composite is much more than that in the normal. These contributes to improve performances, however, it is not clear that what the dominant is. In this study, we make patterned model electrode in GDC's pathway, and we investigate the performance by using *operando* micro X-ray absorption spectroscopy and electrochemical measurements.

Ichitsubo Lab.

Name : Tetsu Ichitsubo
Laboratory : Ichitsubo Lab.
Course : IMR, Professor
Hometown : Osaka city
Hobby : Classic piano, Drinking!

Dr. Tetsu Ichitsubo graduated from Kyoto University in 1995, and he received Ph. D degree from Kyoto University in 2000. He is focusing on various types of phase transformation in terms of controlling microstructure of materials. Especially, through of his research life, he has studied strain effects on phase transformation, including order-disorder structural phase transition, phase separation, electrochemical phase change, photoinduced phase change, etc. Especially, he loves to play the piano... I want to buy a piano for practice!!

Name : Norihiko L. OKAMOTO
Laboratory : Ichitsubo Lab.
Course : Associate Professor, IMR
Hometown : Kyoto
Hobby : Tennis, Golf, Piano, Running

I have been investigating structure-property relationships in thermoelectric materials such as clathrate compounds and transition-metal silicides, as well as in structural materials such as Co-based superalloys, high-entropy alloys and Fe-Zn compounds constituting the coating of zinc-coated steel.

Name : Hiroshi Tanimura
Laboratory : Ichitsubo Lab.
Course : Institute of Materials Research
Hometown : Takarazuka, Hyogo
Hobby : physics, muscular workout

As a trainee.

Although I studied the material for batteries, solid ionic conductor in my graduated course, my current research field is the optical properties of solids. On this occasion, I want re-study about the field of ionics, as the aged student.

Name : Hongyi Li
Laboratory : Ichitsubo Lab.
Course : D3
Hometown : Harbin, China
Hobby : Video Games, Workout

Facilitating solid-phase diffusion of multivalent ions utilizing concerted interactions in dual-ion battery systems

Sluggish solid-phase diffusion has been an essential issue in developing intercalation electrode materials using multivalent ions. Here, combining first-principles calculations with electrochemical experiments, we show that the diffusion of divalent Mg ions is significantly facilitated in Li-Mg dual-ion systems, and the activation energy is remarkably reduced by the concerted interactions of the preceding Li ions and following Mg ions. This work provides a new perspective on solid-phase diffusion that is typically a rate-controlling process in battery systems

Name : Kohei Shimokawa
Laboratory : Ichitsubo Lab.
Course : D2
Hometown : Uji, Kyoto
Hobby : Walking, Climbing

Designing Spinel-Oxide Cathodes for High-Potential Magnesium Rechargeable Batteries

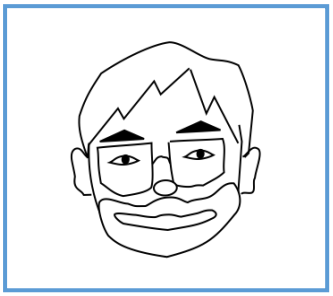
Development of high-potential magnesium rechargeable batteries (i.e., combining high energy density, high safety, low cost, etc.) is strongly demanded for future sustainable society. Spinel oxides containing transition metals such as Co, Fe, and Mn (e.g., $MgCo_2O_4$, $ZnFe_2O_4$, $MgMnO_3$) are promising candidates for cathode materials with high electrode potential and large capacity. In particular, at elevated temperatures around 150 ℃, Mg^{2+} ions can be inserted into these spinel oxides to form rock-salt structure. I will talk about how to design the composition of spinel oxides in order to achieve promising cathode materials.

Name : Takuya Hatakeyama
Laboratory : Ichitsubo Lab.
Course : Material Science, M2
Hometown : Iwate
Hobby : Softtennis, Running

Feasibility of Electrochemical Mg Extraction from $MgMn_2O_4$ Cathodes for Mg Rechargeable Batteries

Rechargeable magnesium batteries have a potential to meet both demands for high energy density and safety performance; however, the challenge is lack of appropriate cathode material. We focus on spinel $MgMn_2O_4$ as promising candidate for cathode material and investigated electrochemical Mg extraction from $MgMn_2O_4$. I would like to talk mainly about characterization result of the Mg-extracted phase.

Kawada lab.



Name	: Tatsuya Kawada
Laboratory	: Distributed Energy Systems Lab.
Course	: Environmental Studies
Hometown	: Maebashi, Gunma
Hobby	: Drinking, Eating, and Sleeping

Enjoy Life, Enjoy Research!

Name	: Keiji Yashiro
Laboratory	: Kawada/Yashiro lab.
Course	:
Hometown	: Kanagawa
Hobby	: Jogging, Finding good croissant

Nam et ipsa scientia potestas est.

Name : Zaka Ruhma
Laboratory : Kawada Lab
Course : D2
Hometown : Java, Indonesia
Hobby : Soccer

Degradation Study of Tape Casted Metal Supported Solid Oxide Fuel Cell

Metal supported solid oxide fuel cell (MS-SOFC) can be fabricated through two different ways, of wet ceramic method and physical deposition method. Experimenting in making MS-SOFC, I focused my work by using wet ceramic of tape casting method. I evaluate the result of my work by means of XRD and Raman to evaluate the electrolyte stress.

Name : Yuki Amano
Laboratory : Kawada Lab.
Course : Environmental Studies, M2
Hometown : Yokohama、Kanagawa
Hobby : Movie , Drama

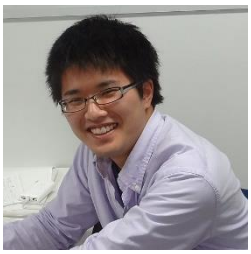
Fabrication and performance evaluation of nanoscale La0.6Sr0.4CoO3 cathode derived from Metal Organic Deposition

SOFC is needed lower operating temperature at intermediate range of 400-600℃.The motivation are an increased life time and reducing cost and so on. At low temperature , the losses associated with the electrochemical reaction at cathode increase drastically. My study is fabrication of high performance LSC thin film cathode made by Metal Organic Deposition. MOD was used to fabricate nanoscaled electrode at low temperature sintering(700℃). Nanoscaled LSC cathode has much surface area for the oxygen surface exchange reaction. Phase structure was investigated XRD and SEM., performance of electrode was investigated EIS.

Name : Emi TAKAHASHI
Laboratory : Kawada lab.
Course : Environmental Studies, M2
Hometown : Miyagi
Hobby : YOSAKOI

Evaluating Oxygen Reduction Reaction on $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ (LSC64)

$La_{0.6}Sr_{0.4}CoO_{3-\delta}$ (LSC64) is an attractive cathode material of SOFC. However, oxygen reduction path on LSC64 surface is still unclear. To evaluate Oxygen Reduction Reaction (ORR) on LSC64, Temperature-Programed Desorption (TPD) used isotope oxygen and Pulse Isotope Exchange (PIE) were establish. TPD is the technique of evaluating adsorbed species on the material surfaces. Introduced isotope oxygen could distinguished surface adsorbed oxygen and bulk oxygen. The result showed origin of oxygen and reproducibility of previous work was taken. PIE is the technique of measuring oxygen exchange coefficient. Blurring of the result was a problem, but by improving the equipment it became possible to measure.



Name : Ryoichi Tahara
Laboratory : Kawada /Yashiro Lab.
Course : Environmental Studies, M2
Hometown : Kochi
Hobby : Reading

Evaluating thermal properties of materials in Solid Oxide Fuel Cell

SOFC is operated in high efficiency at a high temperature (700℃~1000℃). However, some problems occur in its high temperature. One of the problems is delamination, which is caused by thermal stress in boundary of components in SOFC. Also, it is related to delay of start-up time. Therefore, it's necessary to know thermal properties of materials components of SOFC for improvement of performance. I measure thermal conductivity of $Ce_{0.9}Gd_{0.1}O_{1.95}$ electrolytes in several atmosphere, and evaluate its values.

Name : Ryo Hishinuma
Laboratory : Kawada/Yashiro Lab.
Course : Environmental Studies, M2
Hometown : Fukushima, Japan
Hobby : Aikido

Thermodynamic analysis of oxygen vacancy formation in perovskite type oxides for solar thermochemical carbon dioxide splitting cycle

Multi-step thermochemical cycle using solar energy for CO_2 dissociation has been studied as new technology for sustainable society. This technique makes it possible to produce "Solar Fuels" from CO_2 to transport and store solar energy resource. As a redox material in the cycle, oxygen nonstoichiometric oxides are studied actively. Oxygen vacancy formation in oxides is related to solar-to-fuel conversion efficiency of redox material for this cycle. In this study, we focused on perovskite type oxide and performed thermodynamic analysis of oxygen vacancy formation to create a novel high efficiency material for solar thermochemical cycle.

Name : Kota Watanabe
Laboratory : Kawada/Yashiro Lab.
Course : Environmental Studies, M2
Hometown : Tottori,Japan
Hobby : lacrosse

Simulation of AC response of electrode electrolyte interface by unsteady potential calculation

For elucidation of deterioration mechanism and physical property of SOFC, it is important to grasp oxygen potential distribution. However, it is difficult to grasp it by electrochemical measurement directly. So, if the potentials distribution can be calculated by simulation, it will be a great help to the elucidation. There, I try to simulate the previous work conducted in our laboratory by simulation code (SIMUDEL), aim to identify the origin of the electrode capacity at the Ni - YSZ interface.

Name : Hitomi Umemura
Laboratory : Kawada /Yashiro Lab.
Course : Environmental Studies, M1
Hometown : Tsukuba,Ibaraki
Hobby : Gymnastics, NOGIZAKA46

Effect of Impurities on Mechanical Properties of Yittria stabilized Zirconia

For yttria-stabilized zirconia (YSZ) which is an electrolyte material, researches on mechanical properties are actively conducted to improve durability. However, in an actual SOFC operating environment, it is reported that nickel oxide (NiO) used for electrode materials reacts with YSZ, so the atomic structure of YSZ changes.

In this study, I focused on the electrolyte material and evaluated the mechanical properties of 1% NiO 99% YSZ under SOFC operating environment by the resonance method. I will clarify the influence of the dissolution of Ni on durability.

Name : Daichi Oi
Laboratory : Kawada /Yashiro Lab.
Course : Environmental Studies, M1
Hometown : Kashima,Ibaraki
Hobby : Tennis, Eating out

Oxygen nonstoichiometry measurement with LSCF dense thin film

LSCF has been studied as a high performance cathode material of SOFC. When observing the reaction of cathode, a dense thin film electrode is often used to simplify the reaction path. However, previous studies have found that LSCF thin films have different oxygen nonstoichiometry from bulk.

In this study, I would like to clarify the mechanism of this phenomenon. For that, the value of δ is measured while controlling the ion doping of B site, and compared with the bulk literature value.

Name : Kotaro Okuyama
Laboratory : Kawada/Yashiro Lab.
Course : Environmental Studies,M1
Hometown : Fukuoka, Japan
Hobby : Rugby, Muscle training

Electrode reaction of Protonic Ceramic Fuel Cell

Protonic ceramic fuel cells (PCFCs) exhibit better performance compared to traditional solid oxide fuel cells (SOFC) at an intermediate temperature (400~700℃). However, PCFCs show high polarization resistances at the cathodes, and it is one of the biggest issues to be solved. To reduce the polarization resistance at cathodes, the use of protonic-electronic mixed conductive oxides has been considered. However, only limited information is available for the protonic conductivity of cathode candidate materials. In our preliminary experiments, $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ showed good performance. In order to clarify the mechanism, proton incorporation in $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ was tested by TG, isotope exchange and SIMS.

Name : Keiko Kobayashi
Laboratory : Kawada/Yashiro Lab.
Course : Environmental studies, M1
Hometown : Yokohama, Kanagawa
Hobby : Table tennis

Conductivity of Ti-based alloy interconnects for SOFCs

Metal is able to be candidate for use as interconnects instead of ceramics because operating temperature of SOFC is reduced under 800℃.
The required features of interconnects are high oxidation resistance and high conductivity. In the case of iron-based alloys and Cr-based alloys, conductivity is reduced because of Cr evaporation from Cr_2O_3 scale. On the other hand, the effect of Ti oxide scale on conductivity is unknown. And scale growth speed of Ti-based alloys is also unknown. To evaluate conductivity and diffusion speed of Oxygen in Ti bulk, area specific resistance is measured by electrochemical impedance spectroscopy.

Name : Chikara Sekizawa
Laboratory : Kawada / Yashiro Lab
Course : Environmental Studies,M1
Hometown : Gunma,Japan
Hobby : movie

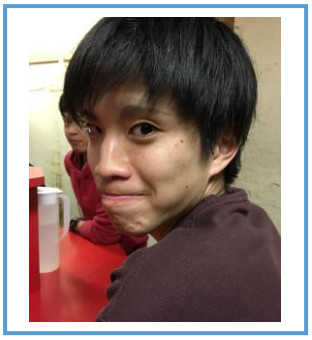
Evaluation of mechanical properties of proton conducting oxides

SOFC provides the highest electrical efficiency among fuel cells. However, as the operating temperature is high, the problem is that it takes time to start up. PCFC(Proton-Ceramic-electrolyte Fuel Cell) is based on ceramic materials that exhibit good proton conductivity at intermediate temperatures(400-700℃). Compared to SOFC, intermediate operating temperature enables the use of raid up. However, since this PCFC uses mechanically fragile ceramics as a material, cell deterioration is a concern. From this, it is necessary to evaluate the mechanical properties of the electrolyte at the operating temperature of the PCFC.

Name : Toshiki Takasu
Laboratory : Kawada / Yashiro Lab.
Course : Environmental Studies, M1
Hometown : Iwate
Hobby : sports, Internet surfing

Evaluating surface diffusion of $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ for SOFC cathode

SOFC cathode material $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ (LSC64) has two reaction sites because it can conduct both oxide ion and electron. Because of its characteristic, the reaction process of the cathode can be roughly divided into three and it is too complex to be clarified. Especially, oxygen surface diffusion, the phenomenon that oxygen moves on the surface of the cathode electrode to three phase boundary (TPB), is difficult to measure and measurement method is not established. To measure the surface diffusion, I made the Porous Oxygen Sensor (POS), and AC impedance measurement is performed on a single cell of the GDC electrolyte and the LSC 64 electrode.



Name : Takashi Tsuchikura
Laboratory : Kawada/YashiroLab
Course : Environmental Studies, M1
Hometown : Sendai
Hobby : Ramen Jiro

Development of detection method of deteriorated position in SOFC by observing potential distribution

Since SOFC is operating at high temperature, damage may occur in the cell during actual operation. If deterioration in the cell can be detected while the SOFC is in operation, it will improve the durability of the cell. However, it is currently difficult to directly detect deterioration. In this research, I focus attention on the potential of the current collector surface due to deterioration within the cell. Currently I am evaluating the change in the potential distribution on the current collector due to deterioration by simulation.

Name : Yutaro Morishita
Laboratory : Kawada/Yashiro Lab.
Course : Environmental Studies, M1
Hometown : Saitama
Hobby : Lacrosse, Soccer

Contraction of porous nickel during low temperature oxidation

Improving durability is one of the requirements for SOFC. Especially, SOFC anode material requires good mechanical stability under SOFC operation situations. There has been reported a phenomenon that fracture occurs in the contacting electrolyte due to expansion due to oxidation of the anode material. But, in some special cases that the anode material contract during oxidation, it will increase the stress for electrolyte, then cause fracture. In order to avoid this kind of damage, we should clarify the mechanism of this special phenomenon. In my studies, my purpose is Clarifying the mechanism of Ni contraction during oxidation procedure.

Kawamura Lab.

Name：Junichi Kawamura
Laboratory：Kawamura Lab
Course：
Hometown：Ueda Nagano
Hobby：Mac & Wine

Name : Naoaki Kuwata
Laboratory : Kawamura Lab.
Course : Associate Professor
Hometown : Sendai and Tokyo
Hobby : Running, Pokémon GO

Recently, I am interested in a diffusion coefficient of solid-state battery materials. The diffusion coefficient is measured by SIMS using ^{6}Li isotope and pulsed field gradient-NMR. We have clarified the diffusion coefficients of a-Li_3PO_4, Li_xCoO_2 and $Li_xMn_2O_4$ thin films and single crystal $Li_{7-x}La_3Zr_{2-x}Ta_xO_{12}$. I would like to discuss the Li diffusion mechanism. In addition, in situ XAFS measurement of the 5V solid-state battery was performed in SPring-8 in collaboration with Amezawa Lab.

Name : DORAI ARUNKUMAR
Laboratory : KAWAMURA LAB
Course : ASSISTANT PROFESSOR
Hometown : TAMIL NADU, INDIA
Hobby : RUNNING, TRAVEL

I was born in a small town named cheyyar, in the southern part of India. I graduated from Madras University in the year 2002. Later I joined in Bharathiar University, Coimbatore for my Masters and Ph.D degree which I completed in 2004 and 2011 respectively. I joined in Kawamura laboratory in 2013 and started to work on NMR. Recently I am interested to study the ion dynamics and diffusion properties of solid ion conductors using PFG-NMR. Together I am interested on fluoride ion batteries.

Name : Ishigaki
Laboratory : Kawamura
Course : D3
Hometown : Hyougo
Hobby : baseball

Local structure of 5-V-class cathode $LiCoMnO_4$ thin film by hard X-ray absorption fine structure

The charge/ discharge reaction of the 5V class cathode material $LiCoMnO_4$ which is attracting attention as a positive electrode material of next generation type lithium ion secondary battery are studied by hard X-ray absorption spectroscopy. In this study, the relationship between reaction mechanisms and Co, Mn, and in $Li_{1.3}CoMnO_4$ thin film were examined. As a result, the capacity of the 4V region associated Mn redox couple and the capacity of 5V reign associated Mn, Co redox couple.

Name : Masakatsu Nakane
Laboratory : Kawamura Lab.
Course : Physics, D2
Hometown : Japan
Picture : Yokohama

Lithium diffusion coefficient in $LiMn_2O_4$ measured by SIMS and MD simulation

$LiMn_2O_4$ has been researched actively as a cathode material of a lithium-ion battery. It is known that $LiMn_2O_4$ has spinel-structure and 8a-16c-8a three-dimensional Li transport path. In this study, a $^6LiMn_2O_4$ pellet was prepared by solid-phase synthesis as a target, and $^6LiMn_2O_4$ thin film was deposited by pulsed laser deposition (PLD) method using ArF excimer laser. Through Li exchange by cyclic voltammetry or dipping into electrolytic solution, ^{6}Li-rich and ^{7}Li-rich parts of the thin film were prepared. After heat treatment, interdiffusion of Li isotopes was occurred. Li isotopic ratio was determined by secondary ion mass spectrometry (SIMS). On the other hand, Li diffusion will be calculated by molecular dynamics (MD) simulation.

Name : Gen HASEGAWA
Laboratory : Kawamura Lab.
Course : Physics, D1
Hometown : Niigata, Japan
Hobby : Skiing

Composition dependence of Li self-diffusion coefficient in Li_xCoO_2 thin films measured by secondary ion mass spectrometry II

Diffusion coefficient of lithium in a positive electrode material is important because it dominated charge-discharge behavior of lithium battery. However, the diffusion coefficient in Li_xCoO_2 has never been measured by the direct method for diffusion measurement. In this study, we established a direct method for measuring the diffusion coefficient of the Li_xCoO_2. We measured the time dependence of amount of isotope exchange by secondary ion mass spectrometry (SIMS). The isotope exchange was performed between the Li_xCoO_2 thin films and liquid electrode. We succeeded in obtaining the self-diffusion coefficient of the Li_xCoO_2 thin films by this method.

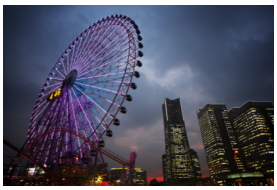
Name : Tsuyoshi Yamamoto
Laboratory : Kawamura Lab
Course : Physics, B4
Hometown : Hiroshima, Japan
Hobby : Photography
Stargazing

Li diffusion coefficient in $LiCoMnO_4$ thin films by measured by secondary ion mass spectrometry (SIMS)

The determination of Diffusion coefficient of lithium in a positive electrode material is important for understanding the ionic transport mechanism in lithium battery. However, only a few experimental studies has been reported on the diffusion coefficient in $LiCoMnO_4$ by the direct method for diffusion measurement. In this study, we measured the accurate isotope ratio of Li^6 and Li^7 by secondary ion mass spectrometry (SIMS). The exchange of Li^6 and Li^7 was performed between the LiCoMnO4 thin films and liquid electronode. By adopting this method, we are able to obtain the diffusion coefficient of the $LiCoMnO_4$ thin films.

Omata Lab.

Name : Takahisa Omata
Laboratory : Omata lab.
Course : IMRAM, Professor
Hometown : Yokohama (**NOT** Osaka)



Hobby : Smoking, Drinking

Name : Satoshi Tsukuda
Laboratory : Omata Laboratory
Course : IMRAM, Assistant Professor
Hometown : Kobe
Hobby : Soccer, Reading books

Name : Issei Suzuki
Laboratory : Omata lab.
Course : IMRAM, Assistant Professor
Hometown : Tokyo
Hobby : Cooking

Name : Sayuri Takemura
Laboratory : Omata Lab.
Course : Environmental Studies, M2
Hometown : Toyama, Japan
Hobby : Traveling and playing the flute

Fabrication of β-$NaGaO_2$ thin film by Mist-CVD method

β-$CuGaO_2$ is a promising material for a thin-film solar cell absorber owing to its direct and narrow-band-gap. Because β-$CuGaO_2$ is a metastable phase and is obtained by ion-exchange of Na^+ in β-$NaGaO_2$ with Cu^+, β-$NaGaO_2$ thin-film is necessary to obtain β-$CuGaO_2$ thin-film. β-$NaGaO_2$ thin-films previously obtained by sputtering and evaporation exhibited Na-poor composition, and the films resulted in Cu-poor β-$CuGaO_2$. In this study, we studied deposition of β-$NaGaO_2$ thin-films by using the mist-CVD technique, in which the composition of the films is controllable by the composition of the source solution, in order to obtain the stoichiometric β-$NaGaO_2$ thin-films.

Name : Masataka Tashiro
Laboratory : Omata lab.
Course : Master course(1st grade)
Hometown : Omiya, Saitama
Hobby : Playing the violin and soccer

Thinning the proton conducting phosphate glass by hot-pressing

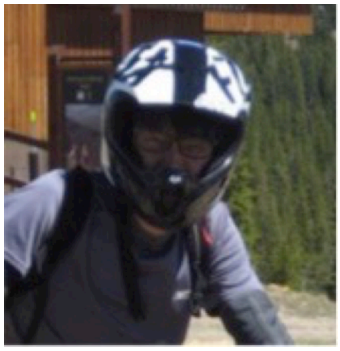
$36HO_{1/2}-4NbO_{5/2}-2BaO-4LaO_{3/2}-4GeO_2-1BO_{3/2}-49PO_{5/2}$ glass exhibits proton conductivity of 1×10^{-3} Scm^{-1} at 280 °C and is a promising electrolyte for the intermediate temperature fuel cells. When the glass with a thickness smaller than 10 µm is used as the electrolyte, maximum output power density of the fuel cell is expected to be higher than 150 $mWcm^{-2}$, assuming the total electrode polarization resistance at the anode and cathode smaller than 1 Ωcm^2. In this study, we fabricated thin glass electrolytes by hot-pressing and obtained a glass with a 16 µm thickness without degradation of the proton conductivity.

Name : Tomohiro Aoyagi
Laboratory : Omata lab.
Course : Environmental Studies,M1
Hometown : Yokohama
Hobby : Playing baseball

Influence of oxygen partial pressure on electrical and optical properties of sputtered Al-doped ZnO thin films

ZnO is used as the transparent electrode owing to its wide band gap and high electrical conductivity. Whereas the conductivity of ZnO is controllable by impurity doping such as Al3+ and Ga3+, it is also known that its deviation from the stoichiometry (ZnO1-x) has a significant influence on its physical properties including conductivity. In this study, Al-doped ZnO films were fabricated by RF magnetron sputtering at room temperature under various oxygen partial pressures. The influences of the oxygen partial pressure on the electrical, optical properties and crystal structures of the resulting films are discussed based on the defect chemistry.

Takamura Lab.



Name : Hitoshi Takamura
Laboratory : Energy Materials
Course : Department of Materials Science
Hometown : Shizuoka
Hobby : Cycling

Name : Itaru Oikawa
Laboratory : Takamura Lab.
Course : Materials Science, Assist. Prof.
Hometown : Okayama
Hobby : Tennis, Cycling

Name : Hiroki Uehara
Laboratory : Takamura Lab.
Course : Material Science, D1
Hometown : Tottori
Hobby : Traveling, watching films

Exploration for mixed proton-hole conductors for PC-SOFC cathode

Intermediate-temperature solid oxide fuel cell (SOFC) has attracted large attention as a cost-effective SOFC. Proton conducting SOFC is one of the candidates due to the low activation energy of proton conduction at 600-800 ºC. However, suitable cathode materials in which proton and electron conduct have not been reported. $BaCo_xZr_{0.9-x}Sc_{0.1}O_{3-d}$ as well as $BaCo_xZr_{0.9-x}Y_{0.1}O_{3-d}$ which is already reported in my master's thesis as a hole conductor and potentially as a mixed proton-hole conductor were prepared to elucidate the effect of the correlation between proton and hole from a view point of microstructure in the future. Their phases, proton diffusion, and NMR spectra were analyzed.

Name : Hiroaki Kawamori
Laboratory : Takamura Lab.
Course : Material Science, M2
Hometown : Sendai
Hobby : Running, Photo

High-pressure synthesis of Perovskite-type $BaScO_2OH$ and its proton conductive property

Proton conductor has attracted much attention as an electrolyte for intermediate-temperature solid oxide fuel cells. $Ba_2Sc_2O_5$ is the end member of famous Perovskite-type acceptor-doped $BaZrO_3$. It has the potential to achieve high proton concentration of 100 mol% and thus it is expected to show high proton conductivity. However, $Ba_2Sc_2O_5$ is Brownmillerite-type structure and ordered oxygen vacancies inhibit protonation. Then this study focused on high-pressure synthesis method. This method can protonate at high temperature and high pressure in a closed environment. Protonated Perovskite-type $BaScO_2OH$ was synthesized by high-pressure synthesis method and its proton conductive property was evaluated.

Name : Yoko Sugawara
Laboratory : Takamura lab.
Course : Material Science, M2
Hometown : Sendai, Miyagi
Hobby : Drive

Oxygen storage capacity and surface exchange reaction of $CoFe_2O_4$-added CeO_2-ZrO_2

$Ce_{0.5}Zr_{0.5}O_2$ (CZ55) has high oxygen storage capacity (OSC) and the OSC was improved by the use of $CoFe_2O_4$ (CFO) showing high electronic conductivity. However the influence of CFO addition on surface exchange reaction of CZ55 that is rate-limiting step has not been identified yet. In addition, the effect of dissociative adsorption assistant $BaZrO_3$ addition on the surface exchange reaction of CZ55 has not been identified yet. So, the purpose of my study is to investigate the surface exchange reaction of CZ55-CFO and to investigate the influence of $BaZrO_3$ on OSC and the surface exchange reaction of CZ55.

Name : Kanako Chiba
Laboratory : Takamura lab.
Course : Material Science, M2
Hometown : Ajigasawa, Aomori
Hobby : Reading books

Relationship between ionic conductivity and magnetic property of hydrated β''-ferrite

β''-ferrite is multi-functional material having ionic conduction and it has layered structure with spinel blocks and ionic conduction planes. Usually, it shows antiferromagnetism due to superexchange interaction between Fe^{3+} ions and O^{2-} ion in ionic conduction plane. Previous studies reported hydrated β''-ferrite showed weak ferromagnetism (enhancement of spontaneous magnetization). S.Nisolopoulos suggested that this phenomenon is attributed to additional ferromagnetic superexchange interaction due to O in H_2O molecules and H_3O^+ ions in ionic conduction planes. So, new type of electromagnetic effect that migration of these species affects magnetic property is expected in hydrated β''-ferrite.

Name : Akihiro Fujimaki
Laboratory : Takamura Lab.
Course : Material Science, M1
Hometown : Hachioji, Tokyo
Hobby : Singing, Running

Defect structure analysis of Y_2O_3 doped CeO_2-ZrO_2 based oxygen storage materials by using NMR Spectroscopy

CeO_2-ZrO_2 based oxides (CZ) has high oxygen storage capacity (OSC). Oxygen can be released and storage with Ce valence change. Therefore, it is suggested that high OSC in CZ is related to oxygen local structure, the mechanism has been uncertain. I focused on NMR spectroscopy, which can observe the local structure in oxide. Ce and Zr isn't sensitive to NMR in CZ, so Y_2O_3 were doped in CZ (CZY) since ^{89}Y can be observed in NMR spectroscopy. In this research, the relationship between local structure of CZY in both oxidation and reduction state and OSC was investigated by using ^{89}Y MAS NMR.

Name : Mina Yamaguchi
Laboratory : Takamura lab.
Course : Materials Science, M1
Hometown : Tsukuba, Ibaraki
Hobby : Walking

Preparation of Ti-O-N thin films by Ion-Beam-Assisted Pulsed Laser Deposition Method

Ti-O-N materials are attracted attention for optical and electrical applications. However, simultaneous control of these composition and microstructure is difficult by conventional methods. In this study ion-beam-assisted pulsed laser deposition method, which has various parameters, is focused on. Ti-O-N thin films were prepared by this method using a TiO_2 target and a nitrogen ion source under various conditions. The composition, optical and electrical properties, crystal structure and microstructure of the films were investigated. Discussions about these optical applicability will be also given in the poster.

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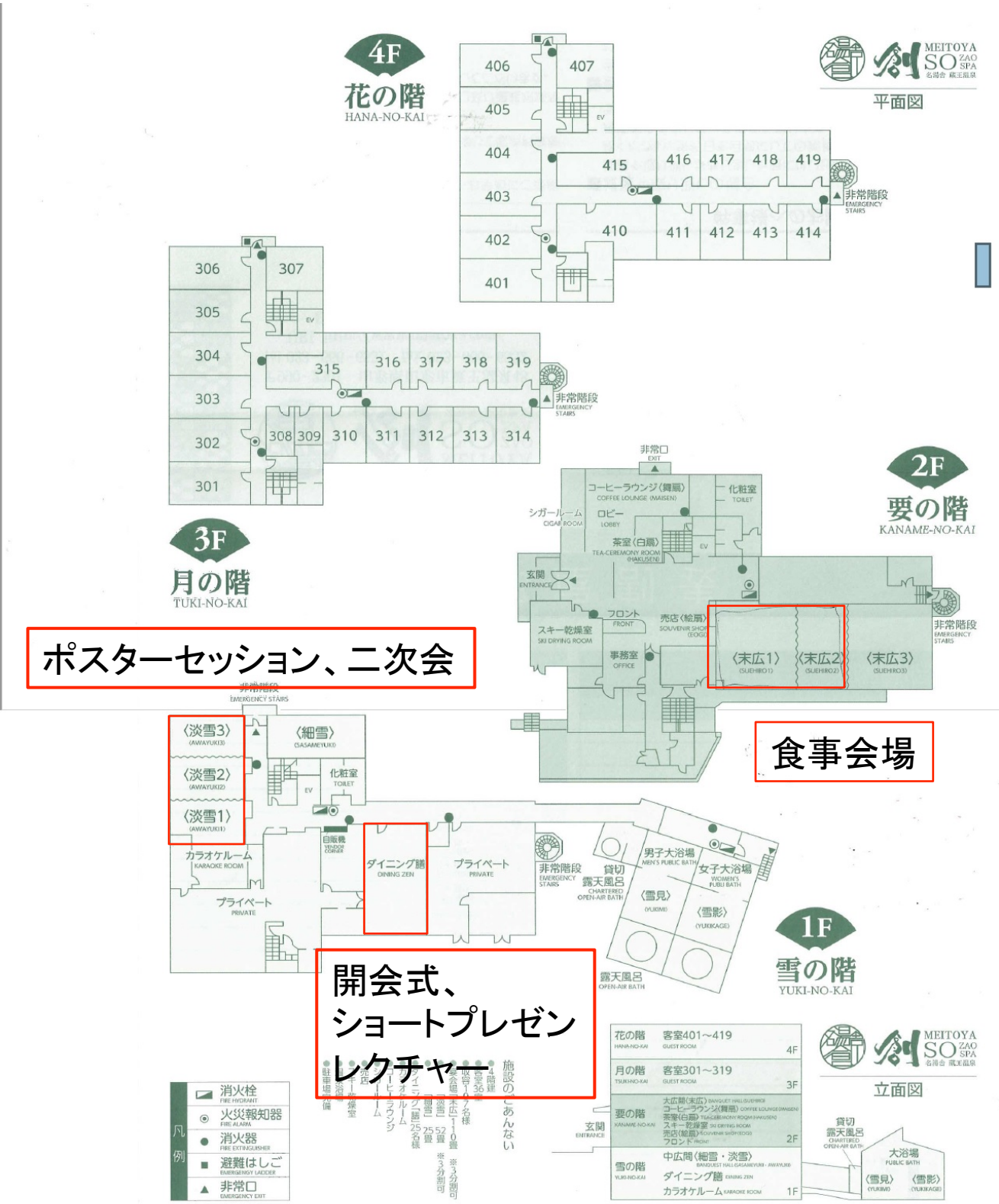
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TOILET
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ロビー
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SKI DRYING ROOM
事務室
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(SUEHIRO2)
〈末広3〉
(SUEHIRO3)
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食事会場
〈淡雪3〉
(AWAYUKI3)
〈細雪〉
(SASAMEYUKI)
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KARAOKE ROOM
自販機
VENDOR CORNER
ダイニング膳
DINING ZEN
プライベート
PRIVATE
非常階段
EMERGENCY STAIRS
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開会式、
ショートプレゼン
レクチャー
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消火栓
FIRE HYDRANT
火災報知器
FIRE ALARM
消火器
FIRE EXTINGUISHER
避難はしご
EMERGENCY LADDER
非常口
EMERGENCY EXIT
施設のごあんない
1階建
客室36室
収容150名様
宴会場(末広)110畳
(淡雪)52畳
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ダイニング膳25名様
ラウンジ
ロビー
乾燥室
売店
1階浴場
駐車場完備
MEITOYA SO ZAO SPA
名湯舎 蔵王温泉
立面図
花の階 HANA-NO-KAI 客室401～419 GUEST ROOM 4F
月の階 TSUKI-NO-KAI 客室301～319 GUEST ROOM 3F
要の階 KANAME-NO-KAI
大広間〈末広〉BANQUET HALL (SUEHIRO)
コーヒーラウンジ〈舞扇〉COFFEE LOUNGE (MAISEN)
茶室〈白扇〉TEA-CEREMONY ROOM (HAKUSEN)
スキー乾燥室 SKI DRYING ROOM
売店〈絵扇〉SOUVENIR SHOP (EOGI)
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雪の階 YUKI-NO-KAI
中広間〈細雪・淡雪〉BANQUET HALL (SASAMEYUKI・AWAYUKI)
ダイニング膳 DINING ZEN
カラオケルーム KARAOKE ROOM
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玄関 ENTRANCE
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