The 4th students' associated seminar

Amezawa Lab.
Kawada Lab.
Yugai Lab.
Kawamura Lab.
Takamura Lab.
Omata Lab.

9 – 10 Aug. 2016
Iwanumaya, conference room

Time Table

1st day (Tuesday, 9, Aug., 2016)

9 : 10	Meeting time (Sakura hall in Katahira)
9 : 30	Bus departure time
10 : 00	Arrival
10 : 30	Opening ceremony
11 : 00	Short presentation I
12 : 00	Lunch
13 : 00	Short presentation II
14 : 00	Poster session I
15 : 00	Poster session II
17 : 00	Free time
19 : 00	Dinner
21 : 00	Banquet

2nd day (Wednesday, 10, Aug., 2016)

8 : 00	Breakfast
9 : 00	Check-out
9 : 30	Lecture I (Prof. Omata)
10 : 40	Lecture II (Prof. Mizusaki)
11 : 40	Closing ceremony
12 : 45	Bus departure time
13 : 30	Arrival (Sakura hall in Katahira)

About place

Iwanumaya（岩沼屋）, conference room

〒982-0241　宮城県仙台市太白区秋保町元字薬師 107

TEL　022-398-2011　FAX　022-398-2825

Presentation schedule

Short presentation for poster session I (1^{st} day 11:00 ~ 12:00)

No.	Presentation title	Presenter	Grade	Lab.
1-01	Operando X-ray Absorption Spectroscopy measurement of a positive electrode for the all-solid-state lithium-ion batteries	Mahunnop Fakkao	D1	Amezawa
1-02	Electrolysis of CO_2 using proton conducting electrolyte	Yuki Shinomiya	M1	Amezawa
1-03	Develop electrolyte material for All-Solid-State Fluoride-ion batteries	Kota Motohashi	M1	Amezawa
1-04	Investigation of Mechanism of Reaction Distribution Formation in Composite Cathodes for Li Ion Batteries by Using Operando 2D-XAS	Kazuki Chiba	M1	Amezawa
1-05	The Ion Conduction of Halide Organic-Inorganic Hybrid Perovskite Compounds	Yosuke Matsukawa	B4	Amezawa
1-06	New Proton Conducting Phosphate Glass Exhibiting High Conductivity at Intermediate Temperatures under Dry Atmosphere	Takuya Yamaguchi	D2	Omata
1-07	Ion-exchange of monovalent M^{I}-ions in ternary wurtzite oxides, β-$M^{I}GaO_2$	Ayako Kakinuma	M1	Omata
1-08	Oxygen permeation property of surface modified $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$	Yoshiaki Hayamizu	D2	Takamura
1-09	NMR study of the local structure and the hydride diffusion in perovskite oxyhydride	Tai misaki	M2	Takamura
1-10	Preparation of novel ion conductors by ion-exchange technique using $LiBH_4$	Hikaru Kobayashi	M1	Takamura
1-11	Electrical Conduction Properties of Bi-Sr-Fe-Based Perovskite-Type Oxides at High Temperature	Yuto Tomura	M1	Takamura
1-12	Study of Reduction Behavior of Samarium Doped Ceria Compounded with MgO	Tomoya Abe	M1	yugami
1-13	Development of IT-SOFC/SOEC with perovskite-type protonic conductors	Yusuke Suzuki	M1	yugami
1-14	Microstructural changes of porous nickel during low temperature oxidation	Zhao Fei	M2	Kawada
1-15	Characterization of the ferroelastic behavior of $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$	Kouhei Shishido	M2	Kawada
1-16	Modification of oxygen potential at $(La,Sr)CoO_{(3-\delta)}$ electrode surface	Dan Nonami	M2	Kawada
1-17	Evaluation of surface exchange coefficient of SOFC cathode materials by pulse isotope exchange	Hiroshi Chiba	M2	Kawada
1-18	Elucidation of the deterioration in the fuel electrode of the solid oxide electrolysis cell	Takayasu Uchi	M1	Kawada
1-19	Evaluation of the reaction site of $La_{0.6}Sr_{0.4}CoO_3$ Cathode with model electrode	Yakaya Hoshi	M1	Kawada
1-20	Electrochemical Potential Simulations in Proton-Conducting Fuel Cells	Bourdon Arthur	M1	Kawada

1-21	Electric chemical property of $LiCoMnO_4$ cathode thin-film by annealing	Norikazu Ishigaki	D1	Kawamura
1-22	Visualization of liquid flow by MRI	Shotaro Endo	M1	Kawamura
1-23	Measuring of lithium diffusion in $LiCoO_2$ and $LiMn_2O_4$	Daiki Maeda	M1	Kawamura

Short presentation for poster session II (1st day 13:00 ~ 14:00)

No.	Presentation title	Presenter	Grade	Lab.
2-01	Investigation of the Cr-poisoning mechanism in SOFC cathode by using the patterned thin film electrode	Yusuke Shindo	M2	Amezawa
2-02	Creation of new nitride based ionics materials	Tomomi Sato	M1	Amezawa
2-03	The mechanism of Oxygen-extraction for Lithim rich Li-Mn-Ni-O series cathode material	Gao Hongze	M1	Amezawa
2-04	Direct Evaluation of Reaction Distribution in an SOFC Cathode by Using Model Patterned Thin Film Electrode	Keita Mizuno	B4	Amezawa
2-05	Control of the electrical conductivity of wurtzite-type oxide semiconductor β-$CuGaO_2$ and β-$AgGaO_2$	Hiraku Nagatani	D3	Omata
2-06	Amorphization induced by substitution of sodium ions with protons observed in $Na_3Zr_2Si_2PO_{12}$ (NASICON)	Keigo Miyake	M2	Omata
2-07	Lithium-ion conduction in hydrated lithium borohydride	Akira Takano	D2	Takamura
2-08	Development of Novel Transparent High-Refractive-Index Material	Akihiro Ishii	D1	Takamura
2-09	Conductivity enhancement in Doped Ceria Oxide-Carbonates composite	Hibiki Ishijima	M1	Takamura
2-10	Mixed Ionic Electronic Conductivity of $Ba_{0.9}Nd_{0.1}In_{1-x}Mn_xO_{3-\delta}$	Yukio Cho	M1	Takamura
2-11	Development of power source for mobile electronic devices using micro-SOFC	Shinpei Takahara	M2	yugami
2-12	Durability Improvement of Micro SOFC by Introducing Porous Silicon Supporter	Koki Kato	M1	yugami
2-13	Stability of LSCF6428 under oxygen potential gradient	Xingwei Wang	D3	Kawada
2-14	Electrode degradation mechanism under SOEC operation	Hiroki Akabane	M2	Kawada
2-15	Cathodic reaction of $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ on proton-conducting electrolyte $SrZr_{0.9}Y_{0.1}O_{3-\delta}$ under fuel cell condition	Shunsuke Noda	M2	Kawada
2-16	Suppression effect of carbon deposition on Ni by coexisting oxides	Mitsuki Haga	M2	Kawada
2-17	Investigation of Mechanical Properties of ZrO_2 Based Oxides at High Temperature	Tomohiro Kori	M2	Kawada
2-18	Development of high performance cathode for SOFC	Jyunichi Sakuraba	M1	Kawada
2-19	Measuring distribution in SOFC	Tenyo Zukawa	M1	Kawada
2-20	High-temperature steam electrolysis in the co-existence with CO_2 by using Solid Oxide Electrolysis Cells	Syun Hatakeyama	M1	Kawada
2-21	Diffusion coefficient of Li in $LiMn_2O_4$ measured by SIMS	Masakatsu Nakane	M2	Kawamura
2-22	Direct measurement of lithium-ion diffusion coefficient of LiCoO2 by SIMS	Gen Hasegawa	M1	Kawamura

Lecture Abstract

新材料の設計と合成

Prof. Omata

はるか昔、鉄器は農耕器具の耐久性を向上し、農業の生産性を大幅に向上した。ごく最近では、固体素子化の流れのなかで取り残されていた照明を青色 LED と新蛍光体が固体素子化し、量産化以来 100 年間にわたって蜜月関係を続けてきた自動車と内燃機関のカップルに、高性能電池と磁石は離縁を迫っている。このように新材料は、人々の生活に大きな変革をもたらすパワーを秘めている。各種資源の枯渇や温暖化が喫緊の課題として突きつけられている今、私たちにはその解決に資する新材料を生み出すことが課されている。狙う新材料を設計し合成するとはどういう作業なのかを、講演者らの研究を例に紹介する。

人口減少時代のエネルギー環境科学

Prof. Mizusaki

東アジアの人口は増加時代から既に減少時代に転じている。世界全体では，今後５０年間に３０億近い人口増があり、世界人口は１００億に迫ると予想されている。然るに、その後来るのは人口減である。世界の人口構成を年代別に表す人口ピラミッドを見れば、その兆候は既に明瞭である。今、５０年先を見据える科学技術が用意しなければならないのは、自然科学や工学だけでなく社会人文科学においても、この人口減時代における社会構造と経済構造の創成と、その産業革命以降では初めて体験する時代への個別コミュニティーの対応法である。本講演では、この状況を踏まえた、持続可能社会のためのエネルギー環境システム創造を論ずる。

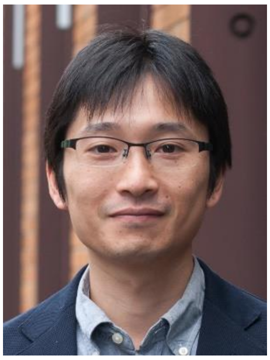
Self-introduction and Poster abstract

Amezawa Lab.

Name	:	Koji Amezawa
Laboratory	:	Amezawa
Course	:	IMRAM & Mech. System Eng.
Hometown	:	Yokkaichi, Mie
Hobby	:	Diet, Muscle training, Running

It's muscle, all is muscle

Pectoral major muscle, trapezius muscle, triangular muscle, latissimus dorsi muscle, erector spinae muscles, rectus abdominis muscle, oblique abdominal muscle, biceps brachii muscle, triceps brachii muscle, gluteus maximus muscle, quadriceps femoris muscle, biceps femoris muscle…..



Name	:	Takashi Nakamura
Laboratory	:	Amezawa-Lab.
Job	:	Assistant Professor
Hometown	:	Sapporo
Hobby	:	Running

I was working on solid state ionic devices and related materials during my undergraduate, Master and Ph.D. courses.

・Search for new mixed conducting oxide anodes for solid oxide fuel cells.

・Estimation of the electrochemically active area in mixed conducting ceria-based anode for solid oxide fuel cells.

・Systematic understanding of the relation between oxygen nonstoichiometry, crystal structure and the electronic structure in layered perovskite oxides.

Recently, I am interested in energy storage devices such as lithium ion battery. I am trying to contribute to the battery research from the view point of solid state ionics. I believe this endeavor will be unique and novel work (hopefully very near future…)

Name	:	Yuta Kimura
Laboratory	:	Amezawa
Course	:	
Hometown	:	Murakami, Niigata
Hobby	:	Weight training, photography

Name	:	Mahunnop Fakkao
Laboratory	:	Amezawa Laboratory
Course	:	Doctoral course (D1)
Hometown	:	Bangkok, Thailand
Hobby	:	Taking photo, Listening Music.

Operando X-ray Absorption Spectroscopy measurement of a positive electrode for the all-solid-state lithium-ion batteries

All-solid-state lithium-ion batteries (ASSLIB) are one of the candidate for the next generation secondary batteries because ASSLIB can overcome serious issues of the conventional type of lithium-ion batteries. However, this technology is still has some serious problem for the practical uses. The large resistance at electrode/solid electrolyte interface is obstructed Li-transport which cause a low power density. Therefore, in this work, we develop a technique for the *Operando* observation of electrode reaction in a positive electrode by using X-ray absorption spectroscopy (XAS). The reaction mechanism in positive electrode will be discussed based on the time-resolved XAS result during charge/discharge processes.

Name : Yusuke Shindo
Laboratory : Amezawa
Course : Grad. Sch. Of Engineering, M2
Hometown : Sapporo
Hobby :

Investigation of the Cr-poisoning mechanism in SOFC cathode by using the patterned thin film electrode

To quantitatively investigate Cr poisoning in an SOFC cathode, we performed electrochemical measurements of a patterned $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ (LSC) thin film electrode at 973K under wet O_2 containing Cr vapor, and following analysis by SEM/EDS, STEM/EDS, and SIMS. Electrochemical impedance spectroscopy measurements showed the time degradation of the electrode reaction resistance caused by Cr poisoning. The Cr-Sr-O deposition was observed on the electrode surface. In some places, Cr seemed to preferentially deposit in the electrochemically active area near the electrode/electrolyte interface, indicating Cr poisoning accompanied by oxygen reduction reaction.

Name : Yuki Shinomiya
Laboratory : Amezawa Lab.
Course : Mechanical Engineering, M1
Hometown : Ibaraki, Japan
Hobby : Yogurt making

Electrolysis of CO_2 using proton conducting electrolyte

Recently, global warming is a world problem. CO_2 is one of the causes of the global warming, and CO_2 reduction is required. Therefore, we tried to conversion of CO_2 into effective energy carriers in proton conducting electrolyte. In this work, Electrolysis of CO_2 is examined using $SrZr_{0.95}Y_{0.05}O_{3-\delta}$(SZY) as electrolyte and Pt as the electrode at 600 ℃. 2%H_2O/H_2 and 100%CO_2 were supplied into the anode and cathode, respectively. In the poster session, results of electrochemical measurements and gas analysis will be given.

Name : Tomomi Sato
Laboratory : Amezawa Lab.
Course : Grad. Sch. of Engineering, M1
Hometown : Tomiya, Miyagi, Japan
Hobby : Music

Creation of new nitride based ionics materials

SOFC is a god electric conversion efficiency fuel cell battery. However, there is the fault that drive temperature is high. Therefore Proton Conductive Fuel Cell where had low drive temperature attracted attention. An oxidized thing has been studied as an electrolyte, but does not lead to practical use widely. Therefore I interest in nitride as a new material. I paid attention to GaN in particular in that. According to the previous study, proton dissolves in Mg doped GaN. I study it whether the proton moves. I experiment on even nitride except GaN in the same way.

Name : Kota Motohashi
Laboratory : Amezawa lab.
Course : Mechanical Engineering
Hometown : Urawa , Saitama
Hobby : soccer

Development of inorganic fast fluoride ion conductor

Tysonite type LaBaF3 has high conductivity and good chemical stability. For device applications, it is necessary to enhance ionic conductivity. For this purpose, the control of grain boundary may be effective. While the grain boundary can be resistive when ionic species migrate through the boundary, the boundary can be fast conduction path when ionic species migrate along the boundary. The effect of grain boundary on the ionic conductivity will be studied by preparing LaBaF3 with different grain size. The gran size is controlled by using Spark Plasma Sintering technique in this study. In the presentation, detail purpose, the result of sample preparation, and future plans will be talked.

Name : Gao Hongze
Laboratory : Amezawa Lab.
Course : Grad. Sch. Engineering
Hometown : Qinghai, China
Hobby : photography, cooking

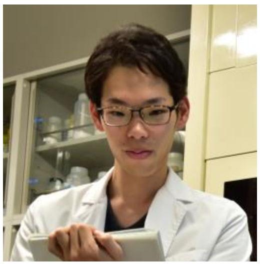
The mechanism of Oxygen-extraction for Lithim rich Li-Mn-Ni-O series cathode material

Li rich Li-Mn-Ni-O series oxides are promising candidate for high capacity cathodes. During the first charge, an oxygen loss proceeds in this material, and their electrochemical properties change drastically. While oxygen loss is important phenomena which significantly affect the electrochemical performance of Li rich cathodes, their mechanism are not well understood at the present stage. In this work, detail oxygen loss behavior is studied for the control of oxygen loss phenomena. In this experiment, the mechanism of oxygen lose, and the influence of electric chemistry with oxygen non-stoichiometry will be studied.

Name : Kazuki Chiba
Laboratory : Amezawa lab.
Course : Grad. Sch. of Engineering, M1
Hometown : Hanamaki, Iwate, Japan
Hobby : Soccer

Investigation of Mechanism of Reaction Distribution Formation in Composite Cathodes for Li Ion Batteries by Using *Operando* 2D-XAS

Lithium-ion batteries (LIBs) are currently growing in popularity for high rate/output applications. However, it is known that, under high rate charging/discharging, the present composite cathodes for LIBs often show lower capacity than expected. One of the reasons of such a capacity loss is reaction distribution formation in the composite cathode. The reaction in the composite cathodes is considered to be strongly influenced by the sluggish ion transport. In this study, we performed *operando* observation of the reaction distribution formation in the composite cathode. Taking the obtained results into account, we discussed the mechanism of the reaction distribution formation in the composite cathode.



Name	:	Keita Mizuno
Laboratory	:	Amezawa Lab.
Course	:	B4
Hometown	:	Tokyo
Hobby	:	Watching fantasy movies

Direct Evaluation of Reaction Distribution in an SOFC Cathode by Using Model Patterned Thin Film Electrode

Solid oxide fuel cell (SOFC) is one of the most promising devices for energy conversion. As an SOFC cathode, mixed ionic/electronic conductor (MIEC) is generally used. In a MIEC cathode, the electrochemical reaction does not progress homogeneously in whole electrode, therefore, reaction in the cathode forms distribution. It is necessary to understand the distribution in detail to optimize its structure for improving the performance of the cathode. However, the distribution has evaluated only indirectly. In this study, the distributions in some electrodes were evaluated directly employing X-ray absorption spectroscopy (XAS). To measure clearly, we created model patterned electrodes. Results are discussed in my poster.

Name	:	Yosuke Matsukawa
Laboratory	:	Amezawa Lab.
Course	:	Mechanical Engineering, B4
Hometown	:	Miyagi, Japan
Hobby	:	Listening to music

The Ionic Conduction of Hybrid Organic-Inorganic Perovskites

Hybrid organic-inorganic perovskites (HOIPs) exhibit semiconducting and light-absorption properties and have been used for dye sensitized solar cells. Recently, Yang, et al reported that $CH_3NH_3PbI_3$ shows mixed ionic/electronic conduction.[1] Although ionic conductivity of $CH_3NH_3PbI_3$ was not high, this work indicated the possibility that HOIPs can be ionic conductors. To find a HOIP ionic conductor, we are synthesizing cubic perovskite NH_4MgX_3 and layer perovskite $(NH_4)_2MgX_4$ (X=F, Cl). Among them, we successfully synthesized almost pure NH_4MgF_3 by solid-state reaction method from NH_4F and basic $MgCO_3$.

[1] T-Y, Yang, G. Gregori, N. Pellet, M. Gratzel, J. Maier, *Angew. Chem. Int. Ed.*, 2015, **54**, 7905-7910

Omata Lab.

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

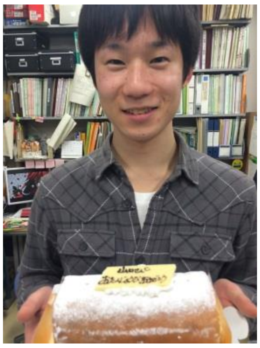
Hobby : Smoking, Drinking

Name : Satoshi Tsukuda
Laboratory : Omata lab.
Course : IMRAM, Assistant Professor
Hometown : Kobe
Hobby : Reading books, Mah - jongg, Cooking (only Chinese fried rice)

Name : Hiraku Nagatani
Laboratory : Omata lab.
Course : Material D3 (of Osaka Univ.)
Hometown : Hikone-shi, Shiga
Hobby : whisky, cooking, eating, sports (active fat!)

Control of the electrical conductivity of wurtzite-type oxide semiconductor β-$CuGaO_2$ and β-$AgGaO_2$

Injection of electronic conduction carriers into β-$CuGaO_2$ and β-$AgGaO_2$ was attempted by impurity doping. β-$NaGaO_2$ precursor, in which Ga were partially substituted with Be or Ti, was prepared and was subjected to ion-exchange of Na^+ ions with Cu^+ or Ag^+ ions. Although the electrical conductivity of β-$CuGaO_2$ did not increase by the Ti-doping, Ti-doped β-$AgGaO_2$ exhibited 5×10^{-2} Scm^{-1} of electrical conductivity that was four orders of magnitude higher than that of undoped β-$AgGaO_2$. Although Be-doping into β-$CuGaO_2$ was successful, increase in the conductivity was very small. This might come from the low crystal quality of the sample.



Name : Takuya Yamaguchi
Laboratory : Omata lab.
Course : Doctoral course (2nd grade)
Hometown : Hirakata, Osaka
Hobby : Music (playing clarinet and saxophone)

New Proton Conducting Phosphate Glass Exhibiting High Conductivity at Intermediate Temperatures under Dry Atmosphere

Proton conducting $36HO_{1/2}$-$4NbO_{5/2}$-$2BaO$-$4LaO_{3/2}$-$4GeO_2$-$1BO_{3/2}$-$49PO_{5/2}$ glass was fabricated by electrochemical substitution of sodium ions with protons. The glass exhibited almost constant proton conductivity of 1×10^{-3} Scm^{-1} at 280 °C for 555 h under dry hydrogen atmosphere, while it gradually degraded at the temperatures higher than 320 °C because of dehydration. The fuel cell consisting of the glass electrolyte, Pd-anode and Pt-cathode was operated at 280 °C. Although the output power was small because of the large cathode overpotential, no distinct change appeared in the glass after the 135 h operation indicating that the glass is stable under the fuel cell operation condition.

Name	: Keigo Miyake
Laboratory	: Omata lab.
Course	: M2
Hometown	: Osaka
Hobby	: Movie

Amorphization induced by substitution of sodium ions with protons observed in $Na_3Zr_2Si_2PO_{12}$ (NASICON)

The electrochemical substitution of Na^+ ions with protons (APS) of $Na_3Zr_2Si_2PO_{12}$ was demonstrated. EDX and IR spectra indicated that the electrochemical substitution was successful, although the region, where the Na^+ ions were completely substituted with protons, was limited around the anode because of the small proton conductivity of the sample after APS. The sample after APS exhibited no X-ray diffraction peak, and its Raman spectrum was significantly broadened. This strongly suggests that the APS induced amorphization of the sample.

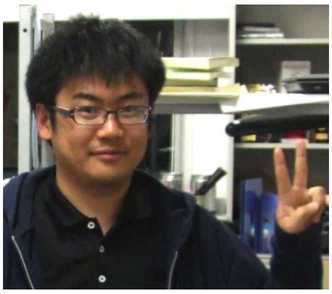
Name	: Ayako Kakinuma
Laboratory	: Omata lab.
Course	: Environmental Studies, M1
Hometown	: Kuki, Saitama
Hobby	: Drinking Japanese sake

Ion-exchange of monovalent M^I-ions in ternary wurtzite oxides, β-M^IGaO_2

Ion-exchange of monovalent M^I-ions in ternary wurtzite β-M^IGaO_2 oxide semiconductors, such as β-$CuGaO_2$ that is expected to be a thin-film solar cell absorber, was studied. The ion-exchange of Na^+-ions in β-$NaGaO_2$ with Cu^+ and Cu^+-ions in β-$CuGaO_2$ with Li^+-ions were successfully developed; however, the ion-exchange, of course, did not develop in the reverse direction. The ionic conductivity of M^I-ions in β-$NaGaO_2$, β-$CuGaO_2$ and β-$LiGaO_2$ was ranked in order of β-$NaGaO_2$ > β-$CuGaO_2$ > β-$LiGaO_2$. This agrees with order of significance in structural deviation of respective materials from ideal wurtzite structure. The driving force of the ion-exchange was discussed based on the understanding obtained in the present study.

Takamura Lab.

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



Name	:	Akira Takano
Laboratory	:	Takamura lab.
Course	:	Materials science
Hometown	:	Niigata, Japan
Hobby	:	Cooking

Lithium-ion conduction in hydrated lithium borohydride

$LiBH_4$ is one of candidate materials for solid electrolyte of lithium secondary battery because it has high lithium-ion conductivity above 115°C. Meanwhile, $LiBH_4$ is also well-known to be easily reacted with water; the hydrated water may affect electrochemical properties of $LiBH_4$. I have been clarified that $LiBH_4 \cdot H_2O$ was produced as a result of reacting with H_2O and it shows higher lithium ion conductivity around room temperature than $LiBH_4$. I will discuss lithium ion conduction property and stabilities of hydrated $LiBH_4$.

Name : Yoshiaki Hayamizu
Laboratory : Takamura Lab.
Course : Materials Science, D2
Hometown : Mitaka, Tokyo
Hobby : Bicycle racing

Oxygen permeation property of surface modified $\mathbf{Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}}$

$Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF) is widely known to exhibit outstanding oxygen permeation property. Further improvement of the oxygen permeation rate of BSCF especially at lower temperatures can be achieved by the enhancement of the surface exchange reaction. Recent studies suggested that the electron transfer from the oxide to adsorbed oxygen species is the rate determining step in the surface exchange reaction and availability of the electron has the important role. In this study, n-type conducting $CoFe_2O_4$ was used to modify the BSCF surface and its effects on the oxygen permeation property were investigated.

Name : Akihiro ISHII
Laboratory : Takamura lab.
Course : Materials Science, D1
Hometown : Sapporo, Hokkaido
Hobby : Visiting museums

Development of Novel Transparent High-Refractive-Index Material

Transparent and high refractive index (n) materials are in demand for use as optical coatings. Up to date, a transparent material having the highest n value is TiO_2, which shows $n_{\square\square=532.1\ \mathrm{nm}}$~2.67 and band gap ($E_g$) ~2.8 eV. If a novel material having both of high n >2.7 and wide E_g >2.8 eV is developed, it extends reflection controllability of the optical coatings. “GaP-based materials” and “nd^{10}-nd^{0} materials” are focused on as candidates, and their optical properties are under investigation using a pulsed laser deposition technique, spectroscopic ellipsometry and DFT calculation.

Name : Tai misaki
Laboratory : Takamura lab
Course : Material
Hometown : Toyama
Hobby : Cycling, Running

NMR study of the local structure and the hydride diffusion in perovskite oxyhydride

Oxyhydride having the H^- ion and O^{2-} ion have attracted much attention because of its unique property, for example high electronic conductivity and H^- diffusion. $BaTiO_{3-x}H_x$ was reported to have H^- ion conductivity. However, the H^- ion diffusion process have not been clarified. Therefore, I focused on the NMR spectroscopy that is the direct observation method of the ligand biding. In this study, the local structure and the H-diffusion was investigated by using ^1H NMR spectroscopy.

Name : Hibiki Ishijima
Laboratory : Takamura Lab
Course : Material science M1
Hometown : Soka, Saitama
Hobby : Kendama

Conductivity enhancement in Doped Ceria Oxide-Carbonates composite

Doped ceria oxide and alkali metal carbonates composite is a candidate material for intermediate temperature solid oxide fuel cell(IT-SOFC) because it shows conductivity enhancement around 400~500℃ which is melting point of carbonates. However, the main carrier or enhancement mechanism has not been clarified yet. Then, in my study, I focus on samarium doped ceria (SDC) and Li,Na,K eutectic carbonate composite and aim to clarify the main carrier at first. For this purpose, I tried to fabricate multi ions blocking layer except oxide ion on the composite by spin-coating. This layer will enable to observe only oxide ion conductivity and its conductivity was investigated by AC impedance measurement.

Name : Hikaru Kobayashi
Laboratory : Takamura lab.
Course : Materials Science, M1
Hometown : Niigata, Japan
Hobby : Baseball, badminton

Preparation of novel ion conductors by ion-exchange technique using $LiBH_4$

Recently, high ionic conductors for all-solid-state lithium battery are demanded. Ion exchange is an exchange of ions between two electrolytes. by ion exchange, synthesis of new substances have been reported. Meanwhile, Lithium borohydride ($LiBH_4$) has high lithium-ion conductivity over 115 °C. In this study, I focused on preparing novel ion conductors by ion-exchange technique using high lithium ionic conductor $LiBH_4$. This preparation method is new, the preparation of novel ion conductors is expected.

Name : Yukio Cho
Laboratory : Takamura Lab
Course : M1
Hometown : Saitama
Hobby : Soccer, Swimming, Motorbike

Mixed Ionic Electronic Conductivity of $Ba_{0.9}Nd_{0.1}In_{1-x}Mn_xO_{3-\delta}$

Reducing the operating temperature of Solid Oxide Fuel Cell (SOFC) has been researching for several decades and the increasing cathode polarization resistance at intermediate temperature regime still has not solved yet. Recently, a study of $SrTi_{1-x}Fe_xO_{3-\delta}$ demonstrated that the surface exchange rate of cathode is governed by the concentration of excited electrons in the conduction band, which suggests the potential superiority of n-type mixed oxide ionic conductor (MIEC). However, the n-type and oxide ionic conductivity are almost incompatible in high pO_2 regime like air and the stable n-type MIEC for SOFC cathode is never reported publically. In this research, the novel n-type MIEC is explored by doping donor elements to high oxygen-deficient perovskite compound; Brownmillerite structure $Ba_2In_2O_5$.

Name	:	Yuto Tomura
Laboratory	:	Takamura Lab.
Course	:	Mater. Sci. and Eng. (M1)
Hometown	:	Chiba
Hobby	:	Novel, Movie, Fleet Simulator

Electrical Conduction Properties of Bi-Sr-Fe-Based Perovskite-Type Oxides at High Temperature

Perovskite-type $Bi_{1-x}Sr_xFeO_{3-\delta}$ (BSF), P-type mixed ionic-electronic conductor, shows high oxide ion conductivity and good chemical stability; therefore, it is considered as a promising material for cathode of solid oxide fuel cell and oxygen permeable membrane. Interestingly it was reported that a sample with x = 0.3 showed electrical conductivity jump around 770°C; however, its mechanism has not been clarified. The purpose of my study is to obtain the knowledge of electrical conducting mechanism and defect equilibrium of BSF by investing its electrical conduction properties at high temperature.

Yugami Lab.

Name	: Hiroo Yugami
Laboratory	: Yugami･Shimizu Lab
Course	: Mechanical Systems Engineering
Hometown	: Fukui
Hobby	: Tennis

Name	: Shinpei Takahara
Laboratory	: Yugami,Shimizu/Iguchi_lab
Course	: M2
Hometown	: Niigata city, Niigata
Hobby	: Beer

Development of power source for mobile electronic devices using micro-SOFC

Many people are not satisfied with battery equipped in mobile electronic devices such as smart phones. As one solution for this problem, there is a method that micro-SOFC which has high energy density is applied. To equip these electronic devices with micro-SOFC, it must be considered that not only miniaturization and improvement of cell durability but also its thermal design. The thermal design means that cell working temperature is maintained by cell generation heat, liquid fuel is vaporized and reformed at working temperature, and package surface temperature is lowered by insulation structure. This time, I will present about thermal design of micro-SOFC system.

Name : Tomoya ABE
Laboratory : Yugami･Shimizu/Iguchi Lab.
Course : Mechanical Systems Engineering
Hometown : Tochigi
Hobby : Driving Car, Audio

Study of Reduction Behavior of $Sm_{0.2}Ce_{0.8}O_{1.9}$ Compounded with MgO

My research is controlling electronic conductivity of Samarium doped Ceria (SDC) in reductive atmosphere at 800℃ focusing on reduction behaviors of SDC which is a candidate for electrolytes of SOFC. Requirements for electrolytes of SOFC are having high ionic conductivity and hardly electronic conductivity. However, electronic conductivity of SDC increases when it exposures to reductive atmosphere at high temperature with volume expansion. There is a possibility that controlling volume expansion of SDC causes less increment of electronic conductivity of SDC. We are trying controlling volume expansion of SDC by introducing interface stress to SDC lattice by compounding with MgO which has nearly no reduction expansion and reactivity with SDC.

Name : Koki Kato
Laboratory : Yugami･Shimizu/Iguchi lab
Course : Mechanical Systems Engineering
Hometown : Miyagi
Hobby : Cycling

Durability Improvement of Micro SOFC by Introducing Porous Silicon Supporter

Micro-SOFC is aimed for low operating temperature by reducing electrolyte thickness and paid attention as an alternative power source of small electric devices. A thin film of micro-SOFC is easily broken by various factors such as sputtering process, temperature change in power generation. So it is necessary to improve the cell durability. To solve this, I tried to support a thin film cell directly by porous silicon and increase cell area. Porous silicon has vertical macro pore (100~200nm) with gas permeability in its structure. In this study, I investigated new micro-SOFC fabrication process using porous silicon.

Name : Yusuke Suzuki
Laboratory : Yugami, Shimizu / Iguchi lab
Course : Mechanical Systems Engineering
Hometown : Iwate
Hobby : History of Sengoku period

Development of IT-SOFC/SOEC with perovskite-type protonic conductors

SOFC and SOEC are attracted for a power storage system with hydrogen produced from renewable energies. Recently, many researchers tried to lower the operating temperature to improve durability, start-up time and so on. I focused on perovskite-type protonic conductors based on $LaScO_3$ and $BaZrO_3$ which exhibit higher ionic conductivities than the conventional electrolytes, such as yttria-stabilized zirconia in the intermediate temperature. The purpose of my research is improving the cell performance using them as electrolytes. I have fabricated fuel electrode-supported-type cells using $La_{0.675}Sr_{0.350}Sc_{0.98}Co_{0.02}O_{3-\delta}$ (LSSC350) and $BaZr_{0.85}Y_{0.15}O_{3-\delta}$ (BZY15) with PLD method and have evaluated it by power generation and electrolysis tests.

Kawada Lab.

Name : Tatsuya Kawada
Laboratory : Distributed Energy Systems Lab.
Course : Dept. Environmental Studies for Advanced Society, Graduate School of Environmental Studies
Hometown : Gunma Prefecture
Hobby : Drinking and Eating

Name : Keiji Yashiro
Laboratory : Kawada・Hashimoto/Yashiro lab.
Course : Environmental Studies
Hometown : Kanagawa, Japan
Hobby : Reading, Jog, Art appreciation

Name : Shin-ichi Hashimoto
Laboratory : Kawada・Hashimoto/Yashiro Lab.
Course : Department of Environmental Studies for Advanced Society
Hometown : Hokkaido
Hobby : Picture-book reading
/Soul Music (Love "The O'jays")
/ Playacting as "Shinkan-sen."

Name : Xingwei WANG.
Laboratory : Kawada Lab.
Course : Environmental Studies, D3
Hometown : Anhui Province, China.
Hobby : Sport and tour.

Stability of LSCF6428 under oxygen potential gradient

Currently, LaxSr1−xCoyFe1−yO3−δ (LSCF) is under intensive research as a potential anode, or air electrode, material for SOEC to replace traditional LSM electrode. As a mixed ionic and electronic conductor (MIEC) with high catalytic activity, LSCF performs much better than LSM as cathode in SOFC. However, the stability of LSCF as air electrode has yet to be thoroughly verified experimentally. Here I'm focus on the origin of the kinetic differences between the A-site and B-site rich LSCF6428 material as SOFC cathode, induced by the Oxygen pressure and annealing temperatures. For this purpose, the surface microstructure and microchemistry arising from the cation segregation were analysised.

Name : Zhao Fei
Laboratory : Kawada lab
Course : Environmental studies of advanced society
Hometown : China
Hobby : Table tennis, Piano

Microstructural changes of porous nickel during low temperature oxidation

SOFC anode material requires good mechanical stability under SOFC operation situations. Thermal expansion coefficient of Ni/YSZ is usually similar with electrolyte material YSZ, so the volume change caused by temperature change will not cause serious impaction to cell, but in some special cases that the anode material contract during re-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 finding a model to clarify the mechanism of the special contraction phenomenon and confirm the model by observing its microstructural changes during low-temperature re-oxidation procedure.

Name : Hiroki Akabane
Laboratory : Kawada Lab
Course : Environmental Studies M2
Hometown : Ibaraki, Japan
Hobby : Futsal, Manga, Mah-jong

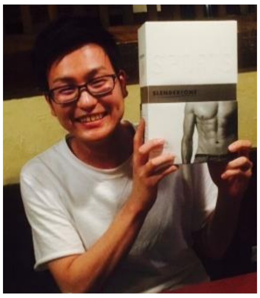
Electrode degradation mechanism under SOEC operation

The hydrogen production by solid oxide electrolysis cell (SOEC) is one of possible options for efficient use of surplus power of renewable energy. However, SOEC have problems of long-term durability and stability. It is essential to understand the degradation phenomena correctly. So the purpose of this study is to clarify mechanism of degradation phenomena under SOEC operation. Degradation test was performed by retaining SOEC operation over 100 h at 1073 k to evaluate the time course of the resistance and capacitance. The cross-section of the cells before and after the test was observed by SEM/EDX in order to evaluate the time course of the microstructure.

Name : Kouhei Shishido
Laboratory : Kawada Lab.
Course : Environmental Studies, M2
Hometown : Kanagawa, Japan
Hobby : Soccer, Running

Characterization of the ferroelastic behavior of $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$

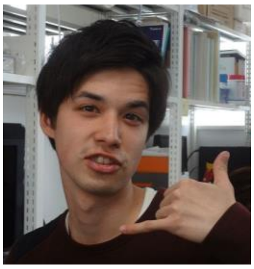
Abstract…The mechanical properties or the behavior under the stress of components of solid oxide fuel cells (SOFCs) should be understood to suppress mechanical failures. For above background, our group investigated the Young's modulus of $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ (LSCF) at high temperatures by the resonance measurement. It was found that the mechanical properties of LSCF depended on environment (temperature, oxygen partial pressure) and that LSCF showed the ferroelastic behavior. It isn't clear how the ferroelastic behavior influences on SOFCs because there are few data about it. In this study, the ferroelastic behavior is characterized by using Electron Backscatter Diffraction (EBSD).



Name : Noda Shunsuke
Laboratory : Kawada lab
Course : Environmental studies M2
Hometown : Hyogo
Hobby : Tennis, Beer,

Title : Cathodic reaction of $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ on proton-conducting electrolyte $SrZr_{0.9}Y_{0.1}O_{3-\delta}$ under fuel cell condition

Cathodic reaction of protonic ceramic fuel cells (PCFCs) using $SrZrO_3$ based proton conducting electrolyte with perovskite oxide cathode was studied. At cathode, pattern electrode $La_{0.6}Sr_{0.4}CoO_3$ (LSC) was made on $SrZr_{0.9}Y_{0.1}O_3$ (SZY) electrolyte. Pattern electrode is dense electrode controlled length of triple phase boundary. PCFC has possibilities to conduct proton, oxygen and hole. Moreover, it showed under oxidant atmosphere there is large effect of hole. Therefore the pattern electrode LSC was measured by impedance spectra and DC polarization measurement under fuel cell condition. The result of the experiment will be discussed in order to evaluate cathodic performance.



Name : Dan Nonami
Laboratory : Kawada Lab
Course : Environmental Studies, M1
Hometown : Matsuyama
Hobby : Pokemon GO

Modification of oxygen potential at (La,Sr)CoO(3-δ) electrode surface

In previous study, electrochemical measurements were performed using a cell which have a $La_{0.6}Sr_{0.4}CoO_3$ film electrode fabricated on a CeO_2 electrolyte by using a Pulsed Laser Deposition(PLD) and at the same time, the oxygen potential on the electrode was monitored, and it showed the interesting result which is that the oxygen chemical potential drastically changes at the surface of LSC. Based on that, I tried electromotive force measurements using Porous Oxygen Sensor(POS) which putted on the LSC surface as a surface prove and analyzed the modification of oxygen potential at (La,Sr)CoO(3-δ) electrode surface.

Name	: Mitsuki Haga
Laboratory	: Kawada lab
Course	: Environmental studies
Hometown	: Gumma, Japan
Hobby	: running!

Suppression effect of carbon deposition on Ni by coexisting oxides

The risk of carbon deposition on an anode is concerned one of the serious degradation factors for its performance, reliability, and durability. Y. Jin et al. reported that adding $SrZr_{0.95}Y_{0.05}O_{3-\sigma}$ (SZY) which has proton conductivity to Ni/YSZ cermet is effective to suppress carbon deposition. In our previous study, suppression effect of carbon deposition on Ni by coexisting oxides was examined under low steam carbon ratio condition, and SZY showed relatively low carbon deposition rate even without electrochemical steam supply. This study examines the factors necessary for suppression of carbon deposition by SZY on Ni/SZY cermet. Carbon.

Name	:Hiroshi Chiba
Laboratory	:Kawada Lab
Course	:EnvironmentalStudies,M2
Hometown	:Tokyo Japan
Hobby	:looking after my frog

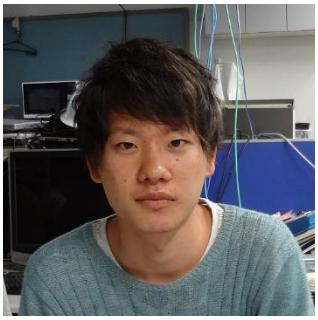
Evaluation of surface exchange coefficient of SOFC cathode materials by pulse isotope exchange

LSC64 has been recognized as good cathodes for SOFC. Their high oxide ion conductivity makes oxygen reduction reaction possible to occur not only at triple-phase boundary but also on two-phase boundary of an electrode and gas phase. Thus, it is important to study the surface exchange kinetics to understand the surface oxygen reduction process. In this study, we attempted to determine the surface exchange kinetics by pulse isotope exchange. This is comparatively new method to determine k* by observe the sample response when 16 Oxygen exchanged by the isotope. The response and k* will be discussed in this study.

Name	:	Tomohiro Kori
Laboratory	:	Kawada Lab.
Course	:	Environmental Studies, M2
Hometown	:	Miyagi, Japan
Hobby	:	Volleyball, VideoGame

Investigation of Mechanical Properties of ZrO_2 Based Oxides at High Temperature

Our group investigated the mechanical properties of SOFC ZrO_2 Based Oxides at high temperatures and under controlled atmospheres. $(Sc_2O_3)_{0.1}(ZrO_2)_{0.9}$ (ScSZ) and $(Sc_2O_3)_{0.1}(ZrO_2)_{0.89}(CeO2)_{0.01}$ (ScCeSZ) has found to not show the usual elastic modulus by phase transition. Also, ScSZ and ScCeSZ might have ferroelasticity in low symmetry phase. In this experiment, the elastic modulus of ScSZ and ScCeSZ was evaluated by resonance method and uniaxial compression test. As a result, it found ferroelasticity of ScSZ and ScCeSZ in low symmetry phase at uniaxial compression test. It was found ScSZ and ScCeSZ have ferroelasticity in rhombohedral. When ScCeSZ have many rhombohedral, it was found clearly ferroelasticity.



Name	:	Uchi Takayasu
Laboratory	:	Kawada laboratory
Course	:	Environmental studies M1
Hometown	:	Chiba,Japan
Hobby	:	guitar

Elucidation of the deterioration in the fuel electrode of the solid oxide electrolysis cell

Over the past few years, there has been an increased interest in solid oxide electrolysis cell(SOEC). SOEC is the device that electrolyzes water vapor at high temperature and can product hydrogen with high efficiency. But, for practical use, durability is one of the critical issue and mechanism of degradation is not evident yet. Generally, Ni/YSZ is used as a fuel electrode material of SOEC, and my study have focused on that. This study was conducted to evaluate the fuel electrode degradation by using electrochemical techniques in long-term durability test. Furthermore, scanning electron microscopy(SEM) was carried out to investigate microstructural changes after long-term durability test.

Name : Sakuraba Junihci
Laboratory : Kawada laboratory
Course : Environmental Engineering
Hometown : Akita
Hobby : Tennis

Title: Development of high performance cathode for SOFC

My study is about high performance cathode of SOFC. High performance cathode will realize lower costs and smaller size of SOFC, and resolve problems of components' durability. At cathode, activation energy for the surface reaction (oxygen reduction) is large. Focusing porous and composite electrode, I prepared composite electrodes of LSC and GDC on GDC pellets. Through impedance spectroscopy and the analysis, 60:40 composite for volume ratio showed 1 Scm^{-2} at 773K, which was the highest conductivity of all composite electrodes. Besides, activation energy at surface of composites got smaller than that of single phase LSC electrode. Results in this work indicated there were catalytic effect of GDC particles.

Name : Takaya Hoshi
Laboratory : Kawada Lab.
Course : M1
Hometown : Fukushima
Hobby : Magic

Evaluation of the reaction site of $La_{0.6}Sr_{0.4}CoO_3$ Cathode with model electrode

$La_{0.6}Sr_{0.4}CoO_3$ (LSC-64), cathode material for SOFC, has two reaction sites for cathode reaction because it can conduct not only electron but also oxygen ion. One of two reaction sites is surface, and another is triple phase boundary (TPB) where electrode, electrolyte and gas meet. Generally, it's thought that main reaction site of LSC-64 is surface, and it's not clear how does TPB contribute to cathode reaction. I make dense film cathodes with different TPB length on $Ce_{0.9}Gd_{0.1}O_{1.95}$ electrolytes, and compare the performance of them to evaluate contribution of TPB to cathode reaction.

Name : Tenyo Zukawa
Laboratory : Kawada Lab
Course : Environmental Studies , M1
Hometown : Saitama Japan
Hobby : triathlon

Measuring distribution in SOFC

Recent years, environmental and energy problem become serious and it is necessary to resolve that as soon as possible. SOFC attracts attention as an effective device to help resolving. In order to spread popularization of SOFC, it needs to improve durability and reliability, but it’s difficult to find damages of cell at operation condition. Some attempts have been made to evaluate temperature or current distribution in the cell applying simulation. Simulating distribution is useful to achieving high durability and reliability, and it needs to measure distribution using direct observation to make simulation accurate. In my research, I measured current distribution of tubular cell.

Name : Arthur Bourdon
Laboratory : Kawada Laboratory
Course : Environmental Studies, M1
Hometown : Calais, France
Hobby : Swimming, coding, traveling.

Electrochemical Potential Simulations in Proton-Conducting Fuel Cells

Proton-Conducting Fuel Cells (PCFC) have recently attracted attention because of the high efficiencies they could achieve. This type of fuel cell uses a nonconventional solid electrolyte which conducts H^+ protons while maintaining residual conductivities of other species. This allows the cells to operate at lower intermediate temperatures, with obvious advantages in terms of mechanical resistance. In order to achieve a better understanding of the transport properties of such cells, numerical simulations of electrochemical potentials are performed. It involves taking into account three chemical species simultaneously, building an adequate physical model and implementing numerical resolution methods. Methods based on direct resolution as well as circuit analogies are presented.

Name : Shun Hatakeyama
Laboratory : Kawada・Hashimoto/Yashiro Lab.
Course : Environmental Studies, M1
Hometown : Akita, Japan
Hobby : Basketball, Darts

High-temperature steam electrolysis in the co-existence with CO_2 by using Solid Oxide Electrolysis Cells

High-temperature steam electrolysis in the co-existence with CO_2 (co-electrolysis) is expected to be a method to decompose CO_2. However, the mechanism and performance of co-electrolysis have not been explained in detail. In this study, the performances of co-electrolysis for different atmospheres are investigated at 1073K by using electrochemical cells which consist of Ni/$Y_{0.16}Zr_{0.84}O_{1.92}$(Ni/YSZ) cathode, $Y_{0.16}Zr_{0.84}O_{1.92}$(YSZ) substrate, and $Gd_{0.1}Ce_{0.9}O_{1.95}$(GDC) interlayer, $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ (LSCF) anode. The Ni/YSZ electrode reaction was measured by AC impedance measurement and DC polarization measurement. The Ni/YSZ electrode surfaces after experiments were observed by using FE-SEM. The results suggested that the shapes of I-V curves in no CO_2 atmosphere differ from shapes of CO_2 atmosphere, and no steam dependence of co-electrolysis is observed.

Kawamura Lab.

Name : Naoaki Kuwata
Laboratory : Kawamura Lab.
Course : Associate Professor
Hometown : Tokyo (Hachioji)
Hobby : Manga, Anime, Motorcycle

Name : Ishigaki Norikazu
Laboratory : Kawamura lab
Course : physics, D1
Hometown : Hyougo
Hobby : Cooking

Electric chemical property of $LiCoMnO_4$ cathode thin-film by annealing

There is much social interest in developing improved Lithium battery for use in portable electronic devices and for large scale. Requirements for advanced lithium batteries include high energy and power density, voltage etc.
Cathode material $LiCoMnO_4$ which has operating potential high voltages (5.1V) in the cathode materials and more capacity than $LiCoO_2$ is able to satisfy these requirements.

In this study, we report the results of $LiCoMnO_4$ thin-film cathode prepared by post annealing in oxygen atmosphere. The electrochemical properties of $LiCoMnO_4$ were studied to show a correlation between the capacity in the 5-V region and the effect of annealing.

Name : Masakatsu Nakane
Laboratory : Kawamura Lab.
Course : Physics, M2
Nationality : Japan
The others : None in particular

Diffusion coefficient of Li in $LiMn_2O_4$ measured by SIMS

$LiMn_2O_4$ has been researched actively as a cathode material for lithium-ion battery because of its rich abundance on the Earth. $LiMn_2O_4$ has a spinel-structure and has attracted interest by its physical properties. In this study, $^6LiMn_2O_4$ was fabricated by solid-phase synthesis as a target and $^6LiMn_2O_4$ thin film was deposited by pulsed laser deposition method with ArF excimer laser. Through Li exchange by cyclic voltammetry or dipping into electrolytic solution, $^6Li-rich$ and $^7Li-rich$ parts of the thin film was made. After heat treatment at 600℃~room temperature, Li isotopic ratio was determined by secondary ion mass spectrometry (SIMS). The diffusion coefficient was calculated by means of the diffusion equation using the profile of the Li isotopic ratio.

Name : Shotaro Endo
Laboratory : Kawamura Lab.
Course : Physics, M1
Hometown : Akita, Japan
Hobby : Golf

Visualization of liquid flow by MRI

Nuclear magnetic resonance imaging (MRI) is a method to create pictures of nuclear spin density with static and gradient magnetic field. In general, the spin density is obtained from detected signals of transverse magnetization through Fourier transformation. The signal intensity changes due to various artifacts caused by motion. In this study, we visualized water flow in a tube by MRI, and confirmed the motion artifact so-called *the ghost*. The ghost appears because of the spin phase effect. This visualization experiment of water flow was made under the condition which eliminated the influence of the ghost.

Name	:	Gen HASEGAWA
Laboratory	:	Kawamura Lab.
Course	:	Physics, M1
Hometown	:	Niigata, Japan
Hobby	:	Skiing

Direct measurement of lithium-ion diffusion coefficient of $LiCoO_2$ by SIMS

It is said that lithium-ion diffusion in solid is closely related to charging rate of lithium-ion batteries. So it is important to be able to measure the lithium-ion diffusion in solid accurately. In this study, I have directly measured the diffusion coefficient of $LiCoO_2$ that is major positive electrode material for lithium-ion batteries by secondary ion mass spectrometry (SIMS). I partially exchanged the lithium in the $LiCoO_2$ thin film for the 6-lithium by charging and discharging half of the film in the $^6LiClO_4$ electrolytic solution. After that, I measured the concentration distribution of 6-lithium by SIMS, and calculated the diffusion coefficient based on the solution of one-dimensional diffusion equation.

Name	:	Daiki Maeda
Laboratory	:	Kawamura Lab
Course	:	Physics M1
Hometown	:	Saitama, Japan
Hobby	:	soccer

Measuring of lithium diffusion in $LiCoO_2$ and $LiMn_2O_4$

Lithium ion batteries are applied in various situations of life. Ionic conductivity and electronic conductivity of the positive electrode material is a major factor in determining the charge / discharge rate. For the improvement of power density and high-rate charge / discharge, fast ion diffusion is essential. In this study, I have measured diffusion coefficient of $LiCoO_2$ and $LiMn_2O_4$ which are a potential positive electrode material for lithium ion battery by Potentiostatic Intermittent Titration Technique (PITT) . PITT is a method for obtaining a diffusion coefficient from the time variation of the current when changing the potential.

Room assignment

320	長谷　拓	羽賀　光紀	畠山　竣	戸村勇登	本橋宏大	鈴木　優介
	小俣研	川田研	川田研	高村研	雨澤研	湯上研
321	山口　拓哉	千葉　洋	高野　彬	石垣　範和	郜 洪澤	
	小俣研	川田研	高村研	河村研	雨澤研	
322	三宅　啓吾	桑折　智大	早水　良明	中根　正勝	千葉一暉	
	小俣研	川田研	高村研	河村研	雨澤研	
323	趙　飛	内　尚泰	石井　暁大	遠藤翔太郎	水野敬太	
	川田研	川田研	高村研	河村研	雨澤研	
324	赤羽根広樹	櫻庭　惇一	三崎　汰	長谷川　源	松川陽介	
	川田研	川田研	高村研	河村研	雨澤研	
325	宍戸　康平	星　貴也	石島　響	前田　大輝	高原　伸平	
	川田研	川田研	高村研	河村研	湯上研	
326	野田　俊介	頭川　天洋	小林　洸	Mahunnop Fakkao	阿部　知也	
	川田研	川田研	高村研	雨澤研	湯上研	
327	野並　暖	Bourdon Arthur	張　幸夫	進藤　勇佑	加藤　晃基	
	川田研	川田研	高村研	雨澤研	湯上研	

420	小俣先生	雨澤先生	水崎先生		
	小俣研	雨澤研			
421	高村先生	湯上先生	川田先生		
	高村研	湯上研	川田研		
422	八代先生	橋本先生	桑田先生		
	川田研	川田研	河村研		
423	佃先生	中村先生	木村先生		
	小俣研	雨澤研	雨澤研		
427	柿沼　綾子	王　興偉	四宮　由貴	佐藤　智美	安藤様
	小俣研	川田研	雨澤研	雨澤研	