

List of Dissertation Abstract (Department of Artificial Environment)

Name	Supervisor	Title	Abstract
LIU WENXIN	Shusa Yoshikazu	The Relationship between Ikigai and Place Utilization among Older Adults in Housing Complexes: A Case Study of Yokodai-kita Danchi	This study explores the relationship between ikigai (sense of purpose) and community space use among eight men aged 65 and over in Yokodai-kita Danchi, Yokohama. Using the K-I Ikigai Scale and interviews, results show that family ties, health, and participation influence ikigai. Active participants had stronger role awareness, while poor health and weak networks limited involvement. The study suggests that ikigai arises from both personal and social factors, emphasizing the need for community-based support.
Iki Hiroaki	Amemiya Takashi	Metabolic Oscillations and IL-6 Secretion in Skeletal Muscle Cells	Skeletal muscle cells secrete IL-6. IL-6 is a cytokine that activates immune responses and regulates inflammatory reactions. It is effective against metabolic syndrome-related diseases by suppressing blood glucose elevation, but its detailed secretion mechanism remains unclear. Glycolytic oscillations have been observed in insulin-secreting β -cells, and they are linked to oscillatory insulin secretion via Ca^{2+} . Since ATP and Ca^{2+} are regulatory factors for IL-6 secretion, the IL-6 secretion mechanism in skeletal muscle cells may be similar to insulin secretion in β -cells. This study aims to observe metabolic oscillations in skeletal muscle cells for the first time and clarify their relationship with IL-6 secretion.

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Ijiri Hinako	Aramaki Kenji	The influence of micelle shape on mechanical properties of SMG	Low-molecular-weight gelators (LMGs) form physical gels via non-covalent bonds, exhibiting reversible sol-gel transitions. Organogelators such as 12-hydroxystearic acid (12-HOA), typical LMGs, are water-insoluble and cannot form hydrogels. However, 12-HOA can form hydrogels by the surfactant solubilization function, which is called the surfactant-mediated gelation (SMG). In this study, the surfactant micelle shape was controlled from spherical to wormlike by varying the concentration of sodium salicylate (NaSal) in the cationic surfactant system, and the effect of the micelle shape on the microstructure and physical properties of SMG hydrogels was investigated.
Imai Natsumi	Ito Akihiko	Preparation of alumina–Tb, Er, and Yb oxide materials and their microstructures	Composite materials are designed to combine the strengths of constituent phases, compensate their weaknesses, or achieve new functionalities. In eutectic ceramic systems, composite eutectics are grown by only melting and solidification process. In particular, alumina–REAG eutectics (RE: rare-earth elements) combine alumina's excellent mechanical properties, thermal stability, and optical characteristics with REAG's fluorescent luminescence properties and corrosion resistance, and are expected to use many applications. However, research on the microstructure formation of them remains limited. In the present study, alumina–REAG eutectics were synthesised by using the CVD and μ -PD method and reveal their microstructure formation.

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Imai Yuki	Iijima Motoyuki	Effect of Particle Concentration and Polymer Additives on the Flow Characteristics of Non-Aqueous SiO ₂ Slurry	The effects of polymer additives with different molecular weights and structures on the flow properties of highly concentrated SiO ₂ /BC slurry were investigated. The dispersion behavior of the slurries can be rationalized in terms of the apparent adsorption layer thickness of the polymer additives and the average particle-to-particle distance. The ¹ H relaxation process of the slurry analyzed by TDNMR can be divided into at least two components, and it was revealed that the short relaxation process derives from the narrow space formed by particle agglomeration and the close approach of neighboring particles.
Urata Ryuya	Ito Akihiko	Preparation of yttria stabilized zirconia and its mechanical properties measured by microcantilever bending test	Yttria-stabilized zirconia (YSZ) possesses low thermal conductivity and high oxygen ion conductivity; YSZ is used as thermal barrier coating and solid electrolyte in solid oxide fuel cell, in which YSZ is exposed to harsh thermal and chemical environments and degraded by thermal stress or interdiffusion. Nanoindentation (NI) testing is widely used for film though mechanical properties acquired from NI testing is influenced by substrate. In the present study, microcantilever bending test were executed for chemically vapor deposited YSZ epitaxial films and its interface between substrate and film, and the mechanical properties were investigated.

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Oikawa Takahiro	Iijima Motoyuki	Influence of structured design in multi-component slurries on the manufacturing process of silicon nitride ceramics via post-reaction-sintering	Post-reaction sintering is a processing route for silicon nitride ceramics that uses Si powder as a starting material and involves two heat-treatment steps: nitridation followed by post-sintering. For effective densification of the final body, a nitrided compact in which Si melting and the formation of β -Si ₃ N ₄ are suppressed is required. In this study, the particle packing structure of a multicomponent slurry containing diluent particles and nitridation catalyst particles was controlled. Furthermore, the relationship between the internal microstructure of in situ solidified green bodies prepared from this slurry and their nitridation behavior was systematically investigated.
Ozawa Mahito	Miyake Yuichi	Comprehensive investigation of per- and polyfluoroalkyl substances (PFAS) and estimation of dietary exposure to PFAS in oil repellent paper products and wastes	Per- and polyfluoroalkyl substances (PFAS) have received worldwide attention because of their environmental persistence and toxicity. The Conference of the Parties of the Stockholm Convention on Persistent Organic Pollutants (POPs) listed PFOA and PFOA-related compounds in Annex A in May 2019. Food contact materials contain numerous PFAS, suggesting the effect of migration into foods and exposure to PFAS. In this study, we determined the concentrations of individual PFAS and total fluorine in oil repellent paper products and wastes by GC-MS/MS and combustion ion chromatography (CIC), respectively. We also estimated dietary exposure to PFAS based on a comprehensive investigation of PFAS. The mass balance analysis was useful to provide information on the extent of unknown fluorinated chemicals in oil repellent paper products and wastes.

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Kakiuchi Genta	Shiraishi Toshihiko	A Study of an Emotion Recognition Method for Children with Profound Intellectual and Multiple Disabilities	Children with profound intellectual and multiple disabilities (PIMD) struggle to communicate through voice or facial expressions. To address this challenge, identifying and displaying their emotions using machine learning based on physiological signals can support their communication. This study aimed to improve classification methods to primarily demonstrate enhanced accuracy in detecting negative states. By applying oversampling techniques to extract negative emotions which naturally have limited real-world data from heart rate signals, cases were confirmed where the system captured SOS signs difficult for human eyes to notice, thereby improving the detection accuracy of negative states.
Sakurai Haruki	Iijima Motoyuki	Development of environmentally friendly manufacturing process for composite materials based on binder jetting	for metal casting and lithium-ion battery electrodes have been attempted. However, challenges remain in realizing material functionality and achieving high-efficiency manufacturing. This research aims to develop an environmentally friendly manufacturing process for composite materials based on the binder jet method, utilizing powder processing to achieve both high-efficiency production and material functionality.

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Sano Kosuke	Kasai Naoya	Development of model for predicting the remaining life of gears using machine learning	This study aims to reduce life-cycle costs by improving conventional maintenance criteria based on visual inspection and operating hours. To this end, a model was developed to quantitatively estimate the remaining life of gears by integrating machine learning with eddy current testing. In the measurement phase, damage signals were acquired using a self-made triple-coil probe. The proposed methodology involves optimizing frequency bands and applying phase rotation correction to the obtained data before inputting it into a 1D Convolutional Neural Network. By selecting the Concordance Correlation Coefficient (CCC) as the evaluation metric and demonstrating an ensemble estimation approach through the refinement of effective conditions, this study evaluated the model's performance for unknown damage and achieved favorable results.
Shikichi Airi	Ito Akihiko	Preparation of $\text{Lu}_2\text{O}_3\text{-SiO}_2$ and $\text{Y}_2\text{O}_3\text{-SiO}_2$ films via chemical vapor deposition and their luminescence properties	Scintillators are phosphors that convert radiation into visible light. Ce^{3+} -doped LSO, LPS, and YSO have high light yield and short decay time, making them promising scintillators for X-ray imaging. Thinning the scintillator crystal promises improved spatial resolution of imaging. However, processing single crystal grown by melt-solidification method into thin films requires enormous time and cost. Furthermore, thin film synthesis by LPE method suffers from reduced light yield due to impurities introduced from flux. In the present study, we prepared Ce^{3+} -doped LSO, LPS, and YSO films directly on substrates using laser-assisted CVD and evaluated their fluorescence properties.

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Sugiyama Natsuki	Hondo Hiroki	The psychological impact of introducing local wind power generation on residents	The aim of this study is to examine the psychological impact of local wind power generation on residents. As a study perspective, this study focuses on the relationship between local residents' involvement in wind power generation and their pro-environmental behavior. The study is examined through a reanalysis of data from a questionnaire survey conducted in areas where wind farms have been installed. Based on the analysis results and interpretations, it is suggested that exposure to information about local wind power generation may raise interest in issues such as global warming and lead to pro-environmental behavior.
Sudo Masato	Kumasaki Mieko	Electrolytic Oxidation of Azoles Using Organic Nitrate and Their Evaluation	We aimed to synthesize new high energetic materials by applying electrolytic oxidation, which is a safer and more environmentally friendly method, to azole compounds, one of the energetic materials. Among them, in electrolytic oxidation using 5-amino-1H-tetrazole (5AT) and tetrabutyl ammonium nitrate (TBAN), I succeeded in obtaining a novel material, 5AT-TBAN. It was found that it has some characteristics of high energetics such as heat generation and high gasification rate. This system has also succeeded in scaling up for practical consideration.

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Takeuchi Akari	Aramaki Kenji	Effect of Thickener Addition on the Structure and Properties of Gels Prepared by Surfactant-Mediated Gelation (SMG Method)	This study systematically elucidates the effects of κ -carrageenan on the microstructure and mechanical properties of 12-HOA gels. By quantitatively evaluating the correlation between structural changes and mechanical properties alongside solvent viscosity increases, the research focuses on the qualitative shift in κ -carrageenan's role at the 1.0 wt% threshold. The results suggest that at high concentrations, κ -carrageenan transcends the role of a mere viscous solvent. Instead, the polymer network appears to physically control the crystalline growth of 12-HOA, potentially forming a synergistic double-network structure where both components interact to enhance material performance.
Taketa Yuto	Hoshino Yujiro	Synthesis of 2,2-Diphenylbenzodioxole from 2-Hydroxybenzhydrol Using Photoredox Catalysts and additive effects	Benzodioxoles are important structural motifs found in fragrances and biologically active compounds. Conventional synthetic methods typically employ dihalomethanes and catechol as starting materials; however, catechol is prone to oxidation and its limited availability, together with the high temperatures required for these reactions, poses practical and environmental concerns. Herein, we describe a new synthetic approach to benzodioxoles using a mild green light source, an organic photoredox catalyst, and phenols as additives.

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Tsuyuki Ryosuke	Matsumiya Masahiko	Investigation for extraction mechanism of Pd(II) and electrodeposition behavior of extracted complex using amide-based extractant	The development of solvent extraction-electrodeposition method is an important challenge from the perspective of reducing secondary waste. In this study, Pd(II) extraction from hydrochloric acid/chloride media using methylimino-bis-<i>N</i>, <i>N</i>-dioctylacetamide (MIDOA) was investigated with three diluents (acetophenone; AP, 1,2-dichloroethane; DCE, or 1-octanol; OC). Slope analysis revealed that the Pd(II) extraction reaction proceeded based on the following anion exchange reaction: $[\text{PdCl}_4^{2-}]_{\text{aq}} + n[\text{MIDOA}]_{\text{org}} \rightleftharpoons [\text{Pd}(\text{Cl})_{4-2n}(\text{MIDOA})_2^{2n-2}]_{\text{org}} + 2n[\text{Cl}^-]_{\text{aq}}$ The electrochemical behavior of the extracted Pd(II) complex in the MIDOA/AP electrolytic bath was evaluated using the electrochemical quartz crystal microbalance (EQCM) method. The results revealed that the extracted Pd(II) complex was reduced to Pd(0) metal via a two-electron transfer. Furthermore, the apparent molar mass of 105.22 obtained from EQCM analysis indicated that the cathode reaction $[\text{Pd}(\text{MIDOA})_2]^{2+} + 2\text{e}^- \rightarrow \text{Pd}(0) + 2[\text{MIDOA}]$ proceeded in the potential range from -2.38 V to -3.40 V. Furthermore, it was confirmed that the change in $\Delta\eta\rho$ corresponded to a local decrease in the viscosity of the organic phase at the electrode interface. The black electrodeposits recovered by potentiostatic electrodeposition of the extracted Pd(II) complex was analyzed by SEM/EDX, XPS, and XRD, and the electrodeposits were identified as Pd metal.

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Tokumitsu Shun	Matsumiya Masahiko	Investigation for extraction mechanism of Rh(III) using NTAamide(C6) and the electrodeposition behavior of the extracted complex	The development of solvent extraction-electrodeposition in this study is extremely important from the perspective of secondary waste volume reduction. In this study, three diluents with relatively high dielectric constants [acetophenone (AP), 1,2-dichloroethane (DCE), 1-octanol (OC)] were used, and the extractant <i>N, N, N', N', N'', N''</i>-hexahexyl nitrilotriacetamide [NTAamide(C6)] to analyze the Rh(III) extraction behavior. Slope analysis revealed that the Rh(III) extraction mechanism proceeds based on ion-pair extraction as follows. Here, HL^+ represents the protonated form of NTAamide(C6). $[RhCl_5(H_2O)^{2-}]_{aq} + n[HL^+]_{org} \rightleftharpoons [RhCl_5(H_2O)(HL)_n^{n-2}]_{org}$ The electrochemical behavior of the extracted Rh(III) complex in each diluent was evaluated by cyclic voltammetry. In the NTAamide(C6)/AP, NTAamide(C6)/DCE, and NTAamide(C6)/OC systems, Rh(III) underwent a three-electron reaction and was reduced to Rh(0). Furthermore, the diffusion coefficient of the extracted Rh(III) complex was analyzed using the semi-differential method. XPS and XRD analyses of the electrodeposits recovered by continuous extraction and direct electrodeposition confirmed that the electrodeposits were Rh metals.

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Tomiyama Ryota	Iijima Motoyuki	Design of aqueous based photocurable ZrO ₂ suspensions for greener DLP-3D printing process	Three-dimensional stereolithography is a promising technique for fabricating complex ceramic components with high precision. However, conventional processes require large amounts of resin and organic solvents, resulting in long debinding times and limited sustainability. In this study, an aqueous-based photocurable ZrO ₂ suspension was developed for greener DLP 3D printing. ZrO ₂ particles were stabilized in water using L-asparagine as a reactive dispersant, and water-soluble multifunctional acrylates with a photoradical initiator were introduced to provide photocurability. By optimizing the monomer and initiator contents, the suspension enabled stable printing of complex geometries. The printed green bodies were successfully debinded and sintered into dense ceramics without cracking.
Hamabe Masahide	Kobayashi Takeshi	Analysis of Dispersion and Infiltration Behavior of Contaminants and Health Risk Assessment at Surface Soil Contamination Sites and Containment Sites	At surface soil contamination and containment sites involving highly adsorptive substances such as lead and dioxins, health risks due to dispersion and infiltration are of concern. The analysis in this study showed that dispersion flux is mainly controlled by wind speed, and higher friction velocities may increase the risk of inhalation of soil particles. In addition, humic acid was found to reduce the adsorption of lead to soil, potentially increasing the risk of groundwater contamination. Furthermore, at containment sites, the results indicate the importance of maintenance and management to limit increases in the permeability of steel sheet piles when substances such as PCB-77 are present. In addition, an indicator enabling comparison with everyday health risks was proposed.

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Hara Yuka	Hoshino Yujiro	Synthesis of 1,3,6,8-tetramethoxythioxanthylum salts and their reaction with phenoxides to give 9-substituted thioxanthenes	Thioxanthylum salts, sulfur-containing aromatic compounds, have recently attracted attention as promising lead compounds for P-glycoprotein inhibitors and photosensitizers. Previously, we reported an efficient Friedel-Crafts approach for the synthesis of 9-aryltetramethoxythioxanthylum triflate (TMTX). In the present study, 1,3,6,8-TMTX was successfully synthesized from bis(3,5-dimethoxyphenyl) sulfide and nitromethane. Subsequent nucleophilic addition to 1,3,6,8-TMTX afforded a series of novel 9-substituted thioxanthenes. These thioxanthenes and thioxanthylum salts, which were not accessible by previously reported methods, were obtained in moderate to good yields.
Matsuura Komaki	Tatami Junichi	Study on Grain Boundary Strength and Cyclic Fatigue of High Thermal Conductivity Silicon Nitride Ceramics	Silicon nitride (Si ₃ N ₄) ceramics are used as heat dissipation substrates for power devices because of their electrical insulation, high thermal conductivity, and mechanical properties. Repeated temperature changes generate thermal stress due to the mismatch in thermal expansion between copper and ceramic substrates. This stress can initiate and propagate cracks, reducing reliability. SiN, ceramics contain a grain boundary glass phase formed by liquid-phase sintering, along which cracks preferentially propagate. Therefore, grain boundary strength governs mechanical reliability. This study investigates the effect of repeated stress on grain boundary strength using the microcantilever beam specimens.

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Mishima Takumi	Matsumiya Masahiko	Investigation for recovery of platinum group metals from spent catalysts by solvent extraction and electrodeposition	In this study, regarding the separation of platinum group metals (PGMs) from spent catalysts, the extractant MIDOA with accumulated research was applied for the extraction of Pt(IV) and Pd(II), while NTAamide(C6) was selected as the extractant for Rh(III). The objective of this study was to recover PGMs by direct electrodeposition from acetophenone (AP) or 1,2-dichloroethane (DCE) with high dielectric constants. EDX analysis results before and after acid leaching revealed that the leaching percentage of the PGM components used in three-way catalysts (Pt: 97.6%, Pd: 99.2%, Rh: 90.5%) were over 90%. Moreover, the extraction mechanism of Pt(IV) and Pd(II) was found to proceed via the following anion exchange reaction: $[\text{PtCl}_6^{2-}]_{\text{aq}} + 2[\text{MIDOA}]_{\text{org}} \rightleftharpoons [\text{Pt}(\text{Cl})_2(\text{MIDOA})_2^{2+}]_{\text{org}} + 4[\text{Cl}^-]_{\text{aq}}$ $[\text{PdCl}_4^{2-}]_{\text{aq}} + 2[\text{MIDOA}]_{\text{org}} \rightleftharpoons [\text{Pd}(\text{MIDOA})_2^{2+}]_{\text{org}} + 4[\text{Cl}^-]_{\text{aq}}$ In the case of using AP as the diluent, the Pd/Rh separation factor was calculated to be 49.66–59.84 at MIDOA concentrations of 4.0mM-6.0 mM, confirming that Pd and Rh can be mutually separated. Furthermore, XPS and XRD analysis confirmed that the electrodeposits exhibited crystalline metallic morphology. The above series of analytical results suggest the effectiveness of the solvent extraction-electrodeposition method for separating and recovering PGMs from spent catalysts.

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Mizuguchi Ryota	Matsumoto Shinya	Crystal Structure of Chlorinated Diketopyrrolopyrrole Derivatives with Ethyl and Butyl groups at the <i>N</i> Positions	Functional organic dyes are commonly used in the solid state. These materials often exhibit crystal polymorphism, where a single compound can adopt different crystal structures. Differences in molecular conformation and packing among polymorphs can result in variations in solid-state properties. Therefore, understanding the relationship between crystal structure and physical properties is essential for developing organic functional materials. In this study, we synthesized a chlorinated diketopyrrolopyrrole derivative bearing asymmetric amino substituents—an ethyl and a butyl group—and explored its polymorphism through crystallization and single-crystal X-ray diffraction. As a result, two new solvate crystal forms were identified.
Mizobuchi Madoka	Miyake Yuichi	A Comprehensive Study on Novel Extraction Solvent to determine a wide range of volatile organic compounds for Individual Exposure Assessment	Carbon disulfide (CS ₂) is a conventional extraction solvent for extracting volatile organic compounds (VOCs) from activated carbon during VOC determination. However, it is one of the most hazardous solvents used in gas chromatography analysis. To investigate alternative extraction solvents to CS ₂ , solvent factors affecting VOC recovery from activated carbon were determined. Low viscosity and a high dispersive component of the surface free energies of extraction solvents were identified as key factors that enhanced VOC recoveries from activated carbon. An effective estimation method for VOC recoveries from activated carbon was developed using quantitative structure–property relationship (QSPR) models for each extraction solvent. A recovery database was constructed for 450 harmful VOCs for each extraction solvent based on the QSPR models.

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Miyamoto Taichi	Shiraishi Toshihiko	Study on Operating Force and Neutral Return Control of a Lever Using a Compact, High-Output Magnetorheological Damper	To achieve real-time operating force control for construction machinery under diverse conditions, we proposed a lever control system utilizing a compact and high-output MR damper. The prototype meets the specific requirements for a maximum torque of 2.0 Nm and an idle torque of 0.21 Nm while achieving the highest possible compactness for installation. By designing force profiles based on operator sensitivity and perception, the system ensures high operability and adaptability for various operators and tasks.
Watanabe Kanta	Amemiya Takashi	Effects of Monocarboxylate Transporter (MCT) on Cancer Malignancy and Glycolytic Oscillations	Monocarboxylate transporter (MCT) promotes cancer malignancy by participating in the tumor microenvironment. Glycolytic oscillations reflect the metabolic characteristics of cancer cells. Therefore, investigating the relationship between MCT and glycolytic oscillations can verify the metabolic characteristics of cancer cells. It has been confirmed that the lactate transport capacity derived from MCT contributes to the oscillation ratio of glycolytic oscillations.

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Chen Cheng	Yasumoto Masanori	Transformation of Value Capture Mechanisms on Metaverse Platforms ~The Impact of the Shift from UGC to AIGC on Creator-Platform Revenue Sharing Structures~	Amid rapid metaverse growth and generative AI proliferation, AIGC is transforming UGC-dependent value creation. This study examines how AIGC affects creator-platform revenue distribution. Using convergent mixed methods, we analyzed Roblox, Fortnite (UEFN), and VRChat (with Decentraland/OpenSea as references), integrating qualitative policy analysis and quantitative CRS/PVCR metrics via Joint Display. Findings reveal: (1) deeper AI integration correlates with higher platform value capture; (2) "skill democratization" lowers barriers but induces oversupply, diminishing creator bargaining power—mitigated by engagement-based models; (3) revenue concentration intensifies under AIGC. We contribute a tripartite value chain model incorporating AI providers and empirically examine the "democratization paradox," offering implications for sustainable creator economy governance.
Zheng Tongwei	Kobayashi Takeshi	Study of Long-Term and Low-cost Remediation Methods for Chlorinated Organic Solvents Contaminated Soil at Small Factory	Soil contamination by volatile chlorinated organic compounds (CVOCs) has become evident. Many small factories remain uninvestigated, and limited site space often makes installation of remediation equipment difficult. This study developed a long-term remediation prediction model for a hypothetical small to medium contaminated site using equations that account for the identified forms of CVOCs in soil and four remediation mechanisms. The prediction results indicate that the proposed compact remediation systems can be appropriately selected according to the financial conditions and site area of small factories, and that, unlike conventional extraction methods, they can achieve remediation at lower cost and with reduced CO ₂ emissions.