アカデミックプログラム［Ｂ講演］ | 21. エネルギーとその関連化学，地球・宇宙化学：口頭Ｂ講演

2026年3月17日(火) 13:00 ~ 15:40 | A1453（14号館 [5階] 1453）

[A1453-1pm] 口頭Ｂ講演

座長：久保 貴哉、福 健太郎

日本語

13:00 ~ 13:20

[A1453-1pm-01] Cuフェライト触媒による光アシストCO_2電解酢酸生成の選択性と安定性の向上

〇加藤 直彦[1]、佐伯 周[1]、西村 友作[1]、竹田 康彦[1]、森部 真也[1] (1. 株式会社　豊田中央研究所)

英語

13:20 ~ 13:40

[A1453-1pm-02] リン酸系電解液におけるPbハイドロキシアパタイト触媒によるCO_2電解

〇岩本 俊太[1]、岡崎 めぐみ[1]、前田 和彦[1] (1. 東京科学大学)

英語

13:40 ~ 14:00

[A1453-1pm-03] 三元系白金-ガドリニウム-ロジウム合金ナノ粒子の調製と燃料電池酸素還元反応特性

〇森山 拓海[1]、郵次 智[1]、唯 美津木[1,2] (1. 名大院理、2. 名大物国セ)

英語

14:00 ~ 14:20

[A1453-1pm-04] 単層カーボンナノチューブ担持白金電極触媒の合成と水電解セルへの応用

〇佐藤 勝一[1]、Miftakhul Huda[1]、Justin Junita[2]、山田 貴穂[3]、橋本 剛[3]、平岩 千尋[4]、川角 昌弥[1,2]、松尾 豊[1,2] (1. 名古屋大学大学院工学研究科、2. 名古屋大学未来社会創造機構、3. 株式会社 名城ナノカーボン、4. 関西電力株式会社 水素事業戦略室)

英語

14:20 ~ 14:40

[A1453-1pm-05] 高精度気泡発生分光計測による電気化学酸素発生機構の解明

〇芦澤 大輝[1]、丁 曽竜[1]、板谷 昌輝[2]、福島 知宏[2,3]、村越 敬[2] (1. 北海道大学大学院総合化学院、2. 北海道大学大学院理学研究院、3. JST-さきがけ)

英語

14:40 ~ 15:00

[A1453-1pm-06] 放電により生成したプラズマ中の原子状窒素と水とのP/L反応によるアンモニア合成機構の解明

〇吉田 蒼馬[1]、村上 直也[1]、髙辻 義行[1]、春山 哲也[1] (1. 九州工業大学大学院)

英語

15:00 ~ 15:20

[A1453-1pm-07] 溶解性改善を指向したエチレンジアンモニウム塩のカウンターアニオン交換とペロブスカイト太陽電池への効果

〇長谷川 晃央[1]、田中 颯人[1]、平 翔太[1]、松重 優子[1]、Chien-Yu Chen[1]、中村 智也[1]、Minh Anh Truong[1]、Richard Murdey[1]、若宮 淳志[1] (1. 京大化研)

英語

15:20 ~ 15:40

[A1453-1pm-08] Sustainable thermoelectric materials fabricated using high entropy perovskite oxynitride nanoparticles as building blocks

〇Simon David Moore[1], Mari Takahashi[1], Jun Uzuhashi[2], Tadakatsu Ohkubo[2], Koichi Higashimine[3], Shinya Maenosono[1] (1. School of Materials Science, JAIST, 2. Res. Cntr. Magnetic and Spintronic Materials, NIMS, 3. Cntr. Nano Materials and Technology, JAIST)

Cu フェライト触媒による光アシスト CO_2 電解酢酸生成の選択性と安定性の向上

（豊田中研 [1]）○加藤直彦 [1]・佐伯周 [1]・西村友作 [1]・竹田康彦 [1]・森部真也 [1]

Enhanced selectivity and stability of acetate production by photo-assisted CO_2 electrolysis using Cu ferrite catalyst

([1] Toyota Central R&D Labs., Inc.) ○Naohiko Kato*, Shu Saeki, Yusaku F. Nishimura, Yasuhiko Takeda and Shinya Moribe.

High solar-to-chemical conversion efficiencies have been demonstrated for artificial photosynthetic reactions producing C1 compounds such as formate 1). However, highly selective production of specific C2 compounds including ethylene, ethanol, and acetate remains challenging. We found that Cu ferrite ($CuFe_2O_4$) catalyst produced acetate with a high faradaic efficiency (FE) over 90% through photo-assisted CO_2 electrolysis, in which light illumination notably enhances the acetate FE compared with that in the dark 2) (Fig. 1). One of the drawbacks of a conventional $CuFeO_2$ catalyst is instability, leading to precipitation of metal Cu particles and leaching of Fe ions into the electrolyte, that lowers the FE during the operation, along with a low initial FE. By contrast, the $CuFe_2O_4$ catalyst was stable; no precipitation of metal Cu or leaching of Fe ions was observed. Introduction of CuO into $CuFe_2O_4$ doubled the current density while retaining the high FE, because the CuO functioned as a conductive additive.

Keywords: Artificial photosynthesis; Solar fuels; photo-assisted CO_2 electrolysis; Acetate; Cu ferrite.

人工光合成的にギ酸などの C1 化合物を生成する反応については、高い太陽光−化学エネルギー変換効率が実証されてきた 1)。一方、エチレン、エタノール、酢酸などの特定の C2 化合物を高選択的に生成するのは容易ではない。我々は、Cu フェライト（$CuFe_2O_4$）触媒を用いると、酢酸生成のファラディー効率（FE）が暗所に比べて光照射により向上する光アシスト CO_2 電解により 90%以上の高い FE で酢酸を生成することを見出した 2) (図 1)。従来の触媒である $CuFeO_2$ では、初期の FE が低い上に、反応中に金属 Cu 粒子が析出、Fe イオンが電解液に溶出し、酢酸 FE が低下した。これに対し、$CuFe_2O_4$ は安定であり、Cu 析出や Fe 溶出は観察されなかった。更に、CuO を混合すると、これが導電助剤として機能し、その結果高い FE を維持しながら電流密度が約 2 倍にまで増加した。

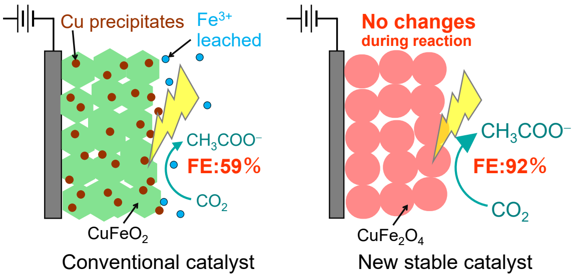


Fig.1 Newly developed $CuFe_2O_4$ catalyst demonstrating stable photo-assisted CO_2 electrolysis to produce acetate with a high Faradaic efficiency exceeding 90%, compared with a conventional $CuFeO_2$ catalyst.

1) N. Kato, et al., *ACS Sustain. Chem. Eng.*, **2021**, 9,16031.
2) N. Kato, et al., *J. Mater. Chem. A*, **2025**, https://doi.org/10.1039/D5TA06122A.

Electrochemical CO_2 reduction on Pb hydroxyapatite electrocatalyst in phosphate-based electrolyte

([1]*School of Science, Institute of Science Tokyo*) ○Shunta Iwamoto,[1] Megumi Okazaki,[1] Kazuhiko Maeda[1]

Keywords: *Electrochemical CO_2 reduction, Lead Hydroxyapatite*

Electrochemical CO_2 reduction has garnered attention because it can convert CO_2 into valuable chemicals using renewable energy sources. Pb(II)-based materials are promising electrocatalysts that can selectively produce formic acid or formate. In Pb(II)-based systems, suppressing self-reduction to metallic Pb is crucial because Pb promotes the undesirable hydrogen evolution reaction. Under typical conditions in KOH or $KHCO_3$ aqueous solutions, they often decompose into lead carbonate, which acts as the actual active species.1) Therefore, suppressing the formation of lead carbonate and stabilizing other phases could open the way to developing new catalysts. In this study, we performed CO_2 electrolysis in various electrolytes and found that Pb hydroxyapatite (Pb-HAP) is a stable active phase and produces formate selectively in phosphate-based electrolytes.

Pb-HAP powder was synthesized by mixing aqueous solutions of Pb(II) acetate and $Na_2HPO_4 \cdot 12H_2O$. Then, a catalyst ink was prepared by dispersing Pb-HAP powder, Ketjen Black, and binder (Sustainion® dispersion) in a mixture of ethanol and water. The ink was coated onto carbon paper and dried to prepare the working electrode. Using the electrode, constant potential electrolysis was performed in an H-type cell. Ag/AgCl and Pt were used as reference and counter electrodes. CO_2-saturated 0.2 M $KHCO_3$ aqueous solution, 0.1 M K_2HPO_4 aqueous solution, and others were used as catholytes.

CO_2 electrolysis in both electrolytes mainly produces formate, and the Faradaic efficiencies exceed 80%. (Figure 1a). However, for the electrode after the reaction in 0.2 M $KHCO_3$ aqueous solution, the X-ray diffraction (XRD) pattern shows that Pb-HAP decomposes, forming $PbCO_3$ and Pb (Figure 1b, red). By contrast, in the case of 0.1 M K_2HPO_4 aqueous solution, Pb-HAP retains its crystal structure without the formation of $PbCO_3$ or Pb (Figure 1b, blue). Therefore, Pb-HAP is a stable active phase that can produce formate with high Faradaic efficiencies in phosphate-based electrolytes.

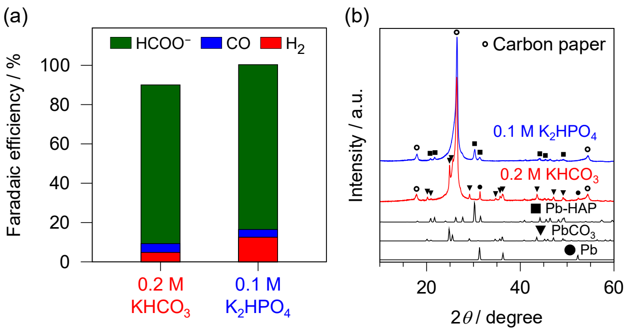


Figure 1. (a) Faradaic efficiencies and (b) XRD patterns of the electrodes after the electrolysis in each electrolyte at −1.0 V vs. RHE for 120 min.

1) Y. Shi et al., *Nat. Commun.* **2020**, *11*, 3415.

Preparation and Oxygen Reduction Reaction Electrocatalysis of Platinum-Gadolinium-Rhodium Alloy Nanoparticles

([1]*Dept. Chem., Grad. Sch. Sci., Nagoya Univ.*, [2]*RCMS, Nagoya Univ.*)
○Takumi Moriyama,[1] Satoshi Muratsugu,[1] Mizuki Tada[1,2]

Keywords: Platinum; Gadolinium; Rhodium; Alloy Nanoparticle; Electrocatalyst

Platinum (Pt) - gadolinium (Gd) alloys are expected to be efficient oxygen reduction reaction (ORR) electrocatalysts. We succeeded in preparing HMCS-supported Pt$_2$Gd alloy nanoparticle electrocatalysts (**Pt$_2$Gd/HMCS**) with narrow size distribution from Pt and Gd organometallic complexes, and the prepared catalyst was found to exhibit high ORR activity and durability compared with Pt catalyst on HMCS.[1] Since the incorporation of the third metal species to Pt-transition metal alloy nanoparticles was reported to be one of the effective modification methods to improve electrocatalytic property of Pt catalysts,[2] we investigated the preparation of Pt-Gd-Rh alloy nanoparticles as more efficient ORR electrocatalysts than Pt-Gd alloy nanoparticles by incorporating rhodium (Rh) as the third metal species.

Pt, Gd, and Rh organometallic complexes, (1,5-cyclooctadiene)dimethylplatinum(II), *tris*(tetramethylcyclopentadienyl)gadolinium(III), and chloro(1,5-cyclooctadiene)rhodium(I) dimer were co-grafted on hollow mesoporous carbon sphere (HMCS), and it was reduced under oxygen- and water-prohibited conditions, similar to the preparation of **Pt$_2$Gd/HMCS**. The powder XRD patterns of prepared sample (**Rh$_{0.39}$Pt$_2$Gd/HMCS**) showed only the peaks attributed to Pt$_2$Gd alloy shifted toward the high-angle side (**Figure 1**), suggesting the formation of Rh-doped Pt$_2$Gd alloy nanoparticles. The formation of Pt-Gd-Rh alloys was also supported by HAADF-STEM-EDS, and Pt L_{III}-edge and Rh K-edge XAFS. The average particle size of the Pt-Gd-Rh alloy nanoparticles on **Rh$_{0.39}$Pt$_2$Gd/HMCS** (5.7 nm) was found to be almost similar to the Pt$_2$Gd alloy nanoparticles on **Pt$_2$Gd/HMCS** (5.9 nm)[1].

ORR properties of **Rh$_{0.39}$Pt$_2$Gd/HMCS** were also evaluated by RDE procedures. **Rh$_{0.39}$Pt$_2$Gd/HMCS** showed higher ORR initial activity than **Pt$_2$Gd/HMCS**, suggesting the positive effect of Rh. The ORR durability of **Rh$_{0.39}$Pt$_2$Gd/HMCS** will also be reported.

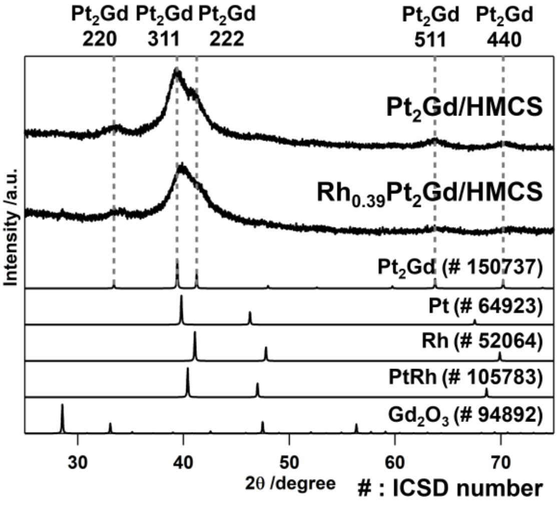


Figure 1. Powder XRD of **Pt$_2$Gd/HMCS** and **Rh-Pt$_2$Gd/HMCS**, and references.

(1) Moriyama, T. *et al. J. Am. Chem. Soc.* **2025**, *147*, 1262-1270.
(2) Li, X. *et al. Angew. Chem. Int. Ed.* **2024**, *63*, e202400549.

単層カーボンナノチューブ担持白金ナノロッド触媒の創製と膜電極接合体作製手法の検討による固体高分子型水電解セルの開発

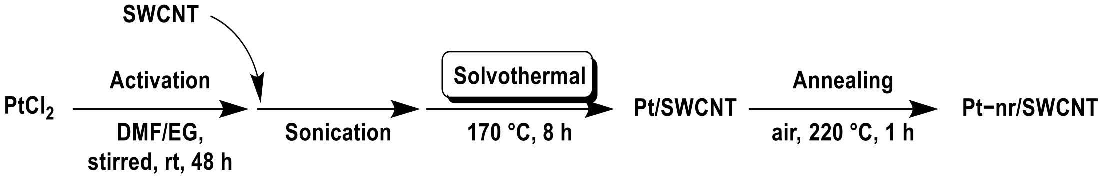
（名古屋大学大学院工学研究科[1]・名古屋大学未来社会創造機構[2]・株式会社名城ナノカーボン[3]・関西電力株式会社[4]）○佐藤 勝一[1]・フダ ミフタフル[1]・ジュニタ ジャスティン[2]・山田 貴穂[3]・橋本 剛[3]・平岩 千尋[4]・川角 昌弥[1・2]・松尾 豊[1・2]

SPE Water Electrolysis Cells: Fabrication of MEAs using Pt Nanorod-SWCNT Catalysts ([1]*Graduate School of Engineering, Nagoya University*, [2]*Global Technology Research Center for the Future Society (G-TRC), Nagoya University*, [3]*Meijo Nano Carbon Co., Ltd.*, [4]*Kansai Electric Power Co., Inc.*) ○Shoichi Sato[1], Miftakhul Huda[1], Justin Junita[2], Kiho Yamada[2], Takeshi Hashimoto[3], Hiro Hiraiwa[4], Masaya Kawasumi[1,2], Yutaka Matsuo[1,2]

Green hydrogen" produced via water electrolysis using renewable energy is carbon-free, yet its development is hindered by high costs and low efficiency. In this study, single-walled carbon nanotubes (SWCNTs)—notable for their high porosity, conductivity, and durability—were employed as the cathode Pt catalyst support. By optimizing heating conditions after Pt deposition, a hybrid catalyst featuring nanorod-shaped Pt elongated along the SWCNT bundles was synthesized 1, 2). When applied to a PEM water electrolysis cell, this catalyst demonstrated superior performance compared to conventional Pt/C with the same Pt loading, primarily due to reduced resistance in the high current density region.

Keywords : Single-walled carbon nanotube; Nanorods; Ionomer; Membrane Electrode Assembly; Water electrolysis

再生可能エネルギーを用いた水電解による「グリーン水素」はカーボンフリーであり，近年，その研究開発が活発化している．しかし，高コストや低エネルギー変換効率が問題である．本研究では，カソードの白金（Pt）触媒担体材料として，従来のカーボンブラックに対して，高多孔性，高伝導性，高耐久性といった顕著な特性を持つ単層カーボンナノチューブ（SWCNT）を採用した．SWCNT に Pt ナノ粒子を担持後，加熱条件を調節することで，SWCNT バンドル方向に伸長したナノロッド状の Pt を含むハイブリッド触媒を合成した 1, 2)．本触媒を固体高分子型水電解セルに適用した結果を同一 Pt 目付量の白金担持カーボンと比較し，高電流密度域における抵抗低減によって水電解性能の向上が確認された．



1) M. Huda, T. Kawahara, J.-H. Park, M. Kawasumi, Y. Matsuo, *ACS Appl. Energy Mater.* **2023**, *6*, 12226.
2) Q. Chen, C.-Y. Yu, T. Watanabe, M. Kawasumi, M. Huda, Y. Matsuo, *Nanoscale* **2025**, *17*, 24503.

高精度気泡発生分光計測による電気化学酸素発生機構の解明

（北大院総化[1]・北大院理[2]・JST-さきがけ[3]）○芦澤 大輝[1]・丁 曽竜[1]・板谷 昌輝[2]・福島 知宏[2,3]・村越 敬[2]

Decoding Electrochemical Oxygen Evolution Mechanisms through *In-situ* Spectroscopic Analysis of Bubble Dynamics (*[1]Graduate School of Chemical Sciences and Engineering, Hokkaido University, [2]Faculty of Science, Hokkaido University, [3]JST-PRESTO*) ○ Daiki Ashizawa,[1] Zenglong Ding,[1] Masaki Itatani,[2] Tomohiro Fukushima,[2,3] Kei Murakoshi[2]

We observed bubbles formation on the electrode to determine the local OER activity. The OER activity was calculated by tracking bubble growth rate. We determined the relationship between bubble formation and electrode activity.

Keywords : oxygen evolution reaction; bubble analysis; machine-learning image analysis; electrochemical reaction rate analysis

【序論】酸素発生反応 (OER) に伴って発生する酸素分子が電極界面近傍にて過飽和となった際に電極上に気泡が生じ、成長、脱離のサイクルを繰り返す。気泡成長は局所電流に伴う物質供給に依存するため、電極上の局所活性と相関している。さらに気泡形成は拡散層領域における電解質濃度勾配も支配因子として関与する。本研究では気泡観測を行い、電極活性を気泡形成の相関を明らかとすることを目標とした[1]。

【実験】作用極として Ni 電極、参照極として Ag/AgCl、対極として Pt-black を用いた。掃引速度を 5 mV s^{-1} として、OER に伴う電極上の気泡形成を電極に対して垂直方向から 60 fps で観測した。気泡の追跡には深層学習による画像解析を用いた。電解質としては緩衝溶液である 1 M K borate + 2 M K phosphate (pH = 8.8) を用いた。

【結果・考察】気泡成長速度から電極上の局所活性を算出した。各電位における電極上の気泡半径を追跡し、その変化量から酸素発生量および反応に関与した電子数を算出した(Figure)。その結果、電極上における複数カ所の局所活性を定量的かつ同時に評価することが可能となった。気泡を用いて電極上の局所活性を評価する手法を確立するとともに、電気化学酸素発生機構を解明する指針を示した。

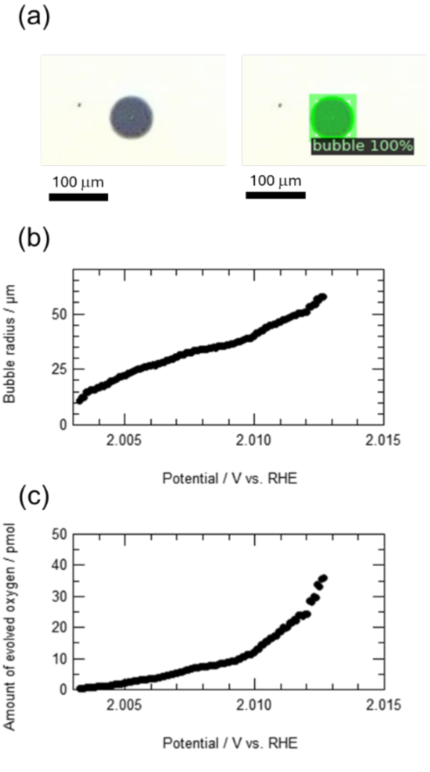


Figure (a) Snapshot images of bubble formation and prediction. Potential was 2.01 V. (b) Bubbe radius as a function of potential. (c) Amount of evolved oxygen versus potential.

【参考文献】D. Ashizawa *et al.*, *J. Electroanal. Chem.,* **2025**, *1003*, 119760.

Ammonia synthesis mechanism by P/L reaction between water and atomic nitrogen in plasma by discharge

(*Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology*)
○Souma Yoshida, Naoya Murakami, Yoshiyuki Takatsuji, and Tetsuya Haruyama

Keywords: Ammonia synthesis; Plasma diagnostics

Ammonia has a wide range of applications, including fertilizer, chemical feedstock, and denitrification reducing, carbon-free fuels, and energy carriers. Currently, the industrial production of ammonia is carried out by catalytic reduction of nitrogen (N_2) and hydrogen (H_2). In contrast, green ammonia synthesis, in particular a reaction system that does not use hydrogen as a row material, is significantly different from these existing synthesis systems. It is expected to be a new technology that will contribute to the development of a sustainable chemical industry. We have developed a plasma/liquid (P/L) reaction that can synthesize ammonia from nitrogen and water under ambient temperature, atmospheric pressure, and without catalyst.[1]

In the P/L reaction, nitrogen is reduced to synthesize ammonia through a two-step reaction: (1) activation of nitrogen by discharge (dissociation and excitation), and (2) a self-reduction reaction in which activated nitrogen abstracts hydrogen from water molecules. The activated nitrogen species can be roughly divided into three types of nitrogen: atomic nitrogen, excited nitrogen molecules, and nitrogen molecular ions. Of these, excited nitrogen molecules and nitrogen molecular ions are also called metastable nitrogen. We have already reported that atomic nitrogen (N_{atom}) is particularly highly reactive and exhibits high selectivity and speed in abstracting hydrogen from water molecules in P/L reaction.[2]

We have so far focused on N_{atom} and devoted our efforts to elucidating the reaction mechanism. Because water is used as the hydrogen source, nitrogen oxides are in principle synthesized in the liquid phase together with ammonia. However, when the P/L reaction is carried out under conditions where N_{atom} is abundant, the synthesis selectivity of ammonia accumulated in the liquid phase reaches nearly 100%, while oxygen derived from water molecules is released as NO in the gas phase.[3] Our previous research results have shown that filling the discharge locus with dielectric beads can increase the amount of N_{atom} produced (the N_{atom} ratio in active nitrogen). In this study, we quantitatively analyzed the amount of N_{atom} when beads with various dielectric constants were filled into the discharge locus, and analyzed the plasma by optical emission spectroscopy. We considered the electron energy in the plasma and the vibrational and rotational excitation of nitrogen molecules, and clarified the plasma conditions necessary for N_{atom} production.

1) T. Haruyama *et al.*, *Green Chemistry*, **18**, 4536-4541, 2016
2) T. Sakakura and T. Haruyama *et al.*, *ChemPhysChem*, **20**, 1467-1474, 2019
3) S. Yoshida and T. Haruyama et al., *Green Chemistry*, **25**, 579-588, 2023

Counteranion Engineering of Ethylenediammonium Salts for Reproducible Surface Modification in Perovskite Solar Cells

(*Institute for Chemical Research, Kyoto University*) ○Akio Hasegawa, Hayato Tanaka, Shota Hira, Yuko Matsushige, Chien-Yu Chen, Tomoya Nakamura, Minh Anh Truong, Richard Murdey, Atsushi Wakamiya

Keywords: Perovskite; Solar Cells; Counteranion; Ammonium; Lead

Perovskite solar cells (PSCs) rely on surface post-treatments for interfacial modification, where the choice of solvent and the solubility of the modifier are critical factors. For p–i–n-type solar cells, treating the top surface of the perovskite layer with a solution of ethylenediammonium diiodide ($EDAI_2$) has been reported to induce an interfacial dipole, leading to a high open-circuit voltage.[1,2] However, $EDAI_2$ exhibits very low solubility in common solvents such as 2-propanol (IPA), posing challenges in reproducibility for practical applications.

In this study, the reproducibility of PSC performance was improved by substituting iodide in $EDAI_2$ with larger anions, such as thiocyanate (SCN^-), tetrafluoroborate (BF_4^-) and hexafluorophosphate (PF_6^-) (Figure 1a). This substitution significantly increased the solubility of EDA^{2+} in IPA, thereby enhancing the reliability of the compositions at the working concentrations by avoiding the risk of unwanted precipitation. Consequently, in lead-based PSCs, the average and standard deviation of power conversion efficiency was improved from 20.7 ± 2.1% with $EDAI_2$ to 21.9 ± 0.5% for $EDA(SCN)_2$, 22.0 ± 0.7% with $EDA(BF_4)_2$, and 21.9 ± 0.2% with $EDA(PF_6)_2$ (Figure 1b). Furthermore, the high solubility of $EDA(PF_6)_2$ in low-polarity solvents such as ethyl acetate facilitated damage-free surface modifications, as demonstrated by its successful application to mixed tin–lead PSCs.[2] In the presentation, we will discuss the underlying principles behind the improved solubility and enhanced reproducibility in detail.

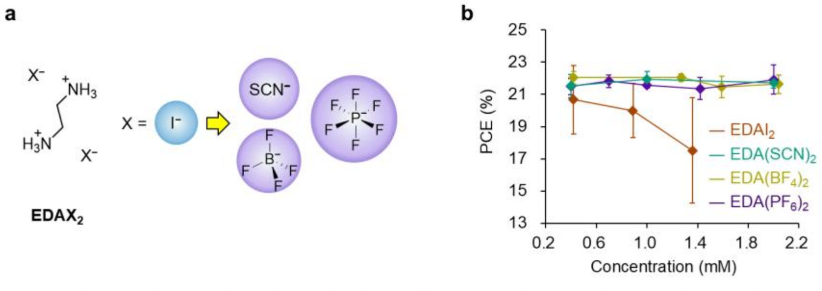


Figure 1. (a) Anion substitution in ethylenediammonium salts, and (b) dependence of the PCE on the concentration of $EDAX_2$ (X = I, SCN, BF_4, PF_6) solutions.

1) S. Hu, A. Wakamiya et al., *Energy Environ. Sci.* **2022**, *15*, 2096. 2) S. Hu, A. Wakamiya, et al., *ACS Appl. Mater. Interfaces* **2022**, *14*, 56290. 3) A. Hasegawa, T. Nakamura, A. Wakamiya et al., *Sol. RRL*, *accepted.*

Sustainable thermoelectric materials fabricated using high entropy perovskite oxynitride nanoparticles as building blocks

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Keywords: Thermoelectrics; Nanomaterials; High entropy; Sustainable materials, Perovskites

Thermoelectric (TE) materials, which can convert temperature differences directly into electric current, are seen as promising materials for sustainable energy systems, but many practical high-performance materials make use of toxic or rare elements. Perovskite-type oxides consist of non-toxic, abundant elements and have high temperature stability.[1] However, their TE performance is limited by their low electrical conductivity (resulting from a low carrier concentration and large band gap) and high thermal conductivity.[2]

For the development of practical, sustainable TE materials we chemically synthesized high entropy perovskite oxynitride nanoparticles containing multiple alloying elements using a simple solvothermal method and confirmed the cationic composition by STEM-EDS (Fig. 1a), while the presence of N was indicated by changes in the band gap. We then investigated the TE properties of their sintered bodies. The use of nanoparticles to create grain boundaries within the material significantly reduced the thermal conductivity, which was further reduced by the high entropy effect as additional elements were added (Fig 1b).[3] Sustainable elements (Ca, Mn, Nb, Ta, and N) were chosen and the effects of each element's inclusion on the TE properties was investigated. Mn and N inclusion reduced the energy band gap, while Nb and Ta increased the carrier concentration, resulting in a significant increase in electrical conductivity compared to the undoped perovskite sample. In this presentation we will discuss the correlation between the structures and their electronic/thermal transport properties.

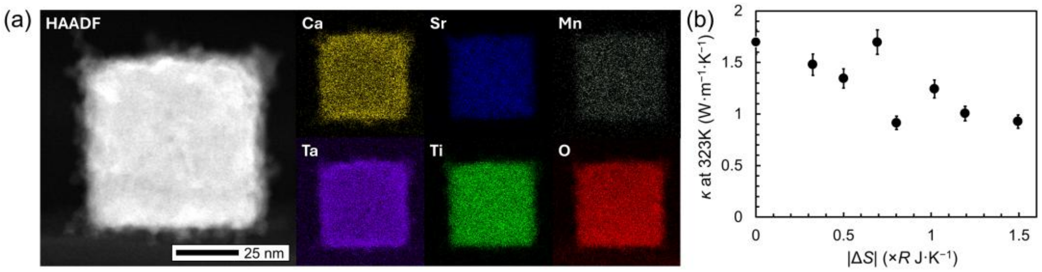

Fig. 1. (a) STEM HAADF image of multi-alloyed perovskite $(Ca_{0.5}Sr_{0.5})(Mn_{0.1}Ti_{0.9})O_3$ NPs and EDS mapping images. In order: Ca K-line (Yellow), Sr K-line (blue), Mn K-line (grey), Ta L-line (purple), Ti K-line (green), and O K-line (red). (b) Plot of thermal conductivity, κ, at 323 K against configurational entropy, $|\Delta S|$, for all samples.

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