YNU 横浜国立大学 YOKOHAMA National University

YNU International Symposium 2024
and
Special Symposium
"AI for Transformation to a Sustainable Society"

Organized by
YOKOHAMA-SXIP Organizing Committee
Supported by
MEXT-JSPS “INTER-UNIVERSITY EXCHANGE PROJECT”

Program

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and
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"AI for Transformation to a Sustainable Society"

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YNU International Symposium 2024

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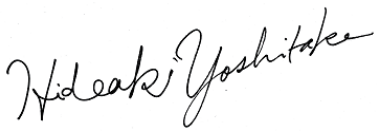
Preface

Welcome to Yokohama!

It is my great pleasure to host the Yokohama National University (YNU) International Symposium 2024 and Special Symposium on AI for Transformation to a Sustainable Society.

The environment surrounding us is rapidly changing due to global phenomena such as climate disruption, transition of social and industrial structures, and emergence of new epidemics. In these symposiums, we collaborate with our partner universities in India and Australia to identify the issues related with the sustainability transformation (SX) and artificial intelligence (AI), analyze them, and explore the solutions. By exchanging the opinions between the students and faculty members in all partner institutes, this hybrid symposium will provide an opportunity for international interactions across various academic disciplines, such as robotic, mechanical, chemical, electrical, safety and medical engineerings, information sciences, economics, management, and education. YNU hopes that the participants are able to find new viewpoints to widen the scope of research of their field and to integrate different values.

We hope that this symposium will contribute toward the growth of the next generation living in a sustainable society.



Dr. Hideaki Yoshitake
Professor
Faculty of Engineering
Yokohama National
University

Schedule at a glance

Time/Day			Aug 30th (Fri)	Sep 4th (Wed)	Sep 5th (Thu)
IND	JPN	AUS	Room 101, Lecture Hall 6 (Ed)	Media Hall in Central Library	Room 101, Lecture Hall 6 (Ed)
5:30	9:00	11:00			
6:30	10:00	12:00			4.SXIP Exchange Session
7:30	11:00	13:00			
8:30	12:00	14:00			Lunch
9:30	13:00	15:00	Special International Symposium "Artificial Intelligence for Transformation to Sustainable Society"	1.SXIP Global Session	5.SXIP Group Exercise Presentation Session
				Break	
10:30	14:00	16:00		2.Student Poster Session	
11:30	15:00	17:00			6.Closing Ceremony
12:30	16:00	18:00		Break	
13:30	17:00	19:00		3.Colloquium (Cafeteria 1)	
14:30	18:00	20:00			

Symposium Program

August 30th (Fri), 2024 13:00-16:50

Venue: Room 101, Lecture Hall 6 (Ed)

SXIP Special International Symposium
"Artificial Intelligence for Transformation to Sustainable Society"

Chairs: T. Arakawa and Y. Maeda

Organized by: Yokohama National University and Anna University
Supported by: Embassy of India Tokyo, Japan

13:00		Opening remarks T. Arakawa, *Yokohama National University* Welcome address Y. D. Panwar, *Embassy of India Tokyo, Japan*
13:10	AI-1	Leveraging Large Language Models for Natural Language Processing and Addressing Related Issues T. Mori, Yokohama National University
13:35	AI-2	Procreation of Trending News Using Deep Neural Networks R. Baskaran, Anna University
14:00	AI-3	Human Sensing and Recognition Model Construction Using AI and Its Applications in Healthcare C. Sugimoto, Yokohama National University
14:25	AI-4	AI for Smart Sensing Systems K. Govardhan, Vellore Institute of Technology
15:05	AI-5	Leverage of AI for Weather and Climate Sciences R. Yoshida, Yokohama National University
15:30	AI-6	Embryonic Quality Assessment using Advanced Deep Learning Architectures utilizing Microscopic Images of Blastocysts P. Varalakshmi, Anna University
15:55	AI-7	Future Perspectives of AI Applications for Motion Data Analysis in Robotics and Mechatronics T. Shimono, Yokohama National University
16:20	AI-8	Artificial Intelligence towards Manufacturing Sustainability S. K. Mishra, Indian Institute of Technology Kanpur
16:45		Closing remarks R. Baskaran, *Anna University*

September 4th (Wed), 13:10 - 18:00

Venue: Media Hall in Central Library

YNU International Symposium 2024 (Day1)

1. SXIP Global Session

Chair: K.Nakamura

13:10 Opening Remarks

13:15 I-01 Rumex crispus L: Profiling, evaluation, and microencapsulation of its bioactive root compounds to enhance antioxidant and antimicrobial activities during food fortification
Anuradha Jabasigh S, Addis Ababa Institute of Technology, Ethiopia

2. Student Poster Session

Chair: Y.Maeda

14:00 – 16:00

P-01 CFD and experimental analysis of power dissipation and shear rate distribution in a stirred tank
Mehak Jain, Takemi Shinkai, Koki Anzai, Ryuta Misumi
YNU

P-02 Yoga
Prachi Tiwari
Panjab University

P-03 LaGaO3 film for intermediate-temperature solid oxide fuel cells
R. Fuseya, A. Ito
YNU

P-04 Epitaxial growth of Yb3+-doped Lu2O3 dense and columnar films for X-ray inspection
Tatsuyuki Nakayama, Akihiko Ito
YNU

P-05 - Carbon Offsets -The Solution for Global Warming in a Capitalist Society
Hirose Miyu
YNU

P-06 The Alarming Reality of Women's Safety
Pakhi Negi
Panjab University

P-07 Formation of phase-separated microstrucrure in Al2O3-Tb3Al5O12 composite film
N. Imai, A. Ito
YNU

P-08 Chemical vapor deposition of Ce-doped Lu3Al5O12 film for White-LED lighting
N. Fujimura, A. Ito
YNU

P-09 PANJAB UNIVERSITY, INDIA
Kiranveer Singh
Panjab University

P-10 Investigation of anti-solvent crystallization conditions for isomer separation of aminobenzoic acid
Nao Kawamura, Kazuho Nakamura, Kenji Wakui
YNU

P-11 Measurement and analysis of Volatile Organic Compounds(VOCs) from unsaturated soils and health risk assessment
Kinari Shima
YNU

P-12 Plastics adsorption and removal by 2D ultrathin iron oxide nanodiscs: from micro to nano
Yitong Cao, CI Sathish, Jiabao Yi
University of Newcastle

P-13 Evaluation of chromatographic separation characteristics by HSP
Kenta Sakamoto, Kenji Wakui, Kazuho Nakamura
YNU

P-14 Convection control of thin liquid film by using temperature differential Marangoni convection
Koshiro Tahara
YNU

P-15 Microwave Doping of Sulfur and Iron in β_{12} Borophene
Zhixuan Li, Prashant Kumar, Ajayan Vinu
University of Newcastle

P-16 Microcantilever bending test of YSZ film for improving reliability towards energy transition devices
Ryuya Urata, Junichi Tatami, Akihiko Ito
YNU

P-17 MoO2 films prepared using CVD methods for electrode materials
T. Akiyama, H.Tajima, D. Sato, A. Ito
YNU

P-18 Study of silver nanoparticle reinforced starch and chitosan- antimicrobial packaging films preparation & application on perishable fruit guava (Psidiumguajava L.)
Divya Verma, Anupama Kaushik
Panjab University

P-19 Effect of Applied Electric Field on the Behavior of Charged Particles in Thermocapillary Convection of a Liquid Bridge
Yuto YOSHIDA, Misa ISHIMURA, Koichi NISHINO
YNU

P-20 Modeling Battery Degradation Based on Long-Term Life Logs of EV and Analysis Through VGI Simulation
Shoki Katahira
YNU

P-21 Biomass-derived hierarchical porous carbons for enhanced CO2 adsorption performance
Vishnumaya Narayanan, Gurwinder Singh, Jae-Hun Yang, Kavitha Ramadass, and Ajayan Vinu
University of Newcastle

P-22 Relationship between classification characteristics and particle size distribution in the up-flow reaction crystallization of CaCO3
Sawano Futa, Kazuho Nakamura, Kenji Wakui
YNU

P-23 Eu-doped SrAl2O4 film synthesized using using CVD merthod for long afterglow phosphors
Y. Kanamoto, A. Ito
YNU

P-24 Ayurveda: The Science of Life
Sahil Angra
Panjab University

P-25 YAlO3 film prepared on SrTiO3 substrate using CVD method for radiation detection
Yuta Ueda, Akihiko Ito
YNU

P-26 AZEC (Asia Zero Emission Community) Decarbonization Movement in Asia and Examples of Collaboration with Japanese Companies
Shunta Doi
YNU

P-27 Australia's Green Shift: A Lack of Enforcement Slowing the Mission
Kolby Parrott & Jake Lawrence
Griffith University

P-28 Force distribution sensing based on photoelasticity
Wu Cheng, Yusuke Maeda
YNU

P-29 Antimicrobial Activities of Starch-Based Biopolymers and Biocom composites incorporated with Fruit and vegetable peels extract
Avni Gupta, Anupama Kaushik
Panjab University

P-30 Yttrium silicate film grown using chemical vapor deposition for X-ray inspection
A. Shikichi, A. Ito
YNU

P-31 Structural Variation by Mono N-alkylation in Indigo Dye
Yugo Suzuki, Sunghoon Kim, Shinya Matsumoto
YNU

P-32 Si-doped AlN film synthesized using CVD method for white-LED phosphor
S. Ichiba, A.Ito
YNU

P-33 Effect of Ionic solution and surface condition on Zeta Potential and Electroviscous Effect of Microporous Alumina Membrane
Wakasa Manami, Wakui Kenji, Nakamura Kazuho
YNU

P-34 Sustainable Development Goals in Pharmaceutical Industry
Dhanush Krishnan A, Vaibhavi Singh, Vamsee Yashwanth
VIT

P-35 Numerical analysis for the relationship between the structure and mass transport performance of PEM water electrolysis anode side PTL
Sota Seki, Takuto Araki
YNU

P-36 Disintegration of particle agglomerate by fluidic shear stress and ultrasonication
Misaki Ikuma, Kenji Wakui, Kazuho Nakamura
YNU

P-37 Hydrogen energy storage
Namya Loomba
Panjab University

P-38 Collembola mortality due to the gas emission by mushrooms
Kein Mizukami, Taizo Nakamori
YNU

P-39 Adaptive Control design for Magnetically Actuated Micro/Nanorobots for the Drug Delivery Applications
Neeta Yadav, Abhilash Patel
IIT Kanpur

P-40 Harnessing the Self- Sensing Properties of SMA for Artificial Proprioreception
Malik Arsala Nissar
IIT Kanpur

P-41 3D Printed Artificial Coral Reef For Ecological Sustainability
Shivam, Sarvesh Kumar Mishra
IIT Kanpur

3.Colloquium

16:30 Colloquium （Venue: Cafeteria 1）

September 5th (Thu) 9:15 - 15:30

Venue: Room 101, Lecture Hall 6 (Ed)

YNU International Symposium 2024 (Day2)

3. SXIP Exchange Session

Chair: H.Yoshitake

9:15	I-02	Are Australian residential consumers on the right electricity tariff? Evidence from Sydney households Alexandr Akimov, Griffith University
9:35	I-03	Anxiety that Drives Kaizen: A Strategic Blueprint for Kaizen Implementation Across Borders Kodo Yokozawa, Yokohama National University
9:55	I-04	Waste Rice Straw: A Sustainable and Effective Substrate for Immobilizing Enzymes for Wastewater Remediation Anupama Sharma, Panjab Univesity
10:15	I-05	 Gurwinder Singh, Univerisity of Newcastle
10:35	I-06	Sustainability integrated approaches towards design and manufacturing of lightweight aerospace component Sarvesh Mishra, IITK
10:55	I-07	Machine learning predictive approach to analyse differential pipe sticking in oil and gas drilling operations Aslam Abdullah, Vellore Institute of Technology
11:15	I-08	The Role of UNESCO Biosphere Reserves on Blue Carbon Ecosystems Miguel Clüsener-Godt

4. SXIP Group Exercise Presentation Session

Chair: H.Kabashima and A.Suzuki

Supported by Toray Industries Inc, Nomura Securities Co.,Ltd.

13:00 – 15:00

Group 1

Shivam	IIT Kanpur
Neeta Yadav	IIT Kanpur
Malik Arsala Nissar	IIT Kanpur
Kinari SHIMA	YNU
Koshiro TAHARA	YNU
Sota SEKI	YNU

Group 2

Vaibhavi Singh	VIT
Dhanush Krishnan	VIT
Vamsee N Yashwanth	VIT
Yuto YOSHIDA	YNU
Satoshi ANDO	YNU
Kanta TOGAMI	YNU

Group 3

U. S. Arunprabhu	Anna University
Ajai Krishna T S	Anna University
Mini Gnanasekaran	Anna University
Shinji HIRAKAWA	YNU
Shogen SEKIGUCHI	YNU
Jo ASANO	YNU

Group 4

Namya Loomba	Panjab University
Kiranveer Singh	Panjab University
Divya Verma	Panjab University
Narutaka KOMA	YNU
Shunta DOI	YNU
Miyu HIROSE	YNU

Group 5

Sahil Angra	Panjab University
Pakhi Negi	Panjab University

Prachi Tiwari	Panjab University
Avni Gupta	Panjab University
Shun ICHIBA	YNU
Yuki NAKATA	YNU

Group 6

Jake Lawrence	Griffith University
Kolby Parrott	Griffith University
Ayaka UENO	YNU
Kanon TOKOYODA	YNU
Vishnumaya Narayanan	The University of Newcastle
Zhixuan Li	The University of Newcastle
Yitong Cao	The University of Newcastle
Airi SHIKICHI	YNU
Kein MIZUKAMI	YNU

5. Closing Ceremony

Chair: H.Yoshitake

15:00 Closing Ceremony

Abstracts

Special AI

Leveraging Large Language Models for Natural Language Processing and Addressing Related Issues

Tatsunori MORI [1]

[1] Faculty of Environment and Information Sciences, Yokohama National University

Abstract:

This presentation will discuss the use of large language models in natural language processing and the various associated issues. Recently, there has been remarkable progress in text generation AI, with large language models at its core. A language model is a probabilistic model that represents the likelihood of the next word's appearance given a particular context. Traditionally, these models in natural language processing have been directly estimated based on the frequency of occurrence from language samples. This approach faced difficulties in constructing language models with long text as context. However, recent advances in deep neural networks have made it possible to learn complex probabilistic models. One such method is the Transformer, proposed by Google, which serves as the foundation for large language models like OpenAI's GPT and Meta's Llama. The widespread use of large language models can be attributed significantly to the provision of the Text-to-Text framework. In this framework, both the content to be processed and the processing details are given as input (referred to as a "prompt"), and the result is also obtained in text form. The way prompts are given is crucial, leading to the emerging field of Prompt Engineering. We are conducting research within the realm of Prompt Engineering. As an example, we introduce a method named "Think From Words." The use of large language models is not only advantageous. We will also overview issues such as the cost of constructing large language models and hallucinations in generated text.

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[2] Chengguang Gan, Qinghao Zhang, and Tatsunori Mori. Think from Words (TFW): Initiating Human-Like Cognition in Large Language Models Through Think from Words for Japanese Text-level Classification. In *Proc. of the 29th International Conference on Applications of Natural Language to Information Systems* (2024)

Biography

Tatsunori Mori, Yokohama National University, Professor
Ph.D. (Information Engineering) (Yokohama National University, 1991)
Yokohama National University (1991-Present)
Award: JSAI Incentive Award (2022), JSAI Best Paper Award (2011)
Research Interests: Natural Language Processing, Information Extraction, Information Retrieval

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PROCREATION OF TRENDING NEWS USING DEEP NEURAL NETWORKS

R. Baskaran[1], P. Dhavachelvan[2], Abirami Murugappan[3]

[1] Professor, Department of Computer Science and Engineering, Anna University, Chennai, INDIA.
[2] Founder Director, Saneeshwar Animations International, Puducherry, INDIA.
[3] Professor, Department of Information Science and Technology, Anna University, Chennai, INDIA.

Before the invention of traditional media like film, television, and photography, comic books served as the main visual medium for presenting historical events. Visual literacy is the ability to integrate text and visual input simultaneously [2]. By melding words and illustrations together, kids get the big picture by causing the brain's synapses to multitask. Comics are a visual media where ideas are expressed through visuals, frequently in conjunction with text or other visual data.

Comics are often composed of panels of images sequenced one after the other. Textual elements like onomatopoeia, speech balloons, and captions are frequently used to convey conversation, narration, sound effects, and other information. In comics, cartooning and related illustration techniques are the most widely used methods for creating images. Comics that are popular include graphic novels, manga, superhero comics, and more. Across the world, a comic book is a popular and beloved medium of expression among many people. Comic is a succinct, illustrative narrative that may or may not be accompanied by words. Comic books, as opposed to other literary media like novels or short tales, can be far more captivating due to its powerful graphics and emphasis on plot and characters. Additionally, comics assist people in gaining the reading comprehension abilities necessary to understand texts that are more complex. Reading comic books teaches readers how to think differently about information. Readers of comic books must digest all the many elements—textual, spatial, and visual—of what they are reading and combine these elements into one firm grasp of the narrative.

Research indicates that reading stories actually has a noticeable effect on brain function. Studies also show reading a compelling novel changed participants' neuron activity and stimulates advanced brain function. Stories can actually change the ways in which our brains function and the ways in which we think and enhance our brain to a new level [1]. The Comic Book Project, emphasizes about arts-based literacy initiative to urban after-school environments where children brainstormed, outlined, sketched wrote and designed original comic books that represented their lives as urban youth.

The goal of the Comic Book Project was to encourage kids to attend classes, take pleasure in their work, and develop their literacy and artistic abilities. Also, this work depict current events and popular culture through comics. The work attempts to create an automated system for the daily comic creation of current news, as it can be a laborious process when done by hand. The project intends to develop a system that can comprehend the news story, find relevant pictures for the characters, and produce the comic strip. Additionally, the system would consider how positive the news was and adjust the comic accordingly.

Figure 1: Procreation of current news in comic format

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3. Chen, S., Liu, B., Fu, J., Song, R., Jin, Q., Lin, P., Qi, X., Wang, C., Zhou, J. "Neural storyboard artist: visualizing stories with coherent image sequences", In: 27th ACM International Conference on Multimedia (MM '19), pp. 9. Nice, France. ACM, New York, NY, USA, (2019).
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Biography

R. Baskaran is currently a Professor in Department of Computer Science and Engineering, Anna University. He completed his Ph.D. in Computer Science and Engineering, Anna University, Chennai. He has a total of 21+ years of experience in teaching and research. He has received several awards such as Research Excellence Award, Sakura Science Fellow, "Young Faculty Research Fellow" under Visvesvaraya Scheme, MeitY, IBM Best Faulty Award, Outstanding Researcher Award, special mention in the Who's who in the world. He has more than 180 scholarly publications with a google scholar citation of 2546 and H-index of 24.

P. Dhavachelvan is a founding director of Saneeshwar Animations International pvt. Ltd. Formerly he was working as a Professor, Department of Computer Science, Pondicherry University, India. He has obtained his M.E. and Ph.D. in the field of Computer Science and Engineering in Anna University, Chennai, India. He has around two decades of experience as an academician and his research areas include Software Engineering and Standards, Software Agents and Distributed Systems. He has published around 150 research papers in National and International Journals and Conferences.

Abirami Murugappan working as Professor in Department of Information Science and Technology, College of Engineering, Guindy, Anna University. Her areas of interest include AI, Video Analytics, Image Processing, Text Mining, NLP, Databases, Multimedia and Big Data. She acted as a Principal Investigator for UGC major project research scheme from 2013–2017 and for Centre for Technology Development and Transfer (CTDT) project from 2012–2013. She also acted as a mentor for nearly 7 projects under CTDT Students Innovative Projects Scheme. Received CTS Best Young Faculty Award, for the year 2017 and mentor award for the best project in 2016 from CTDT, Anna University. Currently she is guiding 4 PhD candidates and finished 4 candidates to her credit. She has published more than 153 publications consisting various journals, conferences and book chapters.

Contacts

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Human sensing and recognition model construction using AI and its applications in healthcare

Chika Sugimoto[1]

[1] Division of Intelligent Systems Engineering, Faculty of Engineering, Yokohama National University

Abstract:

My research interests are human recognition and understanding based on the measurement, analysis, and control of humans and their environment. I conduct research on the methods to evaluate biological functions and estimate human behaviors and internal states such as emotions and stress.

In an aging society with a declining birthrate and increasing individualization, technologies are required to accurately measure and evaluate the needs and conditions of each person in various environments. Based on advanced perceptual information processing, artificial intelligence/machine learning, and IoT technologies, our laboratory is engaged in research on non-contact sensing and evaluation methods for chewing and swallowing functions, gait and motor functions that decline with age, etc. and on methods to construct highly versatile recognition models using biological signals which vary greatly among individuals and over time. We are also working on research and development of an AI platform that can be applied in the medical, healthcare, and other service fields.

YNU Research Center for Artificial Intelligence promotes cutting-edge research on AI technologies such as evolutionary machine learning, advanced reinforcement learning, etc. based on humanities and sciences fusion research and deploys intelligent technologies to industry and society.

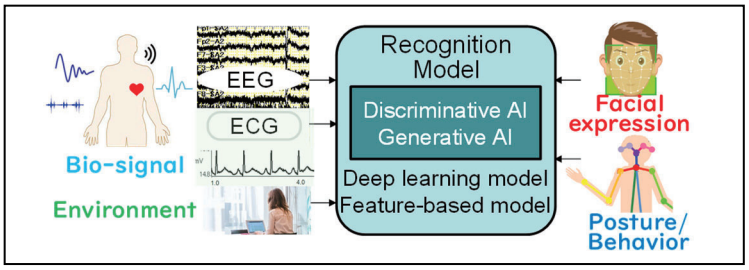

Fig.1 Models for recognizing human activity, emotion, and health condition

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[2]Chika Sugimoto, Masticatory Evaluation in Non-contact Measurement of Chewing Movement, Human Systems Engineering and Design II. Advances in Intelligent Systems and Computing, vol.1026, pp.737-741 (2019)

[3]Yoshitomo Sakuma, Kento Takabayashi, Takumi Kobayashi, Chika Sugimoto, Ryuji Kohno, Learning Scheme Based on Stability Analysis for Prediction Model of Anesthetic Effect Using Recurrent Neural Network, International Journal of Trend in Research and Development, Vol.7, No.2, pp.199-204 (2020)

Biography

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Ph.D. (Environmental Science) (The University of Tokyo, 2006)
The University of Tokyo (2006-2010), Yokohama National University (2010-Present)
Research Interests: Human sensing, Human Informatics, Biological system engineering

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AI for Smart Sensing

K Govardhan[1]

[1] School of Electronics Engineering, Vellore Institute of Technology, Vellore-632014, Tamil Nadu, India

Abstract:

Sensors are now omnipresent. A typical mobile phone is equipped with 26 sensors on average. These sensors act as eyes, ears, etc. for the machines to perceive the environment around them. Most of these sensors provide real-time data output in multiple forms (analogue and digital). (voltage/current, change in resistance/inductance/capacitance, etc.). Real-time processing of this voluminous data is necessary to extract meaningful insights from it. Most sensors have an actuator that performs a relevant operation in response to the sensed parameter. Sensors, processors, and actuators form the complete system, configured either in closed-loop or open-loop systems. Advancements in the domains of material science, data acquisition, signal processing, and data manipulation have resulted in a substantial demand for smart sensing systems in domestic, industrial, biomedical, and even military applications [1]. These systems produce vast amounts of data, known as big data, that require analysis and prompt responses, often within a few microseconds. Manual processing of big data is not feasible. Artificial intelligence (AI) comes to the rescue in these scenarios.

Imbibing intelligence into a machine is a challenging task. Simple tasks for humans, such as standing upright, turning left, or sensing an object's distance, are complex and sometimes impossible for machines. AI mitigates these requirements [2]. Big data is not only a challenge for AI-based models; it is also required for their training. These models can handle different types of data from a variety of sensors to arrive at a comprehensive solution. AI-integrated sensing systems boast improved accuracy, efficiency, full or partial automation, scalability and adaptability to future requirements, reconfiguration to suit a variety of applications, etc.

AI-based sensing systems are already well established in the fields of autonomous vehicles, machine vision, health care, industrial automation, smart home solutions, and weather prediction, and the list is growing very fast [3].

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Biography

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Leverage of AI for weather and climate sciences

Ryuji Yoshida[1, 2]

[1] Graduate School of Environment and Information Sciences, Yokohama National University,

[2] Typhoon Science and Technology Research Center, IMS, Yokohama National University

Abstract:

Atmospheric science is discovering weather and climate mechanisms to understand our Earth system. We construct theories based on observations and try to explain atmospheric phenomena like storm and heat wave, and those knowledges make possible to predict weather and to prevent disasters. In 1970's, a novel tool to support our challenges was realized with an aid of electric computer power. That is, numerical atmospheric model. After continues strives for a half of a century, the numerical model was highly developed and can predict tomorrow with confidence. Today, the weather forecasting aided by the numerical model is called as numerical weather prediction (NWP) and even necessary technique to achieve an accurate prediction. However, we are suffering from the obstacles to get an even accurate model, for instance, computational power, basic understandings for physics and dynamics. To solve these bottlenecks, we tried to utilize the power of Machine Learning (ML) and Artificial Intelligence (AI) into our modeling for more than 10 years. The first step was started to replace physics schemes by ML model. Physics schemes are embedded parts on the numerical model, because small scale processes which are not able to resolve by grids in the NWP model are represented by empirical functions; for example, radiative transfer, turbulence, and cloud microphysics. The surrogate models using Convolution Neural Network (CNN) show success in an improvement of the computational efficiency but put difficulties to understand the processes and to tune the model with combination of the other parts. Recently, game change is happening through large foundation model approach. Google achieved medium-range global weather forecasting by GraphCast [1] which learns whole system of the atmosphere based on the reanalysis data (grided value assimilated various observations), instead learns a part of the weather phenomenon like surrogate models. Astonishing point is the Google's GraphCast shows even better forecast skill in some metrics than the ECMWF's IFS model which is the highest performance NWP model in the world meteorological offices. 12 large foundation models have been developed already from 2021 to 2023 [2]. Atmospheric scientists like me have sought to better understand and technique through a-priori-thinking based on human trials and errors, but we are diving into the new era where necessary to use leverage of ML and AI driven by data.

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Biography

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Embryonic Quality Assessment using Advanced Deep Learning Architectures utilizing Microscopic Images of Blastocysts

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Abstract:

The accurate evaluation of embryonic quality is a key aspect in Assisted Reproductive Technology (ART). It is crucial to ensure the success of in vitro fertilization (IVF), especially at critical developmental phases like day 3 and day 5. To increase the success rate of implantation, morphological feature-based scoring techniques are currently the mainstay of embryo evaluation. Addressing the need for enhanced accuracy and latency, our work uses advanced algorithms based on deep learning to assess microscopic images of embryos at these critical junctures. The images are pre-processed using histogram equalization and fed to various deep learning models and their performance metrics are compared. Upon comparison, Graph Convolutional Networks achieved the highest accuracy of 96.1% with sensitivity of 96.43% and specificity of 95.24%. Further, the accuracy of the model is increased by implementing an optimized form of GCN known as Graph Attention Networks through an attention mechanism by dynamically determining the importance of each neighbor's features achieving an accuracy of 98.8% with sensitivity of 96.4% and specificity of 97.5%.

Index Terms—Assisted Reproductive Technology, Deep Learning, Embryonic Assessment, Neural Networks

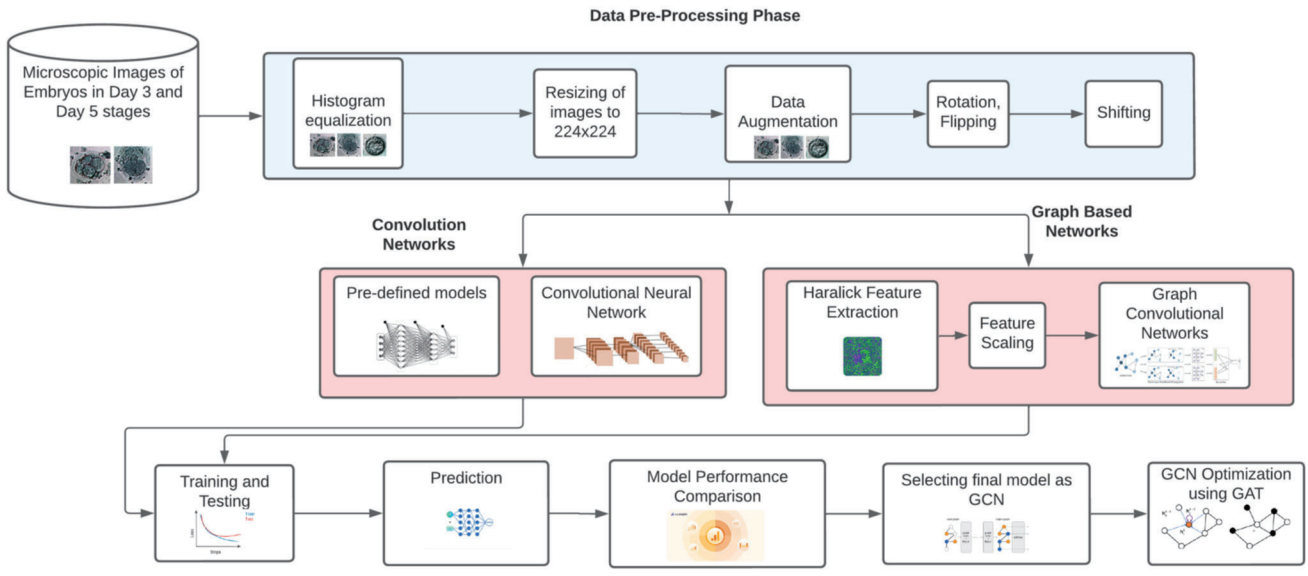

Figure 1. Architecture framework of the proposed model

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Biography

P. Varalakshmi is the Director of Centre for Artificial Intelligence & Data Science Research & Applications (CAInDRA), and serves as Professor in the Department of Information Science and Technology, CEG, Anna University, Chennai, India. She has over 25 years of teaching and research experience in the fields of cloud computing, data analytics, machine learning, deep learning, artificial intelligence, blockchain technology, internet of things, networks, and security. She has published more than 200 papers in reputed journals and conferences, and has guided 13 doctoral theses. She has also received several grants for her research projects and innovations. She has been serving as reviewer for several international journals. She is passionate about teaching and mentoring young researchers and students. She is also involved in various academic and administrative activities at Anna University.

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Future perspectives of AI applications for motion data analysis in robotics and mechatronics

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Abstract:

This presentation will provide an overview of cutting-edge mechatronics technology that enables the transmission, recording, editing, and reproduction of haptic sensations in the real world. Some examples of medical device development that apply this technology will be introduced. Specifically, some prototypes such as a bone drill with an instantaneous automatic stop function when penetrating the spine in the orthopedic field [1], a forceps with a tumor discrimination function based on tactile data in the neurosurgery field [2], and a drug inhalation device with a function to evaluate device operation errors in the respiratory medicine field [3] will be shown. Finally, we will discuss the future prospects for the usefulness of the motion data obtained through these devices.

Fig. 1 Haptic bone drill

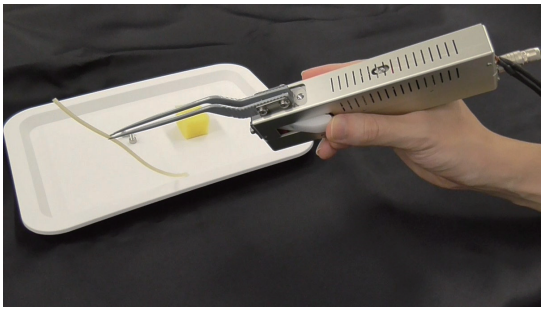

Fig. 2 Haptic forceps

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[3] S. Takano, et. al., "An Inhalation Device With Inertial Measurement Unit for Monitoring Inhaler Technique," IEEE/ASME Transactions on Mechatronics, 2022.

Biography

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Artificial Intelligence for Manufacturing Sustainability

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Abstract:

Manufacturing activities contribute to a significant part of global energy consumption and related pollution. As per the projections from the international energy agencies, the trend will exponentially grow in the upcoming decades. Modern approaches to manufacturing activities have positively reflected that the incorporation of artificial intelligence can benefit manufacturing processes and systems. Artificial intelligence-based approaches have the potential to deliver a more robust, resource-efficient, eco-friendly, and energy-saving manufacturing system by solving many critical issues ranging from material and process redundancy to scrap disposal and energy distribution. In my talk, I'll discuss the AI-based approaches for solving critical issues in hybrid manufacturing domains involving metal cutting to metal additive manufacturing.

Biography
Sarvesh Mishra, Indian Institute of Technology-Kanpur, Assistant Professor
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Abstracts

Invited

Rumex crispus L: Profiling, evaluation, and microencapsulation of its bioactive root compounds to enhance antioxidant and antimicrobial activities during food fortification.

Samuel Begashaw Mandefro[1], Anuradha Jabasingh S[2,*], Zelalem Tumsa Tefera[1], Amare Ayalew Abebe[3]

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Abstract

Rumex crispus L. is a strong aromatic herb, widely employed in traditional healing in Ethiopia, due to its outstanding biological properties. In this study, the root component of *Rumex crispus L.* was extracted by macerating with three solvents to determine the bioactive compounds and other antioxidants. In addition, the antimicrobial activities, and the thermal behavior of *Rumex crispus* root extracts were determined. It was observed that the *Rumex crispus* extract was a rich source of phenolic, flavonoid, and proanthocyanadin compounds that could be used in food preservation and fortification. The antioxidant activity of the solvent extract of the *Rumex crispus* root was evaluated using the DPPH scavenging, ABTS, and ferric reducing antioxidant power (FRAP) analysis. The *Rumex crispus* root extract revealed a good antioxidant activity. The antimicrobial screening effect was evaluated by the agar disc diffusion method to see the growth inhibition effect of the extract on selected bacteria. FTIR spectroscopy and the GC-MS analysis revealed a large number of bioactive substances (antioxidants and antimicrobial agents). The thermal behavior was determined using (TG-DTG) to evaluate their resistance to thermal oxidation during the encapsulation process. Thus, the study reveals that the bioactive components of *Rumex crispus*. L root extract can provide potential contribution to the food fortification processes. However, this bioactive is susceptible to oxidation upon exposure to oxygen, light, and heat, which can result in the loss of antioxidant activity. This required the need to evaluate the encapsulation of bioactive compounds using maltodextrin and gum arabic as encapsulate fabricating agents. Morphological properties of the optimal encapsulate were determined by scanning electron microscopy. Oxygen permeability and oxidative stability were assessed. The presence of polyphenolic and polysaccharide components were detected by Fourier transform infrared spectroscopy (FT-IR) analysis. Furthermore, thermo gravimetric analysis (TGA) confirmed the enhanced thermal stability of the encapsulate for functional food applications.

Keywords: *Rumex crispus* L, Root bioactive compounds, Antioxidant, Antimicrobial activity, Thermal behaviour, Encapsulation.

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Biography

Dr. S Anuradha Jabasingh is an Associate Professor in Process Engineering at the School of Chemical and Bio Engineering (SCBE), Addis Ababa Institute of Technology, Addis Ababa University, Ethiopia since 2014. Currently, she is the serving as the Chairperson for Process Engineering Program at SCBE. Previously, she was serving as Assistant Professor in SAACE, India during 2004-2006 and as Associate Professor in Sathyabama University, India from 2007-2013. She accomplished her B.Tech and M.Tech in Chemical Engineering from Madras University and Anna University during the years 1998-2002 and 2002-2004, respectively. She obtained her Ph.D in Chemical Engineering from Sathyabama University in 2012 with specialization in Enzyme Bioprocessing.

Her core research area of interest is Renewable energy & Alternate fuels. However, currently, she is working on Membrane separation operations, and other Bioprocessing Strategies using Under-utilized feedstocks in Ethiopia. She has published and presented her research in over 90 peer-reviewed research journals and 36 national and international conferences and seminars. She has authored 6 book chapters to her credit and has 5 newly identified microbial strains arising out of her research in GenBanks as submissions. She is a Journal article referee and an Editorial board member in several International/ National journals. She is as well an active member of the Indian Science Congress Association (ISCA), AsiaPacific Chemical, Biological & Environmental Engineering Society (APCBEES), International Association of Engineers (IAENG) and International Association of Computer Science and Information Technology (IACSIT).

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Are residential consumers on the right tariffs? Evidence from the Australian state of New South Wales

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Abstract:

Growing peak electricity demand and recently emerged daytime minimum demand problem in Australia led to calls for the radical re-thinking of electricity tariffs offered to residential customers by network providers and retailers. The tariffs that better reflect the network's costs and operating environment should provide a price signal to the customers when they should use electricity, thus encouraging demand response. There are several network and tariff options available to customers in Australia, yet many households are still enrolled with flat network and retail tariffs. This study explores the suitability of alternative network and retail tariffs for residential customers in Australia for households, based upon existing consumption patterns.

The analysis is performed in three stages. Firstly, using a unique dataset of residential customers in NSW, households' annual bills are tested against several popular tariffs. The study reveals that the most suitable tariffs for the households' current consumption pattens are Demand Fixed network tariff and retail Real Time Pricing (RTP) tariff, whereas over 90% of households in the sample are currently not on the least cost tariff schemes. In the second stage of analysis, the households are grouped based upon their consumption characteristics. A notable finding suggests that households with high consumption enjoy greater financial benefits when moving to more dynamic tariffs. In contrast, households with high intra-day variability of their demand show the greatest potential for demand response. Finally, the study attempts to identify the households with highest flexible demand capacity and suggests suitable tariff schemes for these groups. These findings reveal potential policy intervention and further improvement strategies of tariff schemes.

Biography
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Anxiety that Drives Kaizen: A Strategic Blueprint for Kaizen Implementation Across Borders

Kodo Yokozawa

Kaizen is a continuous improvement process within organizations that aims to eliminate waste from business processes (Imai, 1986). It relies on the knowledge and ideas of employees and is a central value of the Toyota Production System (TPS) (Liker, 2004). Despite its recognized effectiveness and simplicity, implementing and sustaining kaizen can be challenging (Bessant & Caffyn, 1997; Brunet & New, 2003). Research on kaizen also reveals variations in its performance between Japan and other nations (Robinson & Stern, 1998). For instance, European factories generate only 0.4 suggestions per worker per year, whereas Toyota produces an average of 61.6 suggestions annually (Womack et al., 1990). Additionally, in 1995, the average number of suggestions submitted per employee in the US and Japan was 0.16 and 18.5, respectively (Robinson & Stern, 1998). These statistics imply that while the kaizen concept aligns well with the Japanese context, its implementation in different countries and contexts can be challenging. Many factors play a role in the international transfer of kaizen, such as cultural differences (Lagrosen, 2003; Naor et al., 2008; Recht & Wilderom, 1998) , the influence of labor unions (Humphrey, 1995), and job security (Young, 1992). However, an intriguing aspect worth exploring is the impact of "anxiety" on kaizen performance, as suggested by Imai (1986). Imai recounts a conversation with a European diplomat in Japan, who highlighted a stark contrast between Western complacency and overconfidence versus Japanese feelings of anxiety and imperfection. The concept of imperfection and the experience of anxiety among the Japanese workforce may serve as significant driving forces for kaizen (Imai, 1986, p. 32). Similarly, Parker and Slaughter (1988) observed that workers at NUMMI plant, a Joint Venture between General Motor (GM) and Toyota Motor, were consistently motivated to enhance their performance through kaizen, leading to its characterization as "the factory that runs on anxiety." These insights challenge the prevailing belief that anxiety has a negative impact on work performance (Martens et al., 1990), making them particularly thought-provoking. However, Imai (1986) does not delve deeper into the reasons behind Japanese workers' feelings of anxiety, nor does he explain how or why this emotion contributes as driving forces for kaizen. To understand why kaizen is widely practiced in Japan but difficult to transfer to other countries, we must address two crucial questions: 1) Does higher personal anxiety contribute to improved kaizen performance? and 2) Do Japanese individuals experience higher levels of anxiety compared to people in other nations? Answering these questions helps uncover the cultural and psychological factors influencing kaizen implementation globally. If higher personal anxiety does lead to enhanced kaizen performance and Japanese workers experience more anxiety than individuals in other nations, this could explain kaizen's success in Japan and its limitations in other countries. Organizations aiming to implement kaizen effectively in diverse cultural contexts must understand these factors.

Waste Rice Straw: A Sustainable and Effective Substrate for Immobilizing Enzymes for Wastewater Remediation

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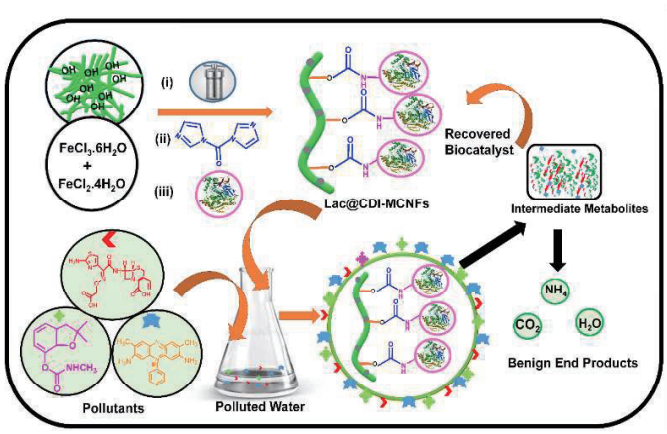
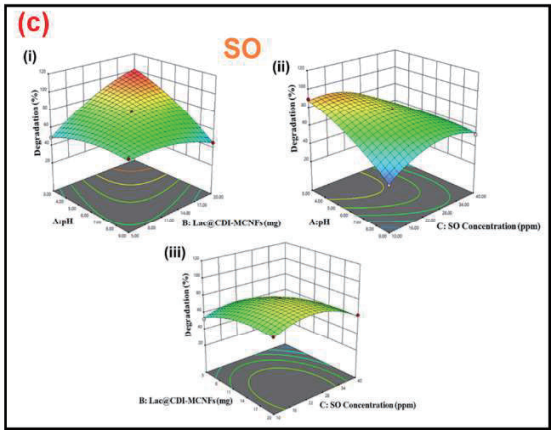
Key words: Lignocellulosic biomass, cellulose nanofibers, enzyme immobilization

Abstract: In India, with the surge in rice production, there has been a substantial increase in the non-edible part left after harvesting i.e. rice straw. The straw is low in lignin and high in silica imparting low crude protein and poor digestibility, limiting its use as cattle feed. The straw is a complex biopolymer consisting of cellulose fibers embedded in an amorphous matrix of lignin, pectin, and hemicelluloses. This research work focuses on the simultaneous extraction of lignin and cellulose nanofibers (CNFs) from rice straw using chemical-mechanical treatment. The extracted CNFs were used as substrates for enzyme immobilization to yield high-performance catalysts for the degradation of multifarious pollutants [1].

In this work, an easily recyclable biocatalyst (Lac@CDI-MCNFs) was synthesized by immobilizing laccase on rice straw-derived carbonyldiimidazole mediated magnetized CNFs (MCNFs). Lac@CDI-MCNFs were utilized for bioremediation of cefixime antibiotic (CT), carbofuran pesticide (CF), and safranin O dye (SO) via oxidation-reduction reactions in wastewater. MCNFs provided enhanced pH, temperature, and storage stability to laccase and allowed reusability for up to 25 cycles with a mere 20% decline in efficacy. The Lac@CDI-MCNFs effectively degraded 98.2 % CT and 96.8% CF into benign metabolites within 20 h and completely degraded SO in just 7 h. Response surface modeling (RSM) was employed based on the Box Behnken Design to evaluate the effect of various parameters i.e. pH, the concentration of catalyst, and the pollutants which were further validated with experimental studies. The degradation products were identified using LCMS, which allowed the degradation pathway of the pollutants to be determined. The degradation of all pollutants followed first-order kinetics with rate constants of 0.1775, 0.0832, and 0.958 h^{-1} and half-life of 3.9, 5.0, and 0.723 h for CT, CF, and SO, respectively. Lac@CDI-MCNFs were demonstrated to be an effective catalyst for the degradation of multifarious pollutants.





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Biography

Prof. Anupama Sharma is currently the Chairperson of SSB University Institute of Chemical Engineering and Technology, and Director of Energy Research Centre, Panjab University, India. She has been Dean of Alumni Relations and Coordinator of the World Bank-sponsored Technical Education Quality Improvement Program (TEQIP) (2014-2022). She is the winner of various awards including the ACCT(1) e-TCR Award for her outstanding contribution published in 'Trends in carbohydrate research with a cash prize of INR 30,000 (2023), Young Researcher Award, Asian Polymer Association (2017) and Career Award for Young Teachers (CAYT), All India Council for Technical Education (AICTE), India. She has handled 10 Major Research Projects and completed 1 International Exchange project with JKU, Linz, and 1 ongoing cultural exchange project with YNU, Japan.

Sustainability integrated approaches towards design and manufacturing of lightweight aerospace component

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Abstract:

Metal additive manufacturing has opened a way to design and manufacture free-form complex geometry components. The excellence in CAD design and modelling has paved the way to stitch the internal structure of a solid body by using micro-structural elements of various shapes and geometries [1]. Recent interests in 3D printing have opened a debate about whether the porous/internal structured load-carrying components can be 3D printed with exact functionalities like that of a solid body with the same geometrical features. Additive manufacturing (AM) has offered the freedom to produce complex-shaped parts. Such advantages have been exploited with the advancement in CAD packages to generate high strength-to-weight and high stiffness-to-weight components using porous lattice designs and structures.

In this talk, I'll discuss how advanced mathematical modelling (CAD design, FE analysis, etc.), manufacturing and mechanical sciences (laser powder bed fusion, low and high-rate deformation behaviour) and material science (heat treatment and transformation) can be integrated to access a new dimension in design and manufacturing of fully functional lightweight superalloy structures. Such integration drastically reduces the weight of the components without compromising specific strength and specific stiffness. I'll highlight the role of mathematical algorithms for lattice-structured heterogeneous AM components which can conform to the shape of the intended geometry with equivalent strength, toughness, durability, and performance as a solid body of the same geometry and dimensional features. Some initial trials and published results will be presented on the porosity-optimized lattice components by additive manufacturing with subsequent stages of transformation, deformation, and extreme mechanics to produce ready-to-deploy lightweight components.

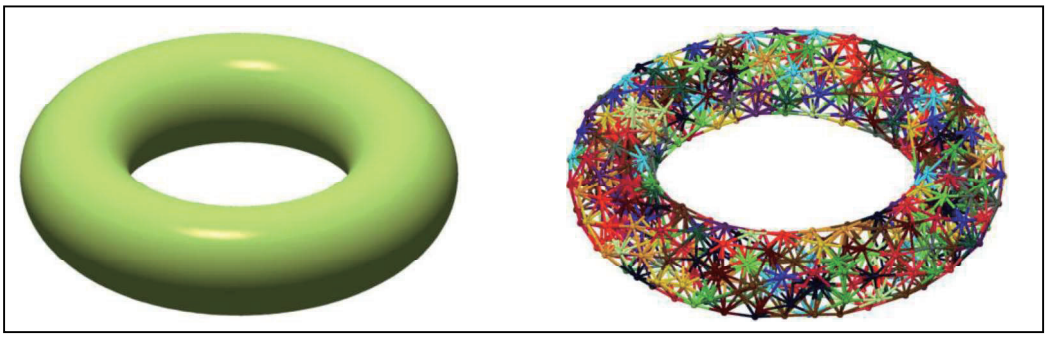

Fig.1 Solid torus model converted into a porosity-optimized lattice microstructure for metal 3D printing

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Biography

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Machine learning predictive approach to analyse differential pipe sticking in oil and gas drilling operations

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Abstract:

This study investigates the application of machine learning methods for real-time identification of differential pipe sticking in oil and gas drilling. We leverage a dataset encompassing operational data from two Indian reservoir wells. To predict differential pipe sticking events, various classification models were implemented, including Artificial Neural Networks (ANN), Support Vector Machines (SVM), Logistic Regression (LR), Naive Bayes, k-Nearest Neighbors (KNN), and Decision Trees to create forecast models. The data was pre-processed by cleansing, standardizing and partitioning to improve the performance of the model. Our findings reveal a stacked ensemble model as top performer with a notable F1 score of 0.95. This highlights the effectiveness of ensemble method in harnessing the strengths of individual algorithms, surpassing LR and KNN in performance with F1 scores of 0.90 and 0.91, respectively. This study underscores the potential of ML techniques to address drilling challenges, particularly in the crucial realm of differential sticking detection.

Keywords: Differential sticking; Classification models; Effectiveness.

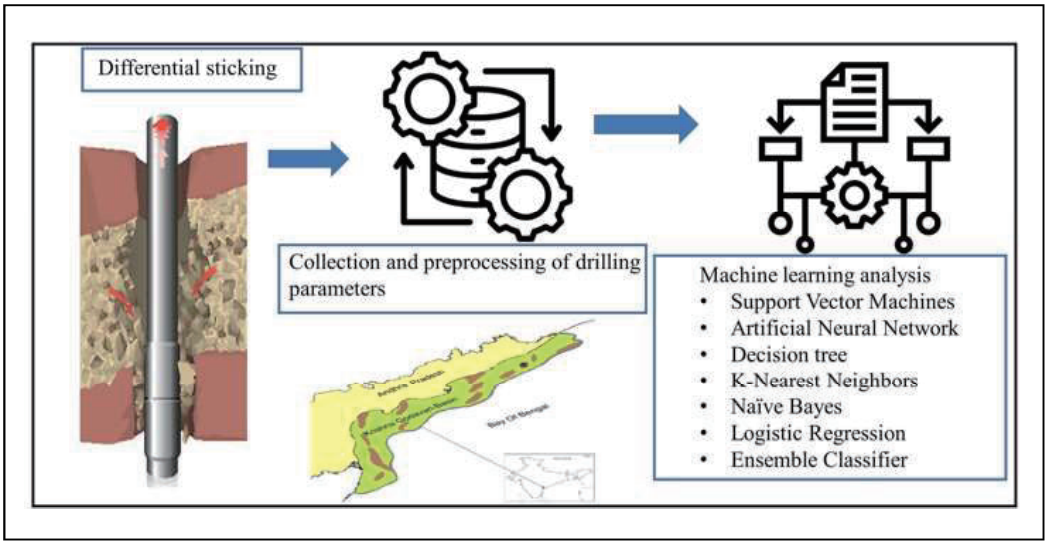

Fig.1 Graphical Abstract.

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Biography

Aslam Abdullah M, Vellore Institute of Technology, Associate Professor
Ph.D. (Petrochemical Technology) (Anna University Chennai, 2017)
Award: SPE Presidency Excellence Outstanding Student Chapter Award 2019,
SPE Outstanding Student Chapter Award 2018
Research Interests: Troubleshooting oil and gas drilling operational problems,
Pollution Abatement Technology

Contacts

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E-mail: aslamabdullah.m@vit.ac.in

Introduction of your study field, research, and perspective for future.

I'm a Petroleum Engineer with a Ph.D. & B. Tech in the field of Petrochemical Technology and a M. Tech in Gas Engineering. For the past 5 years, I've been focusing on applying machine learning/big data to troubleshoot problems in oil and gas drilling operations. Machine learning allows us to analyse vast amounts of data from sensors and equipment in real-time, helping us identify potential issues before they escalate. I've published 5 research papers in the last two years on this topic, even collaborating with undergraduate students on some projects. Looking ahead, I believe machine learning/big data has the potential to revolutionize drilling operations. It can improve efficiency by optimizing drilling parameters, enhance safety by predicting equipment failures, and ultimately reduce costs. My future research interests lie in integrating machine learning with other technologies like automation and robotics, and developing even more sophisticated algorithms to handle the complexities of modern drilling processes.

This is just a starting point, feel free to elaborate on your specific research and future goals.

As the audience's study field will be interdisciplinary, please provide an explanation for abbreviations and highly specialized terms

a. Artificial Neural Network

Artificial Neural Networks (ANNs) are computer networks that are modeled after the functionality of the brain. They consist of nodes that are interconnected in layers, similar to the neurons in the brain. These nodes receive input, process it, and produce output. ANNs are capable of learning various tasks through training with data, during which the connection weights are adjusted based on errors. ANNs are composed of input, hidden, and output layers. The input layer contains the inputs for the problem, while the hidden layer initiates the processing. Depending on the nature of the problem, several hidden layers may be present in ANN models.

b. Support Vector Machines

SVMs are a powerful classification algorithm. They function by creating a hyperplane in high-dimensional space that optimally divides data points into unique groups. To maximize the margin, the space between the plane and the nearest data points from each class, it is selected (support vectors). SVM can handle both types of data: those that are linearly separable and those that are not. This versatility makes SVM a powerful option for classifying complex datasets.

c. Logistic regression

Logistic regression is a machine learning technique employed for classification tasks. Its primary function is to forecast categorical outcomes, contingent upon indepe-ndent variables. This algorithm assigns numerical value-s ranging from zero to one to assess the- probability of an individual being

impacted. Logistic regression bears resemblance to linear regression but is exclusively utilized for binary outcomes. It incorporates a function that transforms probabilities into values confined between zero and one, resulting in an S-shaped curve rather than a linear regression line. Despite its similarities, logistic regression serves as a widely adopted machine learning algorithm specifically tailored for classification purposes. The following equation represents the logistic regression model's formulation.

d. Decision trees

Decision tree classifiers are a useful tool for classification tasks in research. They provide transparency and actionable insights by posing questions about the data and navigating towards specific categories. However, they can become complex with larger datasets and may require pruning. Despite this, decision trees are valuable for researchers seeking clear and understandable classifications.

e. Naïve Bayes

The Naïve Bayes method is a supervised learning technique that is used for classification problems. It uses Bayes' theorem to predict the class label of new data, making the assumption of feature independence. During training, it calculates the probability of each feature value occurring in a specific class. It calculates the posterior probability of every class and designates the class with the highest likelihood when classifying fresh data.

f. K-Nearest Neighbours

The K-Nearest Neighbors (KNN) algorithm categorizes data points by evaluating their resemblance to neighbouring labelled data. For a fresh data entry, KNN pinpoints the k nearest datapoints in the training set using a distance calculation. The algorithm then assigns the new point's class label by majority decision (for classification tasks) or by averaging the target values (for regression tasks) of those k closest neighbours. KNN's straightforward approach and ease of interpretation are advantages. However, it can demand significant computational resources for large datasets and exhibit sensitivity to the chosen value of k and distance metric.

g. Stacked ensemble classifier

The algorithm employs a novel approach to combining base models, setting it apart from conventional methods. Unlike traditional technique's relying on a single classifier, our ensemble leverages the collective intelligence of diverse models. This stacking technique enables the model to harness the strengths of multiple distinct models, resulting in significantly improved generalization, accuracy, and stability. Moreover, the inclusion of a noise model confers resilience to noisy data, a characteristic often lacking in traditional methods. The ensemble's adaptability to varying data distributions also presents a considerable benefit over conventional classifiers.

Role of UNESCO Biosphere Reserves on Blue Carbon

Miguel Clusener-Godt

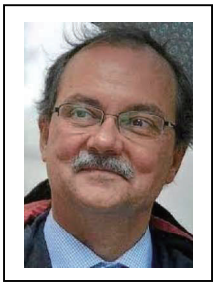
[1] University of Coimbra,

Abstract:

Blue carbon ecosystems are of tremendous value toward the utilization of high-salinity water, such as seawater, as well as hyper-saline soils, and salt-tolerant biota for the production of biomass, for food, feed, fiber, fuel, other economic purposes, and carbon sequestration. In order to achieve the 17 SDGs, the scientific research into blue carbon ecosystems is an absolutely important element. Moreover, monitoring is needed, as well as the conservation of the remaining blue carbon ecosystems, and the restoration of lost habitat. The book will provide comprehensive scientific documentation inspiring the way forward on how to utilize saline resources in the best interest of humanity. It will try to foster the academic research and networking for land-users, politicians, development banks, innovative farmers, investors, energy- producers, and carbon-off-setters.

References
[1] Clüsener-Godt M, Matsuda H, Böer B, Loughland RA (Eds.) (2024/11) Blue Carbon Mangrove Ecosystems: A Concept-Based Approach. Springer, 210pp.

Biography



Miguel Clüsener-Godt, Senior Research Associate at the UNESCO Chair on Biodiversity Safeguard for Sustainable Development, University of Coimbra, PORTUGAL
Former Professor at Yokohama National University

He worked for more than 30 years at UNESCO Headquarters in Paris where he served as UNESCO's Director of the Division of Ecological and Earth Sciences and Secretary of the Programme on Man and the Biosphere (MAB), and, at the same time the Secretary of the UNESCO Global Geoparks Programme (UGGP) until 2021.

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Abstracts

Poster

P-01

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

CFD and experimental analysis of power dissipation and shear rate distribution in a stirred tank

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Mixing of Non-Newtonian fluids is a crucial unit operation and mostly, pseudoplastic non-Newtonian fluids are used in industry. The rheological complexities of pseudoplastic fluids can cause a variety of difficulties, most important is change in viscosity with the shear rate. In these situations, an accurate determination of power consumption and shear rate is essential to optimize the mixing process of non-Newtonian fluids. Apparent viscosity concept proposed by Metzner-Otto (1957) is adapted widely and became a universal method to calculate the power consumption. This study focused on investigating power consumption and shear rate to understand the effect of rheological parameters of non-Newtonian fluid on Metzner-Otto constant $K_{s,exp}$ using multi-purpose CFD software ANSYS Fluent 2022 R1. Direct numerical simulation in the same tank as that of experimental measurements were performed. The results obtained from this study suggest that $K_{s,exp}$ is dependent on n for non-Newtonian highly shear-thinning fluids. CFD power values are nearly same as that of the experimental power values. From the local shear rate distribution, it is evident that $\dot{\gamma}$ changes with change in the shear-thinning behavior of non-Newtonian fluids.

This study was financially supported by the JSPS KAKENHI (Grant No. 22K04799).

- Experimental Method : Metzner-Otto Method (1957)

Newtonian fluid (High-viscosity fluid) $N_p Re = B$ (1)

Same B can apply for the same tank

Non-Newtonian fluid (HEC aqueous solution) $N_p' Re' = B'$ (2)

- CFD analysis Method : For Newtonian fluid: $\eta_a = \eta$

i. Experimental value by torque meter: $P_{exp} = 2\pi N\Gamma$ (5)

ii. CFD analysis from local strain rate: $P_{dis} = \sum_{ijk}[\{\dot{\gamma}^2 \eta_a\}\Delta V]$ (6)

According to Jeong and Hussain (1995), $\dot{\gamma}$ can be obtained by the second invariant of the shear rate tensor $\boldsymbol{S}_{ij}$.

$$\dot{\gamma} = \sqrt{\frac{1}{2}\left(\boldsymbol{S}_{ij} : \boldsymbol{S}_{ij}\right)} \quad (7) \qquad \boldsymbol{S}_{ij} = \frac{1}{2}\left(\frac{\partial u_j}{\partial x_i} + \frac{\partial u_i}{\partial x_j}\right) \quad (8)$$

Results:

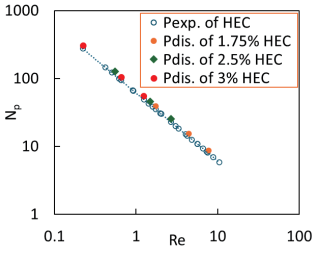


Fig. 2: Power consumption data

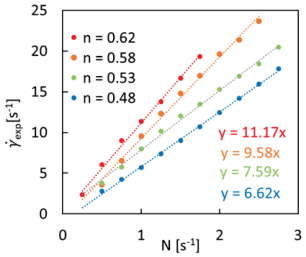
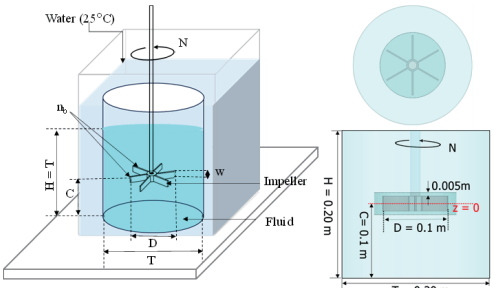


Fig. 3: $\dot{\gamma}_{exp}$ vs N

Metzner-Otto constant Calculation:

$$\dot{\gamma}_{avg,exp} = K_{s,exp} N\ [s^{-1}] \quad (3) \qquad \eta_a = \frac{\tau|_{\dot{\gamma}=K_S N}}{\dot{\gamma}_{avg}} \quad (4)$$



Experimental Set-up CFD analysis geometry

Fig. 1: Schematic representation of stirred tank used for experiment and CFD.

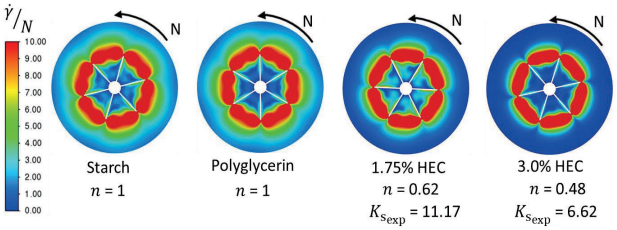


Fig. 4: Shear rate distribution of Newtonian fluid and non-Newtonian fluid at 90 rpm.

PRESENTED BY - PRACHI TIWARI
PANJAB UNIVERSITY , INDIA

THE ESSENCE OF YOGA

An inner journey

"Yoga is the Journey of the Self, to the Self, Through the Self."

THE POSITIVE IMPACTS OF YOGA

HEART BENEFITS

Yoga can help lower blood pressure, cholesterol, and blood sugar, all of which are good for our heart and blood vessels.

OVERALL FITNESS

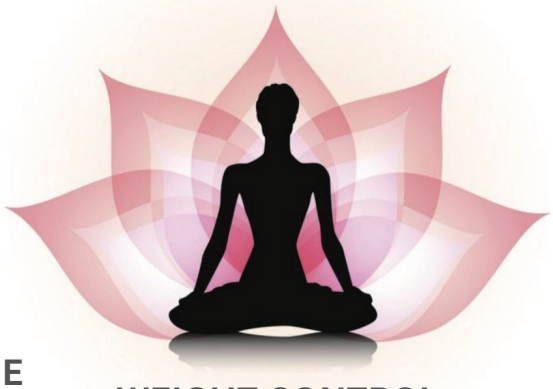
Practicing yoga a couple times a week increases muscle strength and flexibility, boosts endurance, and tunes up our heart, lungs, and blood vessels.

BETTER BODY IMAGE

Focusing inward during yoga helps us to be more satisfied with our body and less critical of it.

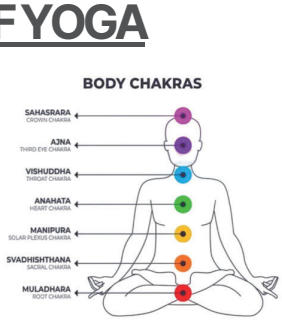
MINDFUL EATING

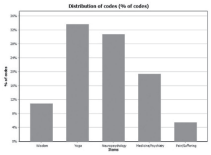
Being more aware of how our body feels carries over to meal times as we savor each bite or sip and notice how food smells, tastes, and feels in our mouth.

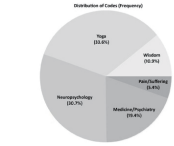


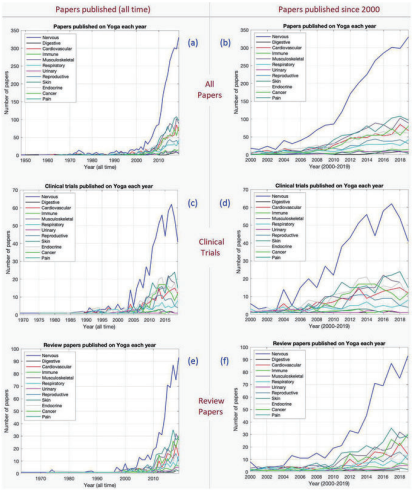
WEIGHT CONTROL

Mindfulness developed through yoga can make us more sensitive to cues to hunger and fullness, which help us develop a more positive relationship with food.









P-03

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

$LaGaO_3$ film for intermediate-temperature solid oxide fuel cells

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Abstract

A challenge in the development of solid oxide fuel cells (SOFCs) has been to reduce their operating temperatures. Conventionally, yttria-stabilized ZrO_2 has been used as an electrolyte in high-temperature SOFCs requiring operating temperatures of 1073–1273 K. To reduce the operating temperature, $LaGaO_3$ doped with strontium and magnesium, which exhibits high ionic conductivity at intermediate temperatures (923–1073 K), has attracted attention. Many attempts have also been made to reduce the operating temperatures by depositing thinner material.

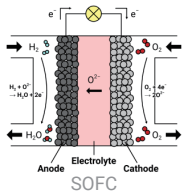
$LaGaO_3$ films have been deposited by electrophoretic deposition (EPD), plasma spraying, pulsed laser deposition (PLD) and sputtering. Chemical vapor deposition (CVD) is a technique capable of depositing solid materials at low temperatures and rapidly. However, there are no reports on the preparation of $LaGaO_3$ by CVD.

In the present study, La_2O_3–Ga_2O_3 films were prepared on both of glass and single crystalline $SrTiO_3$ substrates using chemical vapor deposition. We investigated the effect of chemical composition on the constituent phases and microstructure of the films.

Introduction, Issue and Proposal

■ **Conventional solid oxide fuel cells (SOFCs)**

– Utilizing yttria-stabilized ZrO_2 (YSZ) as an electrolyte (4 S m^{-1} at 1073 K)
– Requiring operating temperature of 1073–1273 K



SOFC

Issue

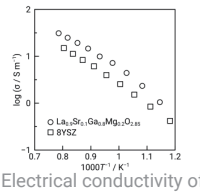
To reduce the operating temperature, materials exhibiting higher ionic conductivity than YSZ are required.

■ **$LaGaO_3$-based materials**

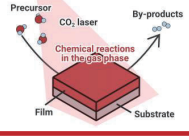
– Higher ionic conductivity than YSZ with the addition of Sr and Mg (10 S m^{-1} at 1073 K)

■ **Chemical vapor deposition process**

– Method for synthesizing inorganic films on substrates from gas phase
  • Low deposition temperature
  • High deposition rate (2–6 μm h^{-1})

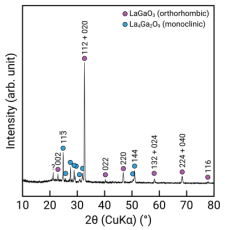


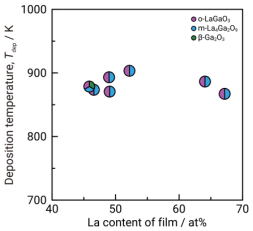
Electrical conductivity of YSZ and doped-$LaGaO_3$



Results and Discussion

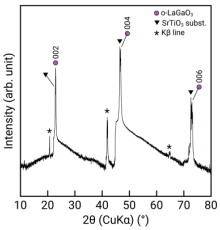
La_2O_3–Ga_2O_3 film prepared on glass substrate

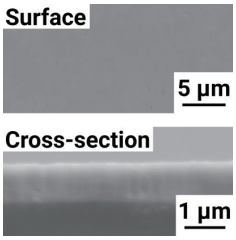




– Orthorhombic-$LaGaO_3$ and monoclinic-$La_4Ga_2O_9$ composite films were synthesized at 50 at%La.
– The o-$LaGaO_3$ has (112) or (020) plane orientation.

$LaGaO_3$ epitaxial film prepared on (100) $SrTiO_3$ (STO) substrate





Method	Deposition temperature / K	Annealing	Deposition rate / μm h^{-1}
EPD	-	1573–1673 K for 1 h	-
Plasma spraying	-	1073 K for 2.5 h	-
PLD	1003	-	0.06
Sputtering	573	1273 K for 2 h	0.72
CVD	**973**	**-**	**5.6**

– O-$LaGaO_3$ films were epitaxially grown with (002) orientation at a deposition temperature of 973 K and deposition rates of 5.6 μm h^{-1}.
– We synthesized dense o-$LaGaO_3$ films by CVD method at low deposition temperatures and high deposition rates.

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Epitaxial growth of Yb^{3+}-doped Lu_2O_3 dense and columnar films for X-ray inspection

Tatsuyuki Nakayama[1)], Akihiko Ito[2)*]
[1),2)] Yokohama National University
[1)] nakayama-tatsuyuki-df@ynu.jp, [2)] ito-Akihiko-xr@ynu.ac.jp

X-ray inspection are used to look the inside of objects in non-destructive, such as medical field and baggage screening at airports. The X-ray absorption rate varies from materials, and the radiographs show this difference as a contrast from white to black.

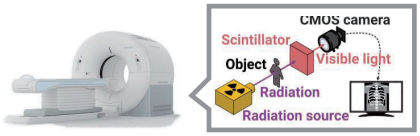
X-ray inspection uses semiconductor cameras such as CCD and CMOS, but they cannot directly detect X-rays. Therefore, it is necessary to convert X-rays into detectable visible light. For conversion to visible light, a phosphor called scintillator , which glows when irradiated, is used.

X-ray inspection has two important factors. The first is high radiation stopping power of scintillators , which is the sensitivity to radiation, and the second is high spatial resolution, which is the clarity of radiographs. Lu_2O_3 has high radiation stopping power due to high density (9.4 g cm^{-3}) and effective atomic number (Z_{eff} = 67). In addition, if the film microstructure is columnar, the spatial resolution can be improved because the extent of the scattering of visible light converted from X-rays can be limited.

The present study demonstrated the epitaxial growth of Yb^{3+}:Lu_2O_3 films with dense and columnar structures and Investigated its luminescence properties.

Introduction

X-ray inspection
- Imaging using X-ray absorptivity differences.
- CCD and CMOS cannot directly detect X-rays.
- Scintillator converts X-rays to visible light.

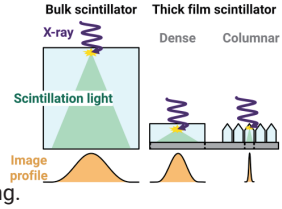


Proposal

Important factors
- High radiation stopping power (Sensitivity)
- High spatial resolution (Clarity)

Properties of Lu_2O_3
- High radiation stopping power due to its high density (9.4 g cm^{-3}) and effective number (Z_{eff} = 67).

Columnar Scintillator
- Improved spatial resolution by limiting the extent of light scattering.

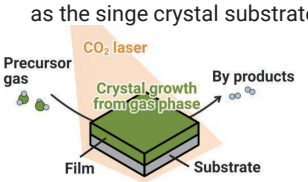


- **Synthesize Yb^{3+}:Lu_2O_3 films with altered microstructures.**
- **Investigate the luminescence properties of Yb^{3+}:Lu_2O_3.**

Experiment

Chemical vapor deposition
- Microstructure control is possible.

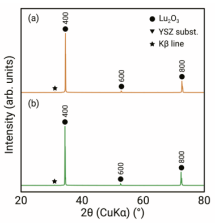
Epitaxial growth
- Films grows in the same orientation as the singe crystal substrate.

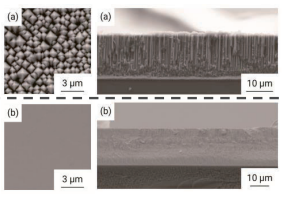


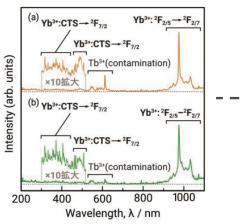
Results and discussions

Columnar

Dense







- The microstructure changed from columnar (a) to dense (b) as precursor vaporization temperature was lowered.
- The deposition rate reached 20–35 μm h^{-1}.
- Under X-ray excitation, emission from the CTL and 4f-4f transition of Yb^{3+} was observed.

P-05

YNU Symposium2024
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- Carbon Offsets -
The Solution for Global Warming in a Capitalist Society

Hirose Miyu
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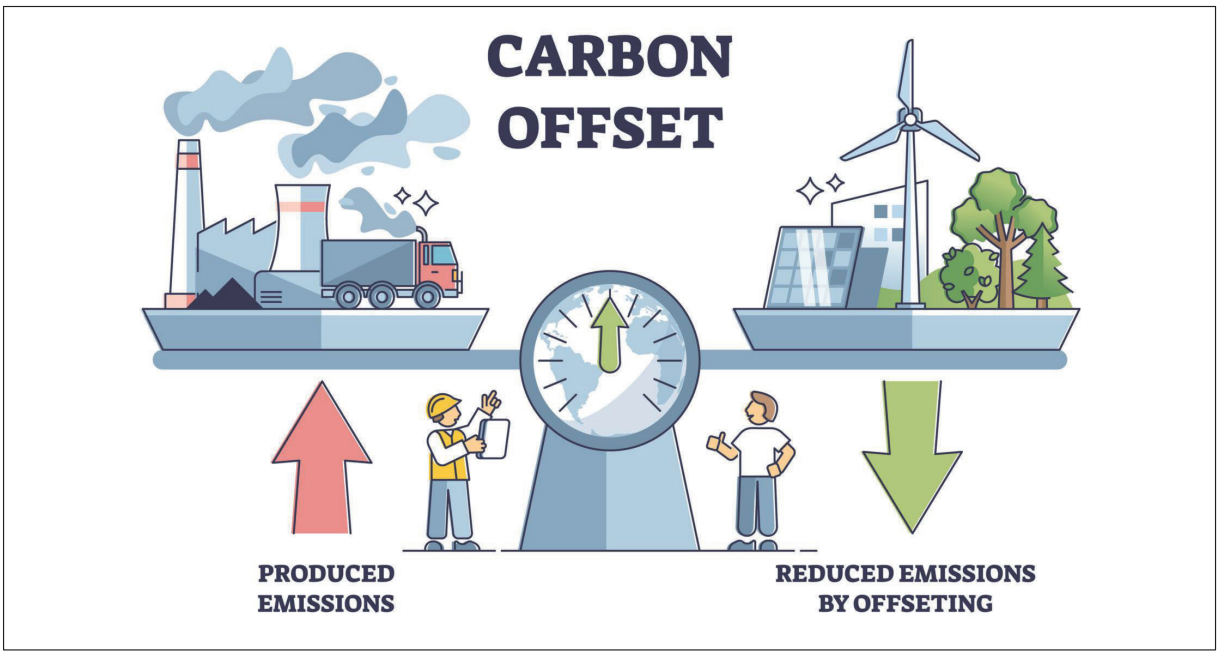
Abstract

One of the key strategies to address climate change from an economic perspective is the concept of “Carbon Offset.” This approach involves “compensating” for the greenhouse gases, such as carbon dioxide, inevitably emitted by human activities by investing in environmental projects that reduce or absorb greenhouse gases elsewhere. The aim is to balance out these emissions and encourage individuals and companies to take responsibility for their carbon footprint, actively engaging in emission reduction activities. Through the purchase of credits, Carbon Offset not only compensates for emissions but also stimulates investment in projects that reduce greenhouse gas emissions. The procedure is three steps: Know, Reduce, and Offset. First, individuals and organizations must measure their carbon footprint to understand how much CO2 they emit. Next, they should make an effort into reducing these emissions as much as possible. Finally, any remaining emissions are offset by funding initiatives that reduce greenhouse gases. However, the biggest issue of Carbon Offset is that it can be used to justify not working hard to reduce CO2 emissions. The ideal solution for global warming is to reduce carbon emissions to zero, but as long as economic activities continue, it is difficult to eliminate CO2 emissions completely. Therefore, Carbon Offset is one of the important approach to global warming in this modern capitalist society.



What is Carbon Offsetting? Why it Helps (AIFS abroad, April 22.2022)
https://blog.aifsabroad.com/2022/04/22/what-is-carbon-offsetting-aifs-green-initiative/

THE ALARMING REALITY OF WOMEN'S SAFETY

Non-Partner Sexual Violence

6%

Worldwide, an estimated 6% of women and girls aged 15 to 49 years have been subject to sexual violence from a non-partner at least once since age 15.

Young women aged 15 to 19 are the most affected by IPV. By the time they are 19 years old, almost 1 in 4 adolescent girls (24%) who have been in a relationship have already been physically, sexually, or psychologically abused by a partner (WHO).

Adolescent girls are more at risk than adult women!

641 million

Applying this percentage to the 2018 population data from World Population Prospects, the WHO estimates that 641 million women have been affected. And an estimated 245 million (or 10% of women ages 15 and above) have experienced IPV in the last 12 months alone..

1 in 3

Estimates published by WHO indicate that globally about 1 in 3 (30%) of women worldwide have been subjected to either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime.

VIOLENCE AGAINST WOMEN

That's 736 million women around the world.

Intimate Partner Violence

More than 1 in 4 women (26%) aged 15 years and older have suffered violence at the hands of their partners at least once since the age of 15.

P-07

YNU Symposium2024
September 4, 2024, Yokohama, Japan

Formation of phase-separated microstructure in Al_2O_3–$Tb_3Al_5O_{12}$ composite film

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[1, 2)] Yokohama National University
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Abstract

Eutectic is a reaction that two or more phases solidified at constant temperature from one liquid phase. Eutectic composites contained α-Al_2O_3 phase show excellent high-temperature mechanical properties, and thus the composites are expected to use as high temperature structural materials.

In α-Al_2O_3–RE_2O_3 eutectic systems (*RE* = rare-earth element), we can prepare α-Al_2O_3–*RE*AlO_3 (REAP) or α-Al_2O_3–$RE_3Al_5O_{12}$ (REAG) eutectic composites. Whether α-Al_2O_3 forms eutectic with the REAP perovskite phase or with the REAG garnet phase depends on the radius of the rare earth ions, and the ionic radius of Tb is on the boundary.

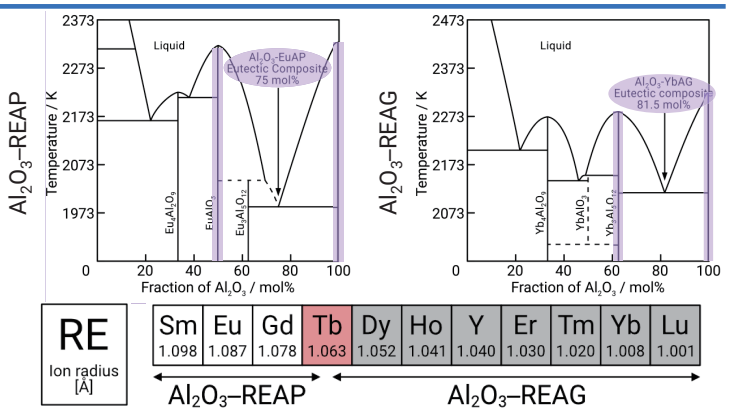
Our research group has recently demonstrated the laser-assisted chemical vapor deposition (CVD) of α-Al_2O_3–YAG and α-Al_2O_3–LuAG composite films. In the present study, we prepared composite films in α-Al_2O_3–Tb_2O_3 eutectic systems using the CVD method and studied their phase composition and microstructure.

α-Al_2O_3–TbAG composite films were prepared using CVD method on m-, c-, r-, a-cut sapphire substrates at 6.4 to 39.6 mol% Tb_2O_3.

Introduction

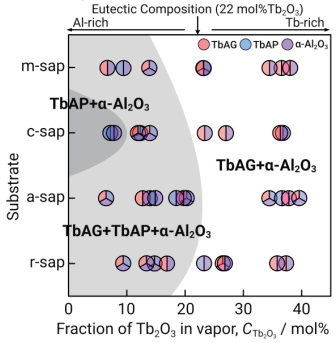
- **Eutectic**
  - A reaction that two or more phases solidified at constant temperature from one liquid phase.
  - Excellent high-temperature mechanical properties
- **α-Al_2O_3–RE_2O_3 eutectic systems (*RE* : rare-earth element)**
  - α-Al_2O_3–*RE*AlO_3 (REAP) or α-Al_2O_3–$RE_3Al_5O_{12}$ (REAG) eutectic composites are prepared.
  - The ionic radius of Tb is on the boundary.

Purpose: To prepare composite films in α-Al_2O_3–Tb_2O_3 eutectic systems using the CVD method and studied their phase composition and microstructure.

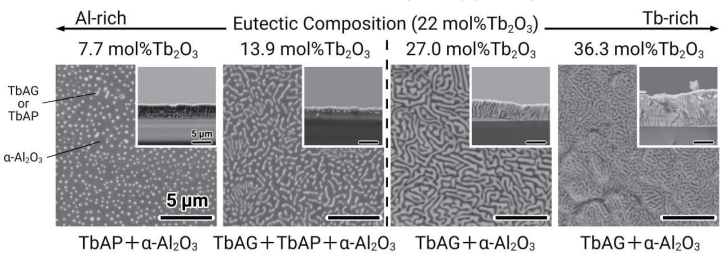


Results and Discussion

- **The phase of CVD films**



- **The microstructure of CVD films (c-sapphire)**



- Each of films showed eutectic-like structure.
  TbAP–Al_2O_3 (Al-rich)
  TbAG–TbAP–Al_2O_3
  (Near the eutectic composite)
  TbAG–Al_2O_3 (Tb-rich)

Result: We successed to prepare composite films in α-Al_2O_3–Tb_2O_3 eutectic systems using the CVD method. CVD films showed phase-separated structure and were composed of α-Al_2O_3 and TbAP and/or TbAG phases.

P-08

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Chemical vapor deposition of Ce-doped $Lu_3Al_5O_{12}$ film for White-LED lighting

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Abstract

White-LED consists of blue-LED and fluorescent parts that emits yellow light excited by blue light. Conventionally, the fluorescent part is made of phosphor powder dispersed in resin. In recent years, a method that replaces blue-laser for blue-LED has been proposed to increase the brightness of white-LED, but resin-type fluorescent parts can't resist the operating temperature. Hence, fluorescent parts consisted of ceramics with high thermal stability get attention.

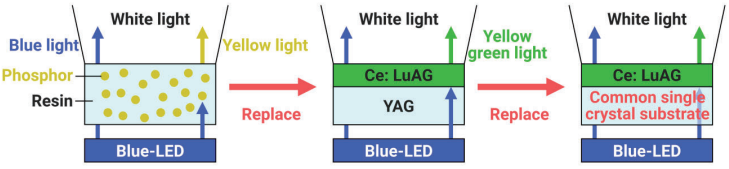
We prepare ceramics films using chemical vapor deposition (CVD), in which inorganic crystals are grown on substrates by chemical reactions of precursor gas. Ce-doped $Lu_3Al_5O_{12}$ (LuAG) is a ceramics phosphor that emits yellow green light excited by blue light and studied for white-LED applications. Conventionally, oriented LuAG films are prepared on $Y_3Al_5O_{12}$ (YAG) substrates with same crystal structure, but the price of YAG substrates is high.

Hence, we focused on common single crystal substrates, which are less expensive than YAG substrates. Although The substrate has a different crystal structure from LuAG, it would match specific orientations, and oriented LuAG films grow. In addition, it is inferred that high thermal conductivity of the substrates makes fluorescent parts more thermally stable.

Here, we prepared Ce-doped LuAG films using CVD and investigated microstructure and photoluminescence. (199 words)

Introduction

- **White-LED (W-LED)**
  - ✓ Consisted of blue-LED and yellow phosphor in resin
- **Ce-doped $Lu_3Al_5O_{12}$ (LuAG)**
  - ✓ Ceramics phosphor emitting yellow green light
- **Elements needed to replace YAG substrates**
  - ✓ Low price (The price of substrates we focused on is about **one-third** the price of YAG substrates.)
  - ✓ High thermal conductivity (The thermal conductivity of substrates we focused on is **2–3 times** of YAG.)



Pros: Low manufacturing cost
Cons: Low thermal stability

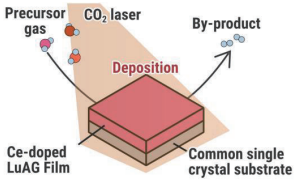
Cons: High manufacturing cost
Pros: High thermal stability

Pros: Low manufacturing cost
Pros: High thermal stability

The development of W-LED and advantages of replacing substrates

Experimental

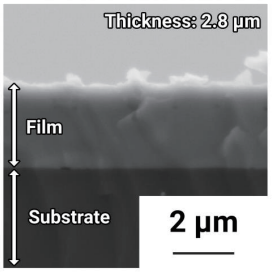
- **Experimental method**



CVD process

- ✓ $Lu(dpm)_3$, $Al(acac)_3$, and $Ce(dpm)_4$ were used as precursor.

Results and discussion

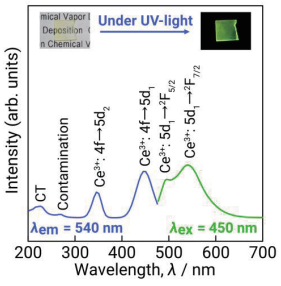


Cross-sectional SEM image

Comparison of deposition rate (R_{dep}) of LuAG films prepared by PLD and CVD

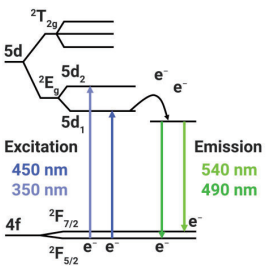
Method-REAG (RE = Lu, Y)	R_{dep}
PLD-LuAG	5 μm/h [1]
PLD-YAG	1 μm/h [2]
CVD-LuAG (Present study)	28 μm/h

- ✓ The Ce-doped LuAG film had a dense structure.
- ✓ Deposition rate (R_{dep}) was 28 μm/h.



PL-PLE spectra

- ✓ Yellow green light due to the 5d–4f transition of the Ce^{3+} center was excited by blue light.



5d–4f transitions of the Ce^{3+} [3]

[1] Sergey V. K. *et al.*, *Appl. Phys. B*, 2019. [2] S. Fukaya *et al.*, *Opt. Comm.*, 2001. [3] D. Hui *et al.*, *ADV. OPT. MATER.*, 2021.

P-09

PANJAB UNIVERSITY, INDIA

"Tamso Ma Jyotirgamaya"

PRESENTED BY - KIRANVEER SINGH
PANJAB UNIVERSITY

· It traces its origins to the University of the Punjab in Lahore, which was founded in 1882.
· After the partition of India, the university was established on 1 October 1947, and called East Punjab University.
· Initially housed primarily at a cantonment in Solan, it later relocated to a newly built campus in Chandigarh, and was renamed Panjab University.
· The university has 78 teaching and research departments and 10 centres/chairs for teaching and research at the main campus located at Chandigarh.
· It has 201 affiliated colleges spread over the eight districts of Punjab state and union-territory of Chandigarh.
· The university's chequerboard layout was devised by Swiss-French Architect Pierre Jeanneret.

NAAC Grading :
CGPA of 3.68 on a four-point scale at A++ Grade

NIRF Ranking 2023 :
25th Rank among the Indian universities

Dr. SSBUICET
· The University Institute of Chemical Engineering & Technology, UICTE (earlier known as Department of Chemical Engineering & Technology, DCET) was established in 1958 in collaboration with I.I.T., Chicago in the present building of the University Campus.
· Oldest Department of Panjab University.

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Investigation of anti-solvent crystallization conditions for isomer separation of aminobenzoic acid

Nao Kawamura, Kazuho Nakamura, Kenji Wakui
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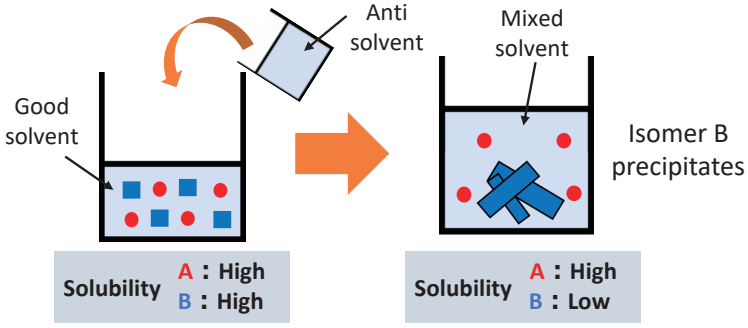
Abstract

Isomers are substances that have the same compositional formula but different structures between molecules. They are often obtained as isomeric mixtures in the synthesis process and requiring separation. Anti-solvent crystallization is one of the most promising isomer separation methods, but it is difficult to select the solvent to be used, and an efficient solvent selection method is required.

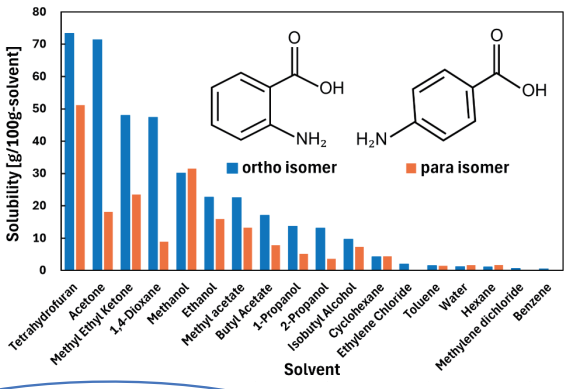
The Hansen Solubility Parameter (HSP) is one of the indices to evaluate the solubility of a substance. Solubility is evaluated as high when the HSP distance is small and low when the HSP distance is large, enabling efficient solvent screening.

In this study, we investigated the anti-solvent crystallization conditions for separating the para isomer of aminobenzoic acid from a mixture of its isomers, ortho and para isomers. The solubility of aminobenzoic acid in 18 pure solvents was measured, and the combination of good and anti solvents for anti-solvent crystallization was selected using solubility estimation using HSP.

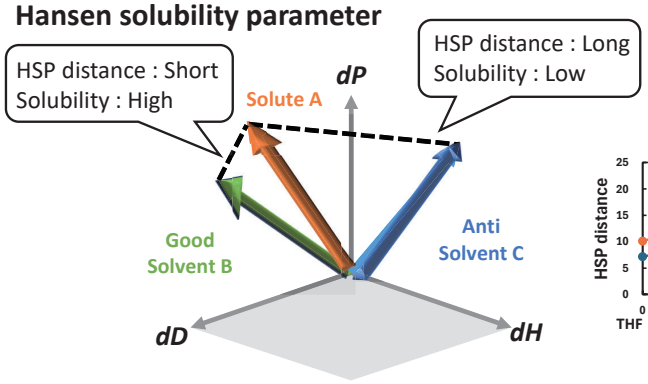
Anti-solvent crystallization



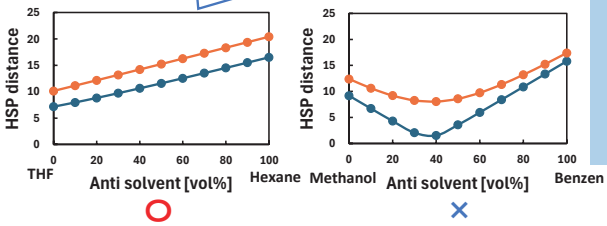
The solubility of aminobenzoic acid in pure solvents



Hansen solubility parameter



It is assumed that the addition of a poor solvent causes crystal precipitation.



○ ×

Selected combination of good and anti solvents

THF-Hexane
THF-Cyclohexane
2-Butanone-Hexane
Acetone-Hexane

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Measurement and analysis of Volatile Organic Compounds(VOCs) from unsaturated soils and health risk assessment

Kinari Shima
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Abstract

There are concerns about health risks due to the inhalation of VOCs for residents living on contaminated sites. These could lead to excessive excavation in soil remediation. In fact, excessive excavation is problematic because it places heavy burdens on the environment and the economy. So, it is important to analyze health risks due to the inhalation of VOCs. Previous risk analysis considers only diffusion of VOCs through soils. However, VOCs in unsaturated soils are transported by not only diffusion but also advection caused by change in atmospheric pressure and temperature. To ease concerns about the health risks, in this study, two things were investigated. Firstly, the characteristics of VOCs diffusion transport through unsaturated soils was investigated. Secondly, a numerical model considering diffusion and advection was constructed and concentrations of VOCs in soils and indoor air were predicted. In the examples of the predictive calculations, the difference in annual average indoor concentrations with and without advection consideration was small. Temporary fluctuations in indoor concentrations due to advection ranged from +17% to -10%, but when these fluctuations coincide with the temporary shutdown of the ventilation fan, indoor concentrations could temporarily become high, and caution could be required in terms of health risks.

1.Measurement and analysis of VOCs fluxes from contaminated soil

- VOCs fluxes were measured and effective diffusion coefficient D_e which is necessary to predict behaviors of VOCs in soils was calculated using Fick's low

$$F = -D_e \frac{\Delta C_g}{\Delta X}$$

F	: Flux[mg/㎡/d]
D_e	: Effective diffusion coefficient [㎡/d]
ΔC_g	: Difference in gas concentration between the top and bottom [mg/㎥]
ΔX	: Soil packing height [m]

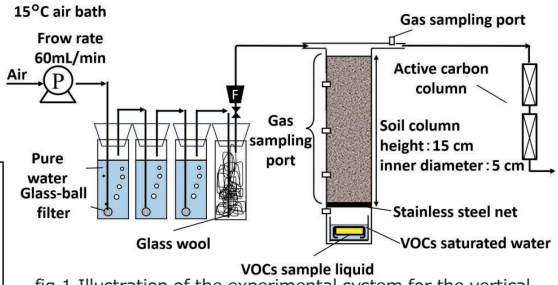

fig.1 Illustration of the experimental system for the vertical vapor-phase diffusive transport of VOCs through a soil sample

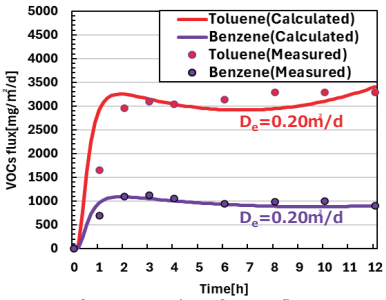

fig.2 Examples of VOCs fluxes

2.Health risk analysis due to inhalation of VOCs for residents living on contaminated sites

- VOC concentrations in soils and indoor air were calculated by inputting meteorological data into the constructed model.
- In examples of predicted calculations result for indoor concentrations, the difference in the annual average indoor concentration with or without considering advection was small, at approximately 2%. And when advection is considered, temporary fluctuations in indoor concentrations were from +17% to -10%, and these temporary fluctuations were unlikely to have significant impacts on chronic health risks.
- In the present calculation conditions, it was assumed that the ventilation rate was always in operation, but a situation in which the ventilation fan is temporarily stopped can also be assumed. If the shutdown of the ventilation fan coincide with fluctuations due to advection, indoor concentrations could temporarily become high, and caution could be required in terms of health risks.

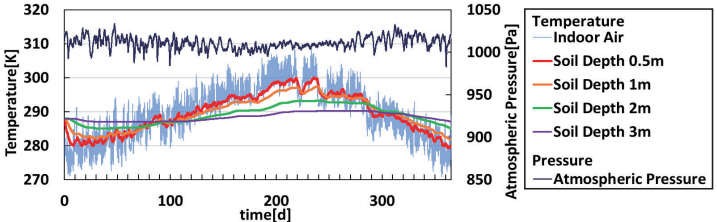

fig.3 Meteorological data used in the example calculations

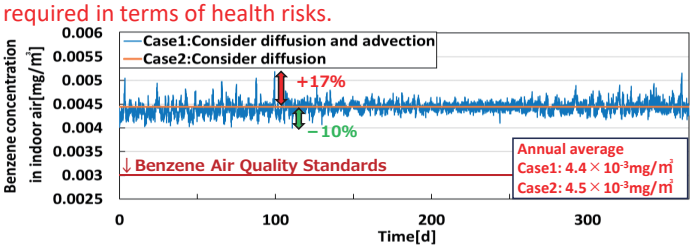

fig.4 Examples of calculated indoor concentration of VOC with and without advection

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YNU Symposium2024
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Plastics adsorption and removal by 2D ultrathin iron oxide nanodiscs: from micro to nano

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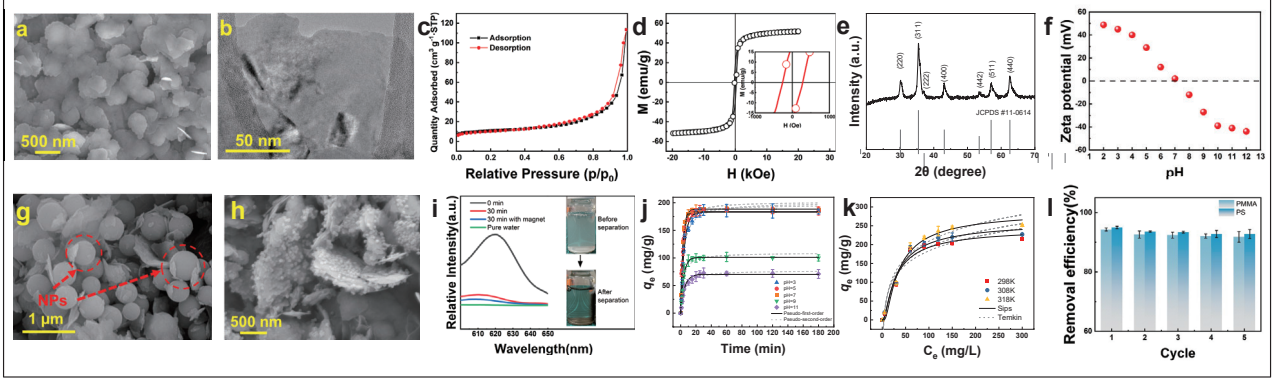
Abstract

The escalation of microplastics/nanoplastics (MPs/NPs) contamination in aqueous systems has ignited considerable concern. Magnetic separation has emerged as a promising remedy for the removal of these pollutants, owing to its notable removal efficiency, cost-effectiveness, and environmentally friendly attributes. This study presents the utilization of ultra-thin magnetic Fe_3O_4 nanodiscs (NDs) for the adsorption and separation of MPs/NPs. Investigations revealed that these NDs could effectively adsorb/remove MPs/NPs across a spectrum ranging from micro- to nano-scale, exhibiting a notable adsorption capacity of 188.4 mg g^{-1}. Mechanistically, MPs/NPs adsorption was driven by both electrostatic and magnetic forces originating from the vortex domain of NDs, which can be well described by pseudo-first-order and Sips models. Furthermore, the NDs exhibited outstanding reusability, maintaining over 90% removal efficiency even after undergoing five cycles. This research introduces a cost-effective method for the separation of MPs/NPs, representing a significant stride in wastewater treatment methodologies.

Results:

- 2D ultrathin Fe_3O_4 NDs were fabricated and achieved 4.26 nm of thickness and 37.5 m^2 g^{-1}.
- Can efficiently remove both MPs and NPs, the removal rate reached 93.5% for 10 μm PET, 97% for 500 nm PP in pure water, removal capacity reached 188.4 mg g^{-1} for 100 nm PMMA.
- Pseudo first order adsorption model and Sip isotherm model.
- Can remove NPs from seawater, reaching 97.3% and 94.8% of removal rate for PMMA and PS.
- Still reached above 90% of removal rate after five times using



P-13

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Evaluation of chromatographic separation characteristics by HSP

Kenta Sakamoto, Kenji Wakui, Kazuho Nakamura
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Abstract

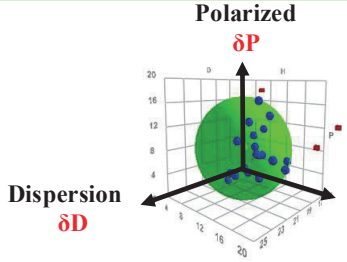
In recent years, there has been an increasing demand for separation processes for molecular that are structurally similar. High-performance liquid chromatography (HPLC) is also often used as one of the common separation methods. To achieve efficient separation of similar molecular using HPLC, it is important to select appropriate packing resin and mobile phase solvents. In this study, we focused on Hansen Solubility Parameters (HSP) and analyzed the relationship between HSP and HPLC separation behavior(distribution ratio). In this study, experiments were conducted using methacrylate-based columns in normal-phase chromatography. Four vitamins (vitamin K_1, vitamin$K_{2\text{-}4}$, vitamin$K_{2\text{-}7}$, vitaminK_3) were used as experimental samples. The HSP values of the substances were calculated by the atomic group contribution method using software (HSPiP). The HSP distance between the solid phase(methacrylate) ,and each sample were calculated and then discussed in relation to the partition coefficient obtained from the experiment. The analysis showed that HSP distance and distribution ratio are in a proportional relationship and highly correlated. In conclusion, it was shown that HSP distances can predict chromatographic separation behavior and optimize separation conditions.

Objective

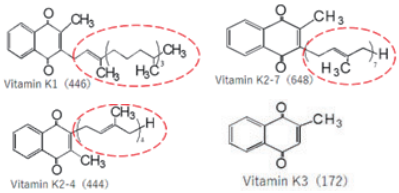
Optimization of HPLC separation conditions

Analysis of the relationship between HSP and HPLC separation behavior

Hansen Solubility Parameters(HSP)



Sample

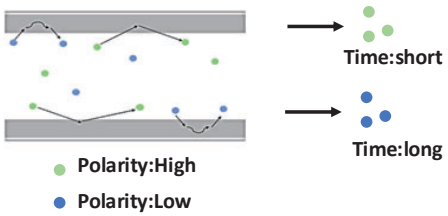


Experiment

Evaluation of separation behavior by partition coefficient(k')

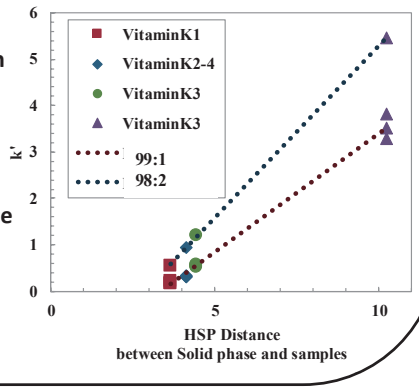
Solid phase : Polar
→ Synthetic Adsorbent column (Methacrylate)

Mobile phase : Non Polar
→ Hexane : EtOH = 99 : 1 ～ 98 : 2



Result

- The HSP distance and distribution ratios between the sample and stationary phase were highly correlated.
- It is believed that the HSP distance can be used to optimize the HPLC separation conditions.



P-14

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Convection control of thin liquid film by using temperature differential Marangoni convection

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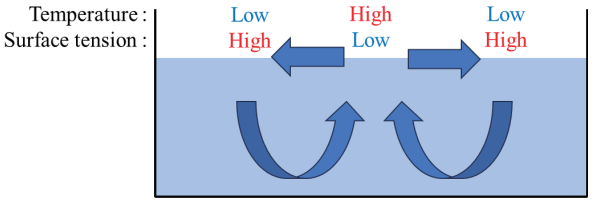
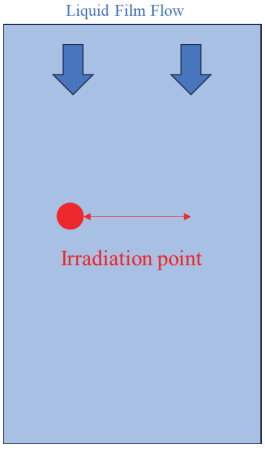
Abstract

Micromanipulation technology has been developed to manipulate micro-objects. As a means of transporting materials with fluid force, research has focused on temperature-differential Marangoni convection. Marangoni convection is a flow that is caused by the difference of surface tension force. There are various reasons for this difference, including temperature, concentration, and electric field, but we focus on the flow caused by temperature difference. Its velocity fields and temperature distributions have been studied. In this study, local heating is applied to a liquid film flow flowing down an inclined plate to investigate the effect of temperature differential Marangoni convection and the possibility of controlling the liquid film flow. The liquid film flow is heated by CO2 laser irradiation, which induces surface tension flow by creating a temperature gradient on the liquid surface. In the experiment, the effects of surface tension flow on the liquid film flow were investigated by varying the kinematic viscosity of the working fluid, tilt angle, and laser power. Numerical calculations were also performed to predict the phenomenon and consider control methods. The possibility of controlling the liquid film flow by dynamically heating the fluid by changing the laser irradiation position and movement speed is also discussed.

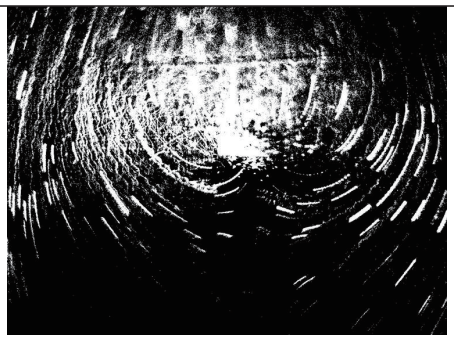
Mechanism of Temperature-differential Marangoni Convection

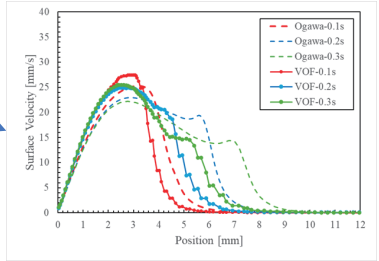


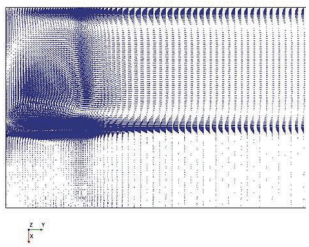


Schematic diagram of heating a liquid film flow

Image of Experimental result







Prediction by using CFD (Computational Fluid Dynamics)

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Microwave Doping of Sulfur and Iron in β_{12} Borophene

Zhixuan Li, Prashant Kumar, Ajayan Vinu
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Abstract

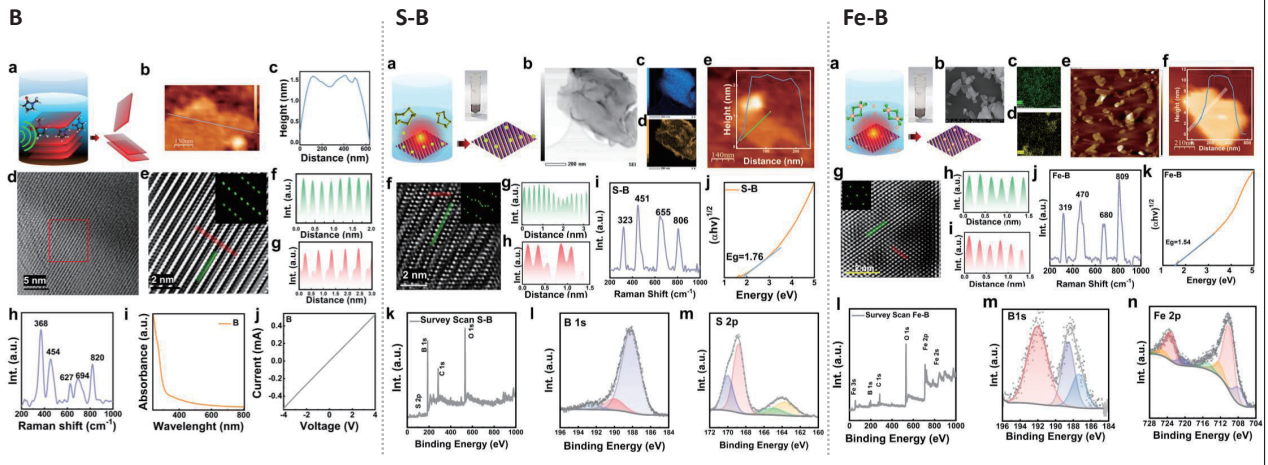
Borophene, a 2D material exhibiting unique crystallographic phases like the anisotropic atomic lattices of β_{12} and X_3 phases, has attracted considerable attention due to its intriguing Dirac nature and metallic attributes. Despite surpassing graphene in electronic mobility, borophene's potential in energy storage and catalysis remains untapped due to its inherent electrochemical and catalytic limitations. Elemental doping emerges as a promising strategy to introduce charge carriers, enabling localized electrochemical and catalytic functionalities. However, effective doping of borophene has been a complex and underexplored challenge. Here, an innovative, one-pot microwave-assisted doping method, tailored for the β_{12} phase of borophene is introduced. By subjecting dispersed β_{12} borophene in dimethylformamide to controlled microwave exposure with sulfur powder and $FeCl_3$ as doping precursors, S- and Fe doping in borophene can be controlled. Employing advanced techniques including high-resolution transmission electron microscopy, Raman spectroscopy, and X-ray photoelectron spectroscopy, confirm successful sulfur and iron dopant incorporation onto β_{12} borophene is confirmed, achieving doping levels of up to 11 % and 13 %, respectively. Remarkably, S- and Fe-doped borophene exhibit exceptional supercapacitive behavior, with specific capacitances of 202 and 120 F g^{-1}, respectively, at a moderate current density of 0.25 A g^{-1}.

Objective: Explore microwave-assisted doping of sulfur (S) and iron (Fe) in β_{12} borophene.

Method: Used microwave irradiation for rapid and uniform doping of S and Fe into borophene.

Results: Successful doping achieved. Improved properties: better conductivity and catalytic activity.

Conclusion: Microwave doping is effective and fast. Potential applications in electronics, catalysis, and energy storage.



YNU Symposium2024
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Microcantilever bending test of YSZ film for improving reliability towards energy transition devices

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Abstract

Yttria-stabilized zirconia (YSZ) is widely applied for thermal barrier coatings (TBC) or electrolyte in solid oxide fuel cell (SOFC); YSZ is exposed to harsh thermal and chemical environments. Therefore, deterioration of mechanical properties of YSZ is concerned. On the other hand, it is difficult to evaluate mechanical properties of each local area such as deteriorated part or films. Microcantilever bending test is solution technique to evaluate mechanical properties of the local areas, for it is possible to fabricate microcantilever beam specimen in only damaged part or film part.

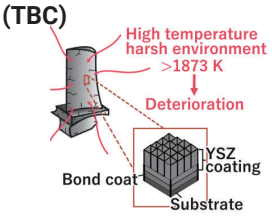
In the present study, as a model case of the applications, (100)-oriented YSZ epitaxial films were fabricated on (100) YSZ substrate by laser assisted chemical vapor deposition and mechanical properties of the YSZ films were studied using microcantilever bending tests fabricated on the surface of YSZ films. By analysis of critical resolved shear stress (CRSS), it is suggested dislocation density in film is lower than single crystal.

Introduction

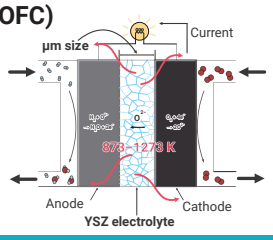
■ **YSZ (yttria-stabilized zirconia)**

- **Low thermal conductivity → TBC**
- **High oxygen ion conductivity → SOFC**

Thermal barrier coating (TBC)



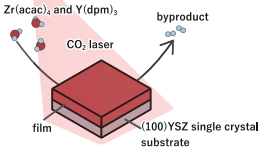
Solid oxide fuel cell (SOFC)



Experimental procedure

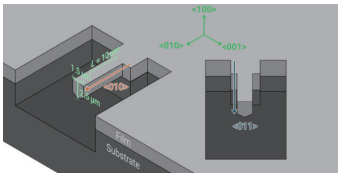
■ **CVD method**

✓ **Rapid deposition rate with controlling composition and microstructure (10–100 μm h^{-1})**

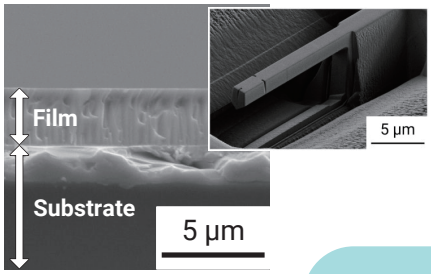


■ **Microcantilever bending test**

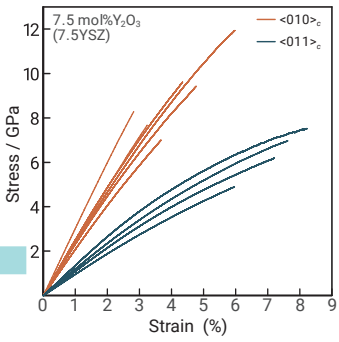
✓ **Beam specimens were only fabricated at the surface of film using focused ion beam technique.**



Results and discussion



$$\tau_{CRSS} = \sigma_Y \cos\varphi \cos\lambda$$



- **Plastic deformation of the beams was due to dislocation slip in YSZ. By testing in different orientations, the critical resolved shear stress ($\tau_{CRSS,}$) at each slip plane can be determined from the yield stress (σ_Y)**

Slip systems	φ, λ	σ_Y	$\tau_{CRSS,film}$	$\tau_{CRSS,\ crystal}$ [1]
{001}<110>	45˚,60˚	1.4±0.2 GPa	0.5±0.1 GPa	1.0±0.1 GPa
{111}<10$\bar{1}$>	54.7˚,45˚	2.6±0.6 GPa	1.1±0.3 GPa	1.8±0.3 GPa
{110}<1$\bar{1}$0>	45˚,45˚	2.6±0.6 GPa	1.4±0.2 GPa	2.0±0.3 GPa

φ,λ: Angles formed by tensile direction and slip plane/direction

- **Since CRSS of film is lower than single crystal for all slip systems, it is suggested dislocation density in film is lower than single crystal (Bailey-Hirsch relation [2]).**

[1] M. Muramoto *et al.*, *J. Eur. Ceram. Soc.*, 44, 2024, pp. 1061–1069
[2] J.E. Bailey, P.B. Hirsch, *Philos. Mag.* A 5 (1960) 485–497.

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MoO_2 films prepared using CVD methods for electrode materials

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Lithium-ion batteries are widely used in electric cars, smartphones, and computers. Molybdenum dioxide (MoO_2) has been widely used in the fields of catalysts, sensors, recording materials, and electrode materials. As an anode material for lithium-ion batteries, MoO_2 has an excellent electronic conductivity, high capacity, and high density.

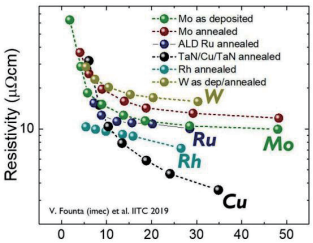
On the other hand, as semiconductors become advanced, the increase in electrical resistance of Al and Cu electrical wiring and its reaction with Si wafer becomes an issue. Molybdenum (Mo) is attracting attention as an alternative electrical wiring material with low resistance and high chemical stability.

Our research group are developing Mo metalorganic complexes for preparing MoO_2 thin layers used in chemical vapor deposition and atomic layer deposition methods for industrial manufacturing process. In the present study, we prepared MoO_2 thin films on (100) Si substrate using laser chemical vapor deposition with a newly developed Mo metalorganic precursor.

Introduction

Molybdenum (Mo) for nanoelectronics

- For advanced semiconductors
  - ISSUE: increase in electrical resistance of wiring material and its reaction with Si wafer
- Molybdenum (Mo) is expected to be an alternative material to Al and Cu metallic materials.



[REF] V. Founta et al., IITC 2019

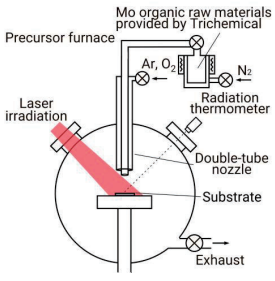
Molybdenum dioxide (MoO_2) for LIB

- Li-ion batteries (LIB) are used in electrical vehicle, smartphones, and computers.
- Molybdenum dioxide is expected to be applied to LIB because of high electronic conductivity, high capacity, and high density.

Li-ion batteries
Image courtesy of YOSHIDA SKT

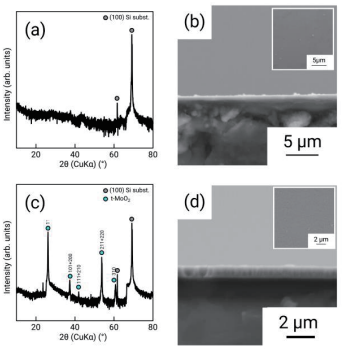
Our research group are developing molybdenum metalorganic complexes for chemical vapor deposition method.

Experiment

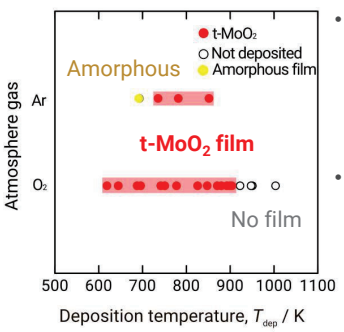


Key parameter: Deposition temperature (T_{dep}), Total chamber pressure (P_{tot}), and atmosphere (O_2 and Ar)

Results & Discussion



- An amorphous film was deposited on (100) Si at P_{tot} = 120 Pa and T_{dep} = 692 K under Ar atmosphere.
- Tetragonal MoO_2 (t-MoO_2) thin film was obtained on (100) Si at P_{tot} = 120 Pa and T_{dep} = 778 K under O_2 atmosphere.



- MoO_2 films were obtained at T_{dep} of 673–873 K in an Ar and O_2 atmosphere.
- Compared to Ar atmosphere, MoO_2 films can be obtained at lower T_{dep} in O_2 atmosphere.

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Study of silver nanoparticle reinforced starch and chitosan- antimicrobial packaging films preparation & application on perishable fruit guava (Psidiumguajava L.)

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Abstract: Impact on environment waste problem caused by plastic used packaging materials and for the consumer's demand for high quality food products has caused increasing interest in developing antimicrobial biodegradable food packaging as sustainable food packaging. In this research work, we synthesized silver nanoparticle reinforced starch and chitosan based films by solvent casting method for antimicrobial food packaging applications. The synthesized films were characterized by XRD and TGA. The incorporation of silver nanoparticles led to improvement of mechanical properties and thermal ability. The experimental results show that silver nanoparticle reinforced starch and chitosan based films has potential to antimicrobial properties.

Study of silver nanoparticle reinforced starch and chitosan- antimicrobial packaging films preparation & application on perishable fruit guava (Psidiumguajava L.)

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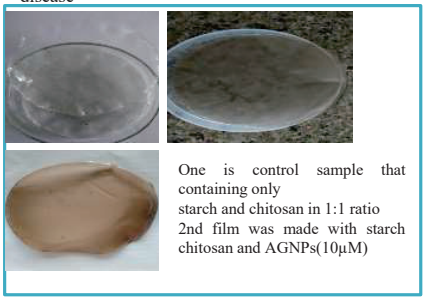
Introduction

Nowadays food preservation, quality maintenance and safety are major concerns of food industry because foods can easily deteriorate in a very short time unless precautions are taken.

Antimicrobial packaging system is one of the best developments in packaging system which incorporates antimicrobial agent into the package to overcome the activities of target microorganism that infect the food.

Recently, nanocomposites with antimicrobial activity has reported as active packaging for applications in food industry to reduce the growth of microorganisms which are responsible for food borne disease

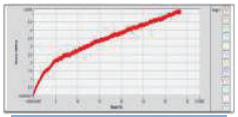


One is control sample that containing only starch and chitosan in 1:1 ratio
2nd film was made with starch chitosan and AGNPs(10µM)

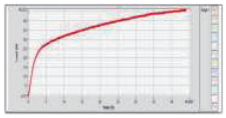
OBJECTIVES

- To synthesize the biodegradable chitosan-starch blended films and characterized them by XRD and TGA
- To incorporate AgNo3 nanoparticles with different percentage in chitosan-starch films
- To evaluate mechanical, thermal, and barrier properties of prepared films.
- To assess the effect of developed nanocomposite films as active packaging on shelf life of perishables fruit Guava.

Mechanical Properties of Films

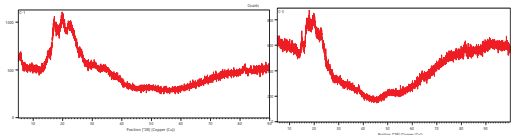


Stress versus strain graph of chitosan blended film



Stress versus strain graph of AGNPs blended Film

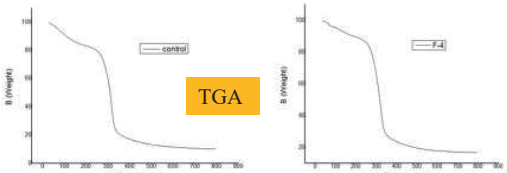
X-Ray Diffraction (XRD)



Antimicrobial activity of nanocomposite Film

Application of Starch- chitosan nano-composite films on Guava (*Psidium guajava* L.)

TGA



References:Hajji, S., Salem, R. B. S. Ben, Hamdi, M., Jellouli, K., Ayadi, W., Nasri, M., & Boufi, S. (2017). Nanocomposite films based on chitosan–poly(vinyl alcohol) and silver nanoparticles with high antibacterial and antioxidant activities. *Process Safety and Environmental Protection*, *111*, 112–121. Tingaut, P., Zimmermann, T., & Lopez-Suevos, F. (2010). Synthesis and characterization of bionanocomposites with tunable properties from poly(lactic acid) and acetylated microfibrillated cellulose. *Biomacromolecules*, *11*(2), 454–464. Kaur, J., Sood, K., Bhardwaj, N., Arya, S. K., & Khatri, M. (2020). Nanomaterial loaded chitosan nanocomposite films for packaging. *Materials Today: Proceedings*, *28*, 1904–1909.

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Effect of Applied Electric Field on the Behavior of Charged Particles in Thermocapillary Convection of a Liquid Bridge

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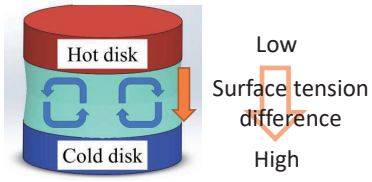
Abstract

Thermocapillary convection is driven by surface tension differences due to a temperature gradient. It is expected that the control of convection by the applied electric field, which is non-contact and easy to operate, will be of great importance in industrial fields. In experiments on Marangoni convection, particle image velocimetry (PIV) is a powerful tool for visualizing flow field, where we can analyze the flow field by capturing images of tracer particles injected into the fluid. However, when an electric field is applied to the liquid bridge, the particles are observed to be driven by the electric field, suggesting that the particles are electrically charged. This effect must be clarified in order to determine whether the application of an electric field contributes to the convection control or simply affects the particle motion (or results in both).

Eulerian and Lagrangian methods were used to analyze the fluid and particles, respectively. A two-dimensional axisymmetric unsteady analysis was performed assuming a one-way coupling between the particle and the fluid and assuming that only the charged particles are affected by the applied electric field.

In this study, the slip velocity, which is the relative velocity between the particles and the fluid, was focused on in order to evaluate the particle fidelity to the fluid. It found that slip velocities are not constant but distributed, indicating particle behavior cannot be simply represented by a superposition of fluid flow and terminal velocity in a stationary fluid. Increasing particle charge shifted $u_{p(z)}/u_{(z)}$ value away from 1 and broadened the distribution. Therefore, In liquid bridge experiments with an electric field, it was found necessary to select tracer particles considering their charging characteristics.

Liquid Bridge

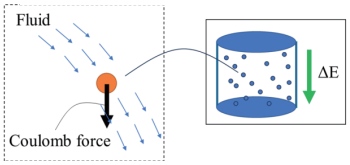


Thermocapillary flow

\+ (For convection control)

Electric field

Particle Image Velocity (PIV)



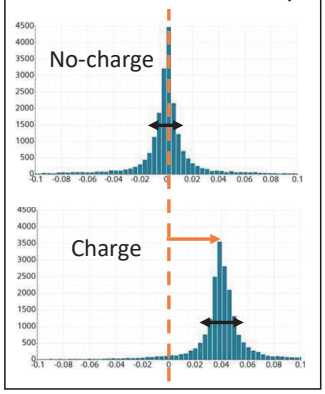
Visualization with particles

Electric field ⇒ Convection control?
Affect particle motion?

Simulation results

Fluid : Eulerian method / Particle : Lagrangian method

Particle relative velocity

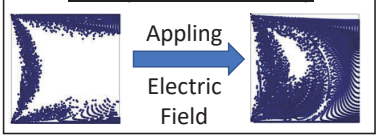


- Not constant, distribution
- Distributed around terminal velocity

⇓

Cannot be represented by simple superposition

Particle distribution with poor traceability



- Particle traceability deteriorated

Considering charging characteristic is important
(for experiments in liquid bridge with electric field)

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Modeling Battery Degradation Based on Long-Term Life Logs of EV and Analysis Through VGI Simulation

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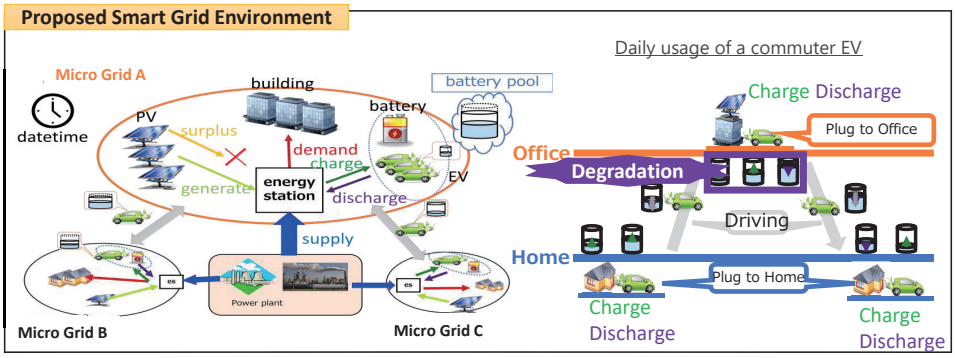
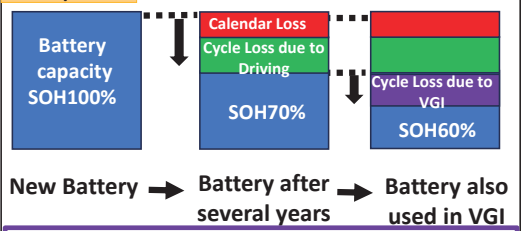
Using electric vehicles (EVs) as batteries in a smart grid to balance the supply and demand of electricity is known as Vehicle Grid Integration (VGI). However, VGI has the drawback of causing additional degradation to EV batteries. Over the past three years, we have collected data using an actual EV in a setting similar to VGI, where the vehicles not only drove but also supplied power to the building. In this study, we used this data to derive a battery degradation model. We then applied this model to the VGI simulation to quantify the extent of battery degradation in EVs that engaged in charging and discharging. The results showed that the additional decrease in SOH (State of Health) due to VGI participation was approximately 0.75 percentage point per year.

Proposed Smart Grid Environment



Purpose



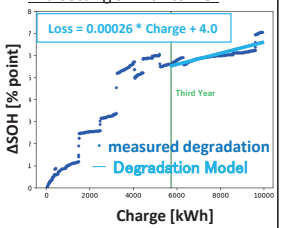
Quantify the extent of battery degradation in EVs due to VGI participation

SOH (State Of Health): Relative capacity compared to the initial capacity [%]

Battery Degradation Model

EV	Nissan LEAF 62kWh
Period	2020/6/28 ~ 2023/6/27 3years
Usage	VGI (Driving・Discharge)
Driving	6000kWh
Discharge	**2500kWh**
Normal Charge	280times
Fast Charge	20times

Collected data using an actual EV in a setting similar to VGI



Factor of Battery Degradation

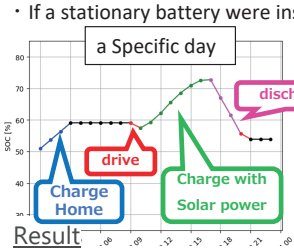
Calendar Loss
- Temp → Limited use under extreme temp
- SOC → Limited use at high/low SOC level
- Time → proportional to the square root of time

Cycle Loss
- Temp → Limited use under extreme temp
- DoD → Limited use at high DoD(Depth of Discharge)
- C-rate→ Limited fast charging or discharging
- Discharge Amount→ proportional to the discharge(charge) amount

The proportion of calendar loss decrease over time.
Cycle loss is proportional to the amount of charge.

VGI simulation

assumption
- If solar panels were installed on the rooftop of YNU (50% of the rooftop at YNU)
- If all the vehicles coming to YNU were EVs (1000 vehicles)
- If a stationary battery were installed at YNU (2500kWh)



Profile of a specific EV

× **1year**
- Commute Frequency 256 days
- Commute Distance 10 km/one way
- Average Duration of Stay 7.3h/1d

Result
Proportion of EV charging powered by PV → 65%
Driving amount 909 kWh → 0.23% point degradation / year
Discharge amount 2870kWh → 0.75% point degradation / year

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Biomass-derived hierarchical porous carbons for enhanced CO_2 adsorption performance

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Abstract

Biomass-derived porous carbons are a class of widely studied CO_2 adsorbents due to their tunable pore characteristics, flexibility towards surface modifications and heteroatom doping, stability and durability[1]. The wide variety of carbon-rich biomass precursors that could be used for the synthesis of porous carbons validates their viability as CO_2 adsorbents. By creating hierarchical porous carbon structures with both meso- and micropores in these biomass-derived carbons, the adsorbents with superior CO_2 adsorption capacity could be achieved. However, the reports on synthesising hierarchical biomass-derived nanoporous carbon with meso- and microporous structures are quite limited. Our current research is focused on developing a unique and facile synthesis strategy for biomass-derived high surface area hierarchical porous carbons with controllable porosity parameters via the method of activation with mixed chemical activating agents. The appropriate use of activating agents like KOH and $ZnCl_2$ can facilitate precise control over the porosity parameters of hierarchical porous carbons, making them excellent CO_2 adsorbents under both low- and high-pressure adsorption conditions. The meso- and microporosity in these materials can be finely tuned with the simple adjustment of the ratio of the chemical activating agents. The proposed materials have exhibited considerable CO_2 adsorption performance with tunable adsorption capacities under different pressure conditions.

References: [1] G. Singh, J. Lee, A. Karakoti, R. Bahadur, J. Yi, D. Zhao, K. AlBahily, A. Vinu, Emerging trends in porous materials for CO_2 capture and conversion, Chemical Society Reviews 49(13) (2020) 4360-4404.

Results

- The X-ray diffraction patterns of the synthesised hierarchical porous carbons exhibit two broad diffraction peaks at 2θ=25.4° and 44.4°, indicating their amorphous structure.
- SEM images of the synthesised materials display that these materials exhibit an irregularly shaped surface morphology further validating the amorphous nature of the materials with a disordered carbon structure.
- The N_2 adsorption-desorption analysis of the synthesised materials shows that the isotherms of these samples belong to type I(b) with a minor H4 type hysteresis loop at relative pressures greater than 0.4 as per the IUPAC classification. The analysis also indicates the presence of both micropores and mesopores, thereby confirming a hierarchical pore structure.
- The CO_2 adsorption isotherms of the hierarchical porous carbons collected at 0°C reveal CO_2 adsorption capacities of 5 mmol/g and 39 mmol/g under low- and high-pressure conditions respectively, tunable with the porosity parameters.

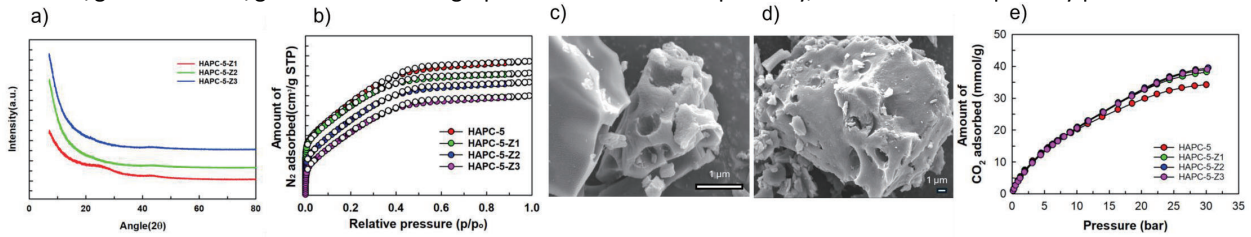

Fig 1. a) X-ray diffraction patterns, b) N_2 adsorption-desorption isotherms, c, and d) SEM images and e) CO_2 adsorption isotherms at 0°C of synthesised hierarchical porous carbons.

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YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Relationship between classification characteristics and particle size distribution in the up-flow reaction crystallization of $CaCO_3$

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The technology to fix CO_2 in the air as calcium carbonate crystals after absorbing it in basic aqueous solution such as NaOH is attracting attention because of necessity of carbon neutrality. One of the challenges is that the formation of small particles during the crystallization process reduces the efficiency of the subsequent filtration process.

We approached this problem by using an up-flow column (a device in which raw materials flow from bottom to top) to perform crystallization and solid-liquid separation in a continuous process.

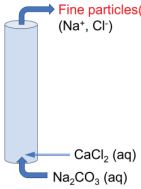
In the up-flow reaction crystallization of calcium carbonate, the particle size distribution is affected by particle classification in addition to nucleation rate and crystal growth rate. In systems where the terminal velocity of particles is small, the decrease in solid-liquid separation efficiency because of particle outflow is a problem.

In this study, the flow condition of particles in the column was observed. And the effects of the concentration of the reaction solution and the presence of seed crystals on the particle size distribution of the particles were examined.

Introduction

○ Phenomena and characteristics of the up-flow column

$Na_2CO_3(aq) + CaCl_2(aq) \rightarrow CaCO_3(s) + 2NaCl\ (aq)$



・ Phenomena

Crystallization & Classification

・ Characteristics

Large particles remain

Solid – liquid separation efficiency is good

○ Definition of retention rate

$$\text{retention rate } [\%] = \frac{W_{\text{in}}\ [\text{g}]}{W_{\text{in}}\ [\text{g}] + W_{out}[\text{g}]} \times 100$$

W_{in} : particle in the column [g]
W_{out} : effluent particle [g]

○ Objective

Effect of reaction solution concentration and presence / absence of seed crystals on recovery rate and particle size distribution

Method

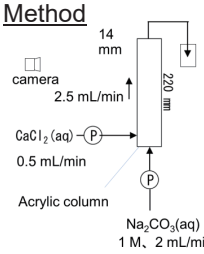


Fig. Experimental setup
Injection time = 1 h

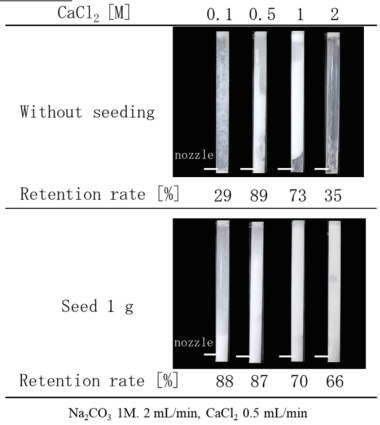
Table. Experimental condition

Run	seed*1 [g]	Na_2CO_3 [M]	$CaCl_2$ [M]
1	0	1	0.1
2			0.5
3			1
4			2
5	1	1	0.1
6			0.5
7			1
8			2

*1: $CaCO_3$ reagent on a 53 μm seive

Result

○ Retention rate



Na_2CO_3 1M. 2 mL/min, $CaCl_2$ 0.5 mL/min

Fig. Particle distribution in the column at the end of the experiment

Increase of retention rate depended on reaction solution concentration.

○ Particle size

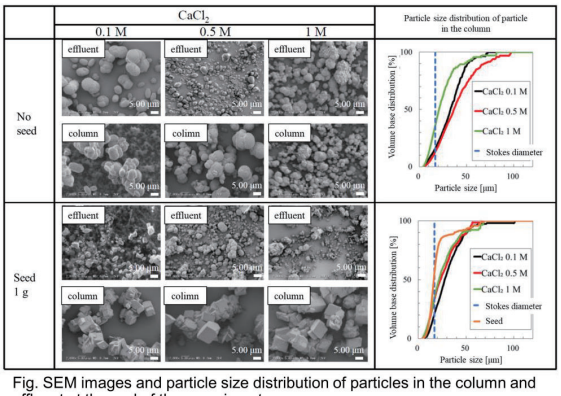


Fig. SEM images and particle size distribution of particles in the column and effluent at the end of the experiment

・ Growth of seed crystals was observed under all conditions.

・ Particle size is not necessarily related to recovery rate.

YNU Symposium2024
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Eu-doped SrAl2O4 film synthesized using using CVD merthod for long afterglow phosphors

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$SrAl_2O_4$ co-doped with Eu and Dy ions ($SrAl_2O_4$:Eu^{2+}, Dy^{3+}) has a long afterglow with green luminescence, which is widely used as luminescent materials such as road signs and clock decorations. Because $SrAl_2O_4$:Eu^{2+}, Dy^{3+} also has mechanoluminescence, which is light emission under mechanical load, $SrAl_2O_4$:Eu^{2+}, Dy^{3+} coating can be used to visualize stress and deformation of base materials. $SrAl_2O_4$:Eu^{2+}, Dy^{3+} phosphor is generally synthesized in powder by solid-phase reaction methods.

In the present study, $SrAl_2O_4$ films were synthesized using chemical vapor deposition, allowing the $SrAl_2O_4$:Eu^{2+}, Dy^{3+} phosphor layer to be patterning directly onto flexible substrates and smart devices. $SrAl_2O_4$ films were synthesized on *c*-cut sapphire single crystal substrates with the aid of laser heating, and the effects of pressure and composition on the constituent phases were investigated. Eu-doped $SrAl_2O_4$ films were also synthesized to study their photoluminescence properties.

Introduction

Long afterglow phosphor: $SrAl_2O_4$:Eu^{2+}, Dy^{3+}

- Brighter, longer afterglow, and higher safety than conventional phosphor such as ZnS:Cu

Evacuation sign boards using luminescent materials.[1]

Mechanoluminescence

✓ Can be used as damage and impact sensors in aircraft and automobile.

[1] Research report of the Nagasaki Ceramics Technology Centre (2010)

The phosphor layer (sensor layer) should be patterning directly onto the flexible substrate or smart device.

Needs for direct synthesis at the film

Issue and Proposal

Issue

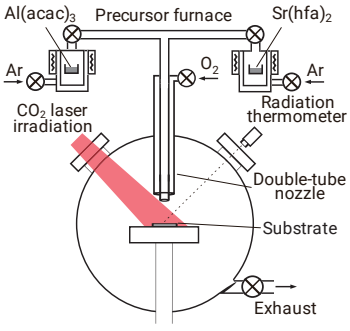
- Mainly powder synthesis
  - ✓ If used in film, further processing steps are required.
- High synthesis temp. (1600 K)

Proposal

Chemical vapor deposition

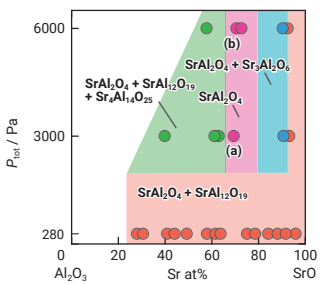
- No additional processing to the film with high adhesion
- Low synthesis temp. (1100 K)

CVD apparatus



Result and Discussion

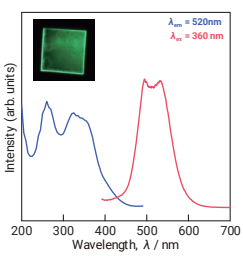
Phase mapping of non-doped $SrAl_2O_4$ films



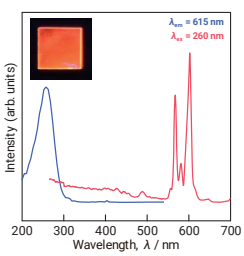
$SrAl_2O_4$, $Sr_4Al_{14}O_{25}$, $SrAl_{12}O_{19}$ and $Sr_3Al_2O_6$ were synthesised.

$SrAl_2O_4$ single phase was synthesized at P_{tot} = 3000 and 6000 Pa, and Sr at% = 70.

PL spectra of Eu-doped $SrAl_2O_4$ films



T_{dep} = 1072 K, P_{tot} = 9000 Pa
Sr at% = 69.7, Eu at% = 8.3



T_{dep} = 1050 K, P_{tot} = 6000 Pa
Sr at% = 66.7, Eu at% = 7.9

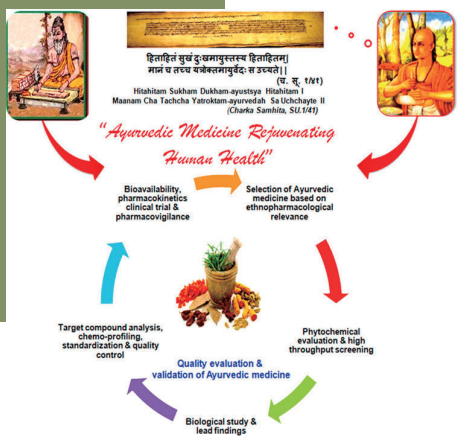
Green and orange emission were associated with Eu^{2+} and Eu^{3+} ions, respectively.

Higher P_{tot} was effective to obtain Eu^{2+} state.

FUTURE STUDY: CVD and afterglow evaluation of $SrAl_2O_4$ films co-doped with Eu^{2+} and Dy^{3+} ions.

AYURVEDA:
The Science of Life

Presented by- Sahil Angra
Panjab University, INDIA



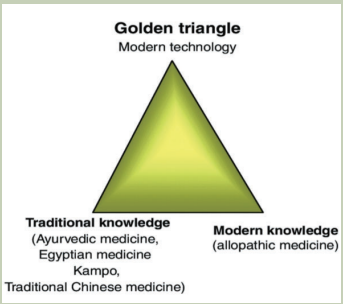
AYURVEDA: Ancient natural healing secrets

When diet is wrong, medicine is of no use. When diet is correct, medicine is of no need." "Ayurveda teaches us to cherish our innate-nature "to love and honor who we are", not as what people think or tell us, "who we should be." "Life (ayu) is the combination (samyoga) of body, senses, mind, and reincarnating soul.

It is beneficial because:

1. Holistic approach 2. Personalized treatment
3. Natural remedies 4. Preventive care
5. Emphasis on Balance 6. Long term benefits.
7. Stress management. 8. Promotes digestive health
9. Complementary to modern medicine
10.Time tested tradition

Ayurveda deals with several classical formulations including arka, asavas, aristas, churna, taila, vati, gutika, bhasma etc. There are several lead molecules that have been developed from the Ayurvedic herbs, which have various significant therapeutic activities.





Conclusion:

Scientific validation and the documentation of Ayurvedic drugs are very essential for its quality evaluation and global acceptance. Therapeutic efficacy of Ayurvedic herbs may be enhanced with high quality, which can be achieved by identity, purity, safety, drug content, physical and biological properties. Ayurvedic medicines need be explored with the modern scientific approaches for its validation.

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

$YAlO_3$ film prepared on $SrTiO_3$ substrate using CVD method for radiation detection

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1) ueda-yuta-gr@ynu.jp, 2) ito-akihiko-xr@ynu.ac.jp

Abstract

Energy-dispersive X-ray spectroscopy (EDX) is a technique used in research and industry fields for chemical composition analysis by measuring the energy of characteristic X-rays emitted from a target material. Scintillators are equipped in EDX detector to convert X-rays into ultraviolet-visible lights that can be detected by semiconductor sensors.

Cerium-doped $YAlO_3$ (Ce:YAP) has been studied as a scintillator for X-ray spectroscopy because of excellent chemical stability, rapid response, and high light yield. Recently, thick film scintillators with a few micrometers in thickness have attracted much attention to detect radiation efficiently. The typical production method for thick film scintillators including Ce:YAP is cutting and polishing the bulk single crystal grown by melting process. Because such thinning process is a cost- and time-consuming process, a novel direct and rapid synthesis route to the thick film scintillator is strongly demanded.

Our research group has successfully synthesized thick film scintillators on substrates at high speed and directly by laser-assisted metal–organic chemical vapor deposition (LCVD). In the present study, we aim to synthesize Ce:YAP films on $SrTiO_3$ substrate using LCVD and investigate their photoluminescence properties.

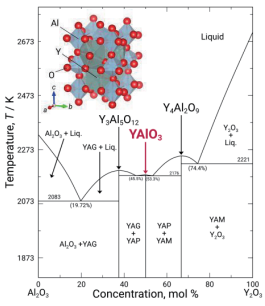
Introduction

- **Cerium-doped $YAlO_3$ (Ce:YAP)**
  - Excellent chemical stability
  - Rapid response (decay time: 25 ns [2])
  - High light yield (25000 photons/MeV [2])

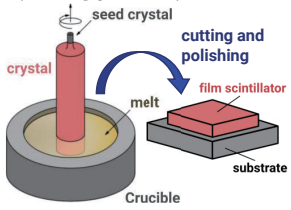
Ce:YAP has been used as detector scintillator for X-ray spectroscopy.

[1] O. Fabrichnaya, *et al.*, *Scand. J. Metall.*, 30 (2001) 175–183, [2] Crytur

Phase diagram of Y_2O_3–Al_2O_3 [1]

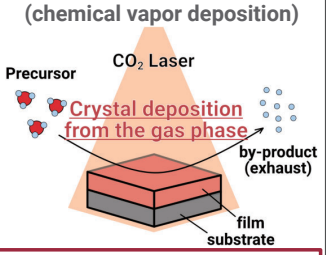


- **Conventional process** (meting process)



- **Issue**
  - High processing costs
  - Waste for thinning bulk scintillators

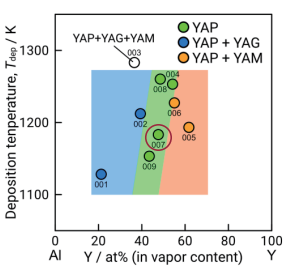
- **Present study** (chemical vapor deposition)



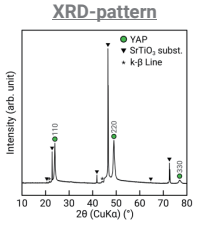
We propose laser-assisted CVD process to synthesize Ce:YAP for thick film scintillator.

Results & Discussion

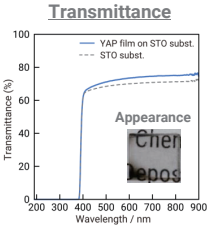
Phase composition mapping of Y_2O_3–Al_2O_3 ($SrTiO_3$ substrate)



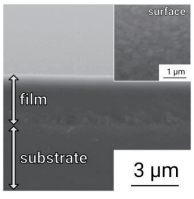
XRD-pattern



Transmittance



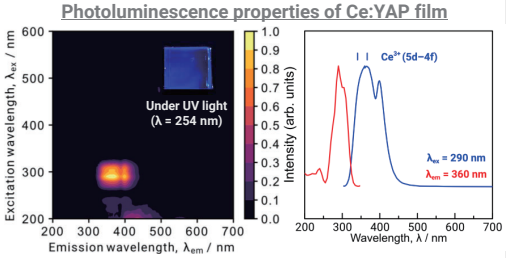
Microstructure



- (110)-oriented YAP film was epitaxially grown on the (100) $SrTiO_3$ substrate.
- The film was transparent, and SEM images showed that the YAP thick film had a dense structure with a deposition rate of 19 μm h^{-1}, which was 570 times faster than that reported for RF sputtering method [3].

[3] Y. Shimizu, *et al.*, *Opt. Mater.*, 91 (2019) 371–375.

Photoluminescence properties of Ce:YAP film



- Photoluminescence emission peaks at a wavelength of 340 and 367 nm were attributed to 5d-4f transitions of Ce^{3+} center in the Ce:YAP [4].

[4] D. Cao, *et al.*, *J. Alloys Compd.*, 489 (2010) 515–518.

Conclusion: We succeeded in synthesizing Ce:YAP film on $SrTiO_3$ substrate by chemical vapor deposition method.

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YNU Symposium2024
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AZEC (Asia Zero Emission Community)
Decarbonization Movement in Asia and Examples of Collaboration with Japanese Companies

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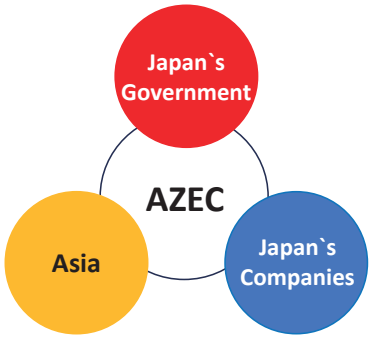
Abstract

Decarbonization, economic growth, and energy security are critical issues for Asian countries experiencing population growth and rapid economic development. To address these challenges and foster mutual cooperation, Japan has proposed the Asian Zero Emissions Community (AZEC) in 2022 as a collaborative framework. AZEC comprises Japan, nine Association of Southeast Asian Nations (ASEAN) countries, and Australia, aiming to promote decarbonization while ensuring economic growth in each member country. The framework seeks to address these issues in ways that are suitable for each country's unique circumstances, including their varying industrial structures, energy mixes, and other factors. With the launch of AZEC, Japan aims not only to achieve economic growth across Asia, including Japan itself, but also to enhance its market presence by showcasing the decarbonization technologies that are the strength of Japanese companies. The presidents of the member countries have expressed high expectations for AZEC's initiatives, and several projects have already been established to support energy transformation in other countries by cutting-edge technologies developed by Japanese companies. The following slides introduce specific cooperation projects between Japanese companies and member countries.

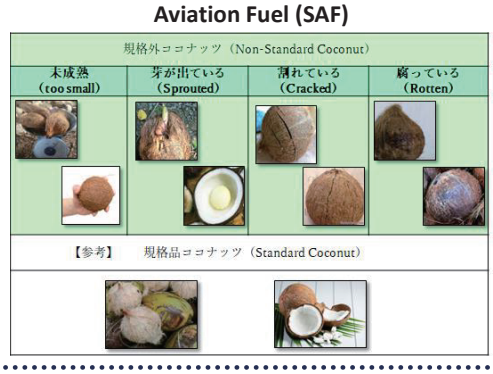
Expanding the decarbonization technologies` market and building a clean supply chain



Supporting Japanese companies' decarbonization business in Asia

EX①: Green Hydrogen Production Plant in Malaysia

EX②: Substandard Coconuts in Indonesia for "Sustainable Aviation Fuel (SAF)



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Australia's Green Shift: A Lack of Enforcement Slowing the Mission

Jake Lawrence & Kolby Parrott

Business Students of Griffith University Australia

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Abstract: Australia has achieved considerable success in expanding its renewable energy sector, marked by significant investment and growth in solar and wind power projects. However, the country's progress in addressing global warming is hampered by shortcomings in emissions regulations and enforcement. Corporations are increasingly leveraging carbon offset credits to reduce their reported emissions, often focusing on financial benefits rather than genuine environmental impact. These credits allow businesses to meet their emissions targets on paper while continuing practices that do not significantly reduce their carbon footprint. As a result, Australia is falling behind its emission reduction goals, and the anticipated shift towards a cleaner, low-carbon economy is lagging. The exploitation of carbon offset schemes underscores a critical gap in Australia's climate strategy, where the pursuit of profit undermines the effectiveness of emission controls and delays meaningful progress in combating climate change. Without stronger enforcement and more robust regulations, the shift towards meaningful and sustainable reductions in greenhouse gas emissions remains unable to meet necessary goals.

Global Warming Targets: Nation Lacking

International Agreements and Focuses:

- **Paris Agreement** (2016): Largest global action/commitment for Australia:
  - ❑ Reduce emissions by 43% of 2005 totals by 2030,
  - ❑ Net zero emissions by 2050
  - ❑ Limit global temperature rise to below 2ºC, and
  - ❑ Regularly report and review emissions targets

- Also, a signatory to: Kyoto protocol, UNFCCC, Glasgow Climate Pact, and the Global Methane Pledge to name a few.
  - ❑ Focus: reducing emissions, implementing climate change
  - ❑ policies, and providing climate financing.

Nation Goals	Progress
43% Emission Reduction by 2030 & Net Zero Emissions by 2050	Australia not fully on track, efforts have been made but emissions rising in energy and transportation, lack of emission legislation.
2020 Renewable Energy Target (RET) (33k GWH Large Scale, Incentivise small-scale renewables) (See Figure 1)	Program led to significant increase in small-scale solar panels domestically & 31k GWh of RET large-scale. 2050 Targets in prep.
Removal of C02 in Atmosphere (No current Quantification of amount)	Since 2020 $4bn+ Invested in Reforestation and Carbon Capture and Storage Programs

Corporations Capitalising on Minimal Efforts

- **What Are Carbon Credits?**
  - Tradeable certificates that represent the removal of one metric ton of carbon dioxide
  - Currently one carbon credits costs $32 Australian dollars
  - Certain projects such as afforestation, renewable energy, and methane capture can be invested into in exchange for carbon credits (See Figure 2)
- **Why Don't They Work?**
  - Temporary fixes to a permanent problem
    - Ex. Reforestation temporarily stores carbon, forest can later be cut down releasing carbon back into atmosphere
  - Used to finance projects which would have occurred regardless
- **How do Corporations take Advantage?**
  - Corporations bypass paying directly by investing in projects that align with CSR goals
    - Extremely weak verification process surrounding projects
      - Research from The Australia Institute determined 20-80% of carbon credits generated from land-fill gas projects were over-credited
  - Companies pass costs on to consumers by offering carbon-neutral products at a premium price

Recommendations

- Introduction of program similar to Californias Carbon Offset Program
  - Rigorous third-party verification and periodic audits of offset projects
- Adapting system to either limit carbon credit usage or monitor work of said carbon credit companies (currently highly unregulated)
  - Create system similar to EU Emissions Trading System (Public Data)
- Bring back carbon tax mechanism
  - Australia decommissioned in 2014, due to businesses being less competitive globally
- Measure companies on emissions created, not emissions reported
  - Sweden's climate law focuses on reducing emissions directly

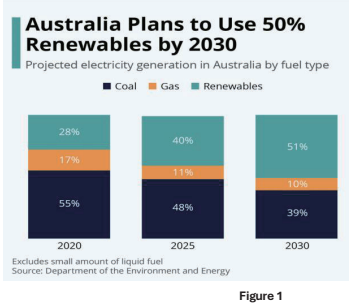

Figure 1

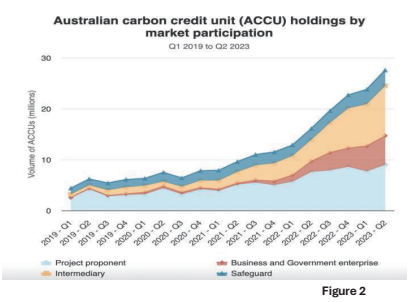

Figure 2

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Force distribution sensing based on photoelasticity

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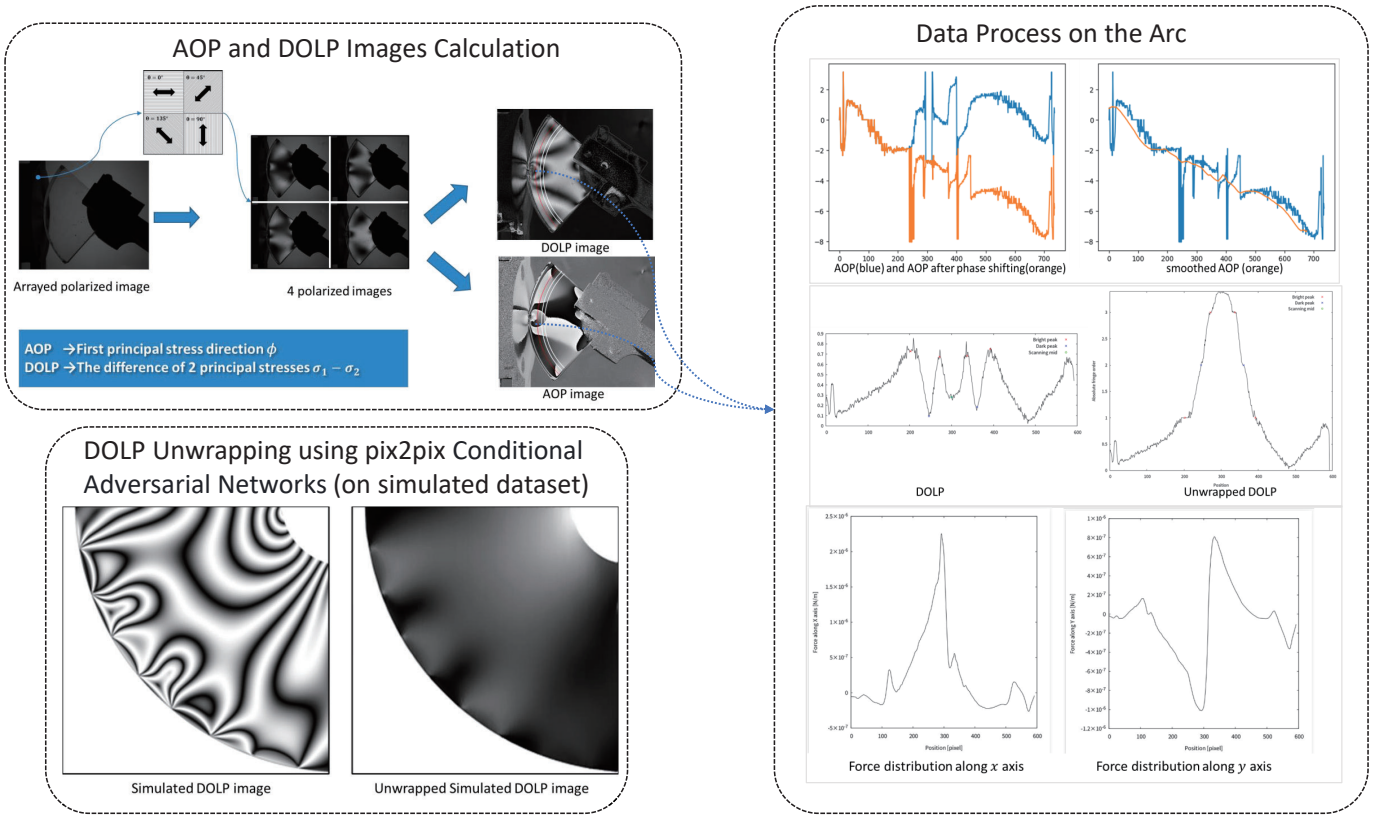
This study focuses on photoelastic sensing techniques to improve robotic force sensing capabilities. Photoelasticity, an optical phenomenon that visualizes stress distributions within transparent materials, is leveraged to develop high-resolution, real-time force sensors. The research addresses critical challenges such as unperfect Angle of Photoelasticity (AOP) and unwrapping of Degree of Linear Photoelasticity (DOLP). By integrating sensing methods for multi-modal force distribution and image to image translation, the study aims to create a comprehensive sensing solution capable of accurate and reliable force measurement in dynamic environments. This involves refining current photoelastic models, ensuring their alignment with experimental data, and optimizing these sensors for integration into robotic control systems. The research not only contributes to the field of robotics by offering a novel, cost-effective solution for force sensing but also opens up new possibilities for delicate manipulation tasks that require high precision.



P-29

Antimicrobial Activities of Starch-Based Biopolymers and Biocom composites incorporated with Fruit and vegetable peels extract

Avni Gupta[1], Anupama Kaushik[1]

[1]*Dr. SSB University Institutes of Chemical Engineering and Technology, Panjab University, Chandigarh, India*

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Fruit and vegetable peel extracts were utilized in preparing the corn starch based film to study the improvement in shelf life of the tomatoes. Corn starch and glycerol were used as base and plasticizer respectively along with water. Results demonstrated that the pomegranate, ginger, lemon, bamboo fiber ethanol extracts incorporated induced the antimicrobial property against the gram-positive (*S.aureus*) and gram-negative (*E.coli*) bacteria. FESEM indicated porous structure of the film. The XRD results indicated that the extracts did not affect the semi – crystalline structure of the film. Peel extract impregnated film showed a positive result to the shelf life of the tomatoes.

Keywords : Starch, Peel extract, Antimicrobial, Antioxidant

Antimicrobial Activities of Starch-Based Biopolymers and Bio composites incorporated with Fruit and vegetable peels extract

Avni Gupta , Anupama Kaushik Nee Sharma

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INTRODUCTION

- In recent years, there has been a great interest in antimicrobial food packaging technologies due to increased food-borne microbial outbreaks caused by minimally processed fresh products and refrigerated products.
- Polymeric food packaging films are some of the most commonly used films because they are easy to produce and have excellent performance.
- Biopolymers obtained as by-products from agriculture (such as cellulose, chitin/chitosan and starch) are very attractive for the development of antimicrobial materials .
- By product utilization is of essential use as it is of high value of reprocessing as it has the presence of bioactive compounds for instance the presence of simple sugars, carbohydrates, fibers and bioactive molecules that are phenolic acids, carotenoids, tocopherols, flavonoids, vitamins and aromatic compounds.
- If these waste are utilized properly they will help in solving various environmental issues as well as help in improving the food nutrition or via increasing the shelf life of food.

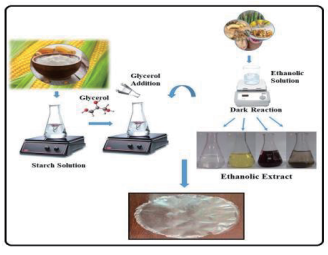
OBJECTIVES

- To develop an antimicrobial film based on starch and ethanol extracts of pomegranate peel, lemon peel, ginger peel and bamboo shoot.
- To study the comparative effect of extracts on the antimicrobial properties and antioxidant properties of corn starch films.
- To evaluate physical, mechanical, barrier , and thermal properties of the films incorporated with various extracts.
- To assess the effect of developed starch film as active packaging on shelf life of perishable fruit tomato..

ACKOWLEDGEMENT

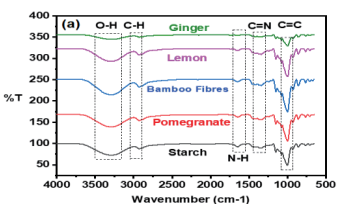
I express my gratitude to Prof (Anupama Kaushik Nee Sharma Professor Dr.SSB UICET Panjab University

METHODOLOGY

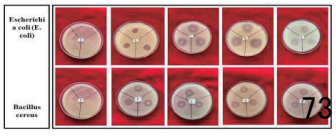


RESULTS

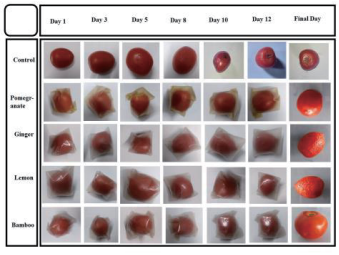
FTIR RESULTS



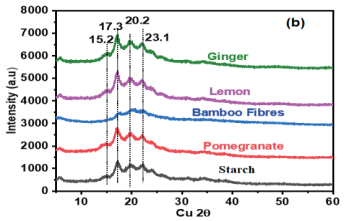
ANTIMICROBIAL RESULT



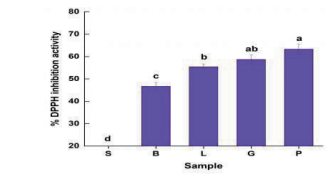
APPLICATION ON TOMATOES



X-RAY DIFFRACTION RESULT



ANTIOXIDANT RESULT



IMPORTANCE

- Cost effective
- Environment friendly.
- Easily available.
- Biodegradable and renewable.

CONCLUSIONS

- In this work, starch films were formed by film casting method.
- Films were functionalized by ethanol extracts.
- Successful modification of starch films were confirmed using different characterization methods FTIR, XRD.
- Modified films showed excellent antibacterial activity against *staphylococcus aureus* and *escherichia coli*.
- Prepared extract incorporated starch films were used to prepare antimicrobial and antioxidant food packaging films
- Through this work, it is proposed that functionalized starch films can be used as promising material for antimicrobial food packing films.

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YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Yttrium silicate film grown using chemical vapor deposition for X-ray inspection

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Abstract

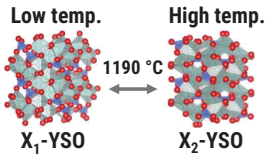
Ce-doped yttrium oxyorthosilicate ($Ce:Y_2SiO_5$, Ce:YSO) is a blue emitting phosphor with relatively high density, high light yield, and fast decay time, and is expected to be used in scintillator screens when made into films.

Ce-doped yttrium silicate scintillators in the form of single crystals and polycrystal ceramics have been widely studied; however, there are few reports on those films due to difficulty of the crystallization of silicate phases via film deposition processes. In the synthesis of films by the liquid-phase epitaxy method, impurities such as Pb^{2+} and Pt^{2+} from flux degraded scintillation light yield of Ce:YSO.

We focused on laser-assisted chemical vapor deposition (LCVD) method. This method is capable of high-speed and high-purity synthesis of phosphor materials in the gas phase. Such rapid production method can improve the production efficiency of Ce:YSO thick film phosphors for scintillator screens. In the present study, we prepared $Ce:X_1$-YSO film on quartz glass substrate using laser-assisted chemical vapor deposition and investigated the microstructure and luminescent properties of the film.

Introduction

■ **Ce-doped Y_2SiO_5 (Ce:YSO)**
- Relatively high density (4.45 g/cm^3)
- High light yield (2200 ph/5.5 MeV)
- Fast decay time (40–62 ns)
- Two monoclinic crystal structures

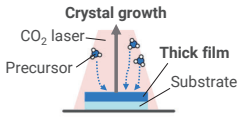


Ce-doped YSO is promising for scintillator screens when made into films. However, crystal phase should be controlled.

Issue and Proposal

■ **Competing method: Liquid-phase epitaxy method**
- Impurities such as Pb^{2+} and Pt^{2+} from flux degraded scintillation light yield of Ce:YSO

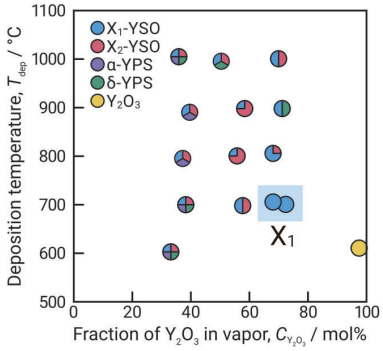
■ **Present study**



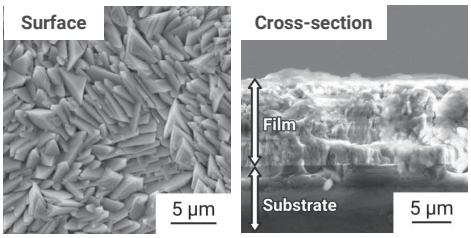
Proposed method :
Chemical vapor deposition process
- **High deposition rates**
- **High purity process**

Experiment, Results and Discussion

Constitutive phase mapping

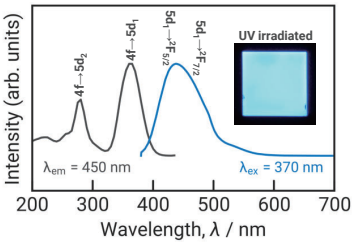


SEM images



- ✓ $Ce:X_1$-YSO film was prepared on quartz glass substrate, and its surface was faceted.
- ✓ Cross-sectional structure was dense and 12 μm thick.

Luminescent properties



- ✓ $Ce:X_1$-YSO film emitted blue light under UV irradiation.
- ✓ Excitation spectra correspond to the 4f–5d transitions of Ce^{3+} ions.

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Structural Variation by Mono *N*-alkylation in Indigo Dye

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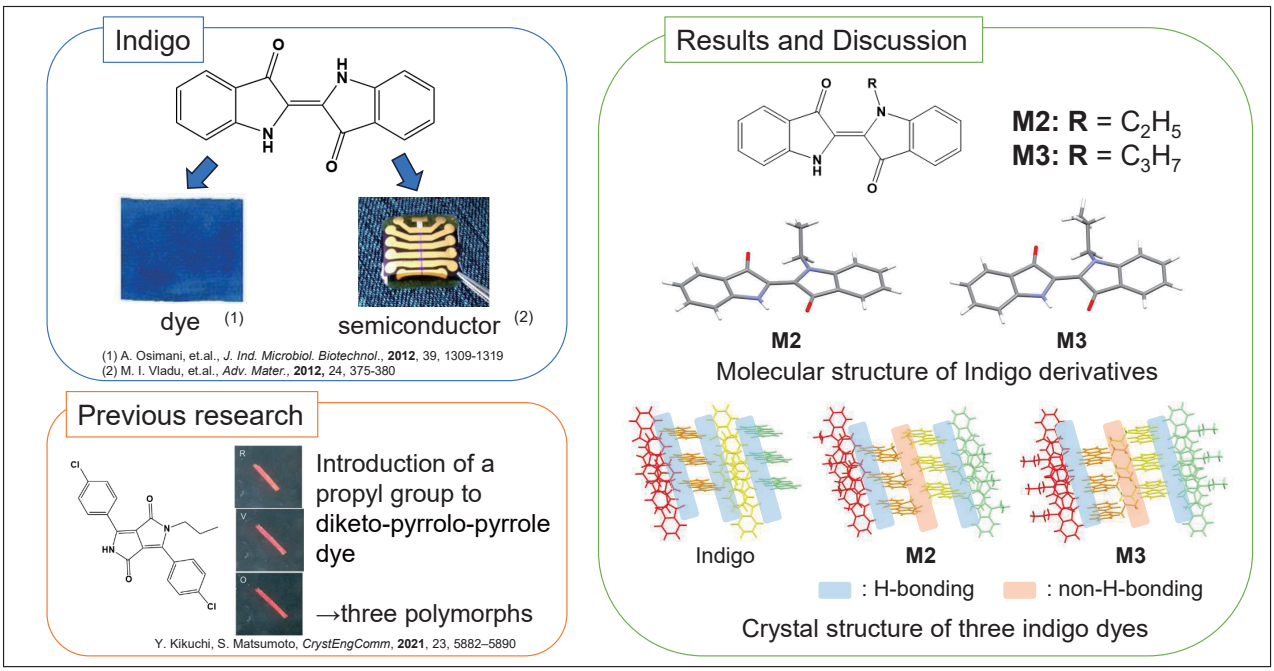
Abstract (100-200word, 16 point)

In recent years, organic dyes have been applied as functional materials such as highly efficient light absorbers, emission materials and so on. Indigo dyes, in particular, are expected to be applied to an organic semiconductor. Solid state characteristics based on crystal structure are essential in the application of dye solids to electronic materials.

In this study, We synthesized two *N*-alkylated indigo dyes , mono *N*-ethyl derivative (M2) and mono N-propylated derivative (M3) and investigated the effect of the alkyl substitution on structural variation in crystal structure.

A comparison of the crystal structure of unsubstituted Indigo with those of M2 and M3 showed that the introduction of substituents changed the molecular arrangement in their crystals.

All three Indigo dyes form one-dimensional (1D) columns due to π-π interactions. In unsubstituted indigo, 1D columns are hydrogen-bonded each other to form crystal structure. The arrangement of the 1D columns of both M2 and M3 is changed by the introduction of the alkyl groups.



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Si-doped AlN film synthesized using CVD method for white-LED phosphor

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Currently, white LEDs use a combination of blue LED and YAG:Ce^{3+} yellow phosphor, but the color rendering is low due to the lack of red components, and thermal quenching is an issue. AlN and SiAlON have excellent thermal and chemical stability and can emit various colors by adding rare earth elements. They exhibit less thermal quenching compared to oxide phosphors, making them promising phosphors for white LEDs.

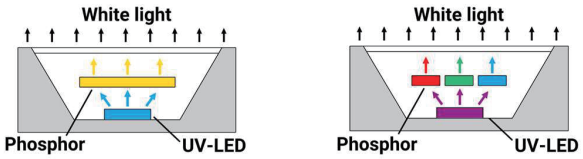
Traditionally, nitride materials are synthesized by the gas pressure sintering (GPS) method, which produces bulk ceramics at high pressures (around 1 MPa), requiring expensive high-pressure equipment and significant energy, taking several hours. The laser-assisted chemical vapor deposition (LCVD) method is a solid material synthesis method which synthesizes ceramics as films in a low vacuum (about 1000 Pa) in just 10 minutes. This method simplifies the experimental setup and reduces energy consumption, offering a more efficient and cost-effective alternative to the GPS method.

In the present study, we synthesize Si^{4+} doped AlN films and investigate the effects of Si^{4+} doping on the crystalline phase and photoluminescence by varying the Si ratio and deposition temperature.

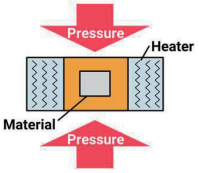
Introduction

■ SiAlON and AlN phosphors for White LEDs
– Excellent thermal and chemical stability
– Lower thermal quenching than oxide phosphors

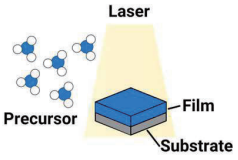
Promising as phosphors for white LEDs



Issues & Objectives



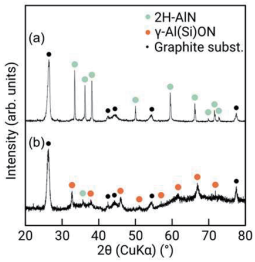
Gas Pressure Sintering (GPS)
✓ bulk-ceramics
✓ High-pressure (1 MPa)
✓ Long synthesis time (1–2 hour)

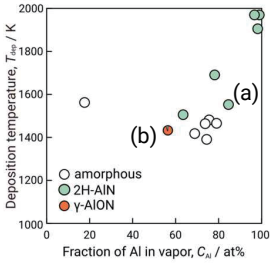


Chemical Vapor Deposition (*CVD*)
✓ film-ceramics (20 μm)
✓ Low vacuum (1000 Pa)
✓ Short synthesis time (10 min.)

Results & Discussion

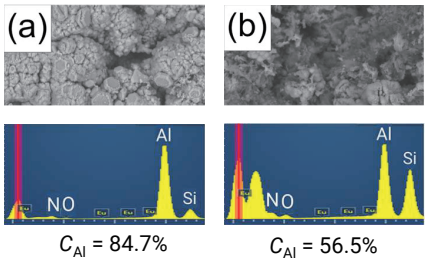
XRD patterns & mapping





・ 2H-AlN was obtained at T_{dep} = 1496 K or higher and C_{Al} = 64% or higher.
・ γ-AlON was obtained at T_{dep} = 1411 K and C_{Al} = 56%.

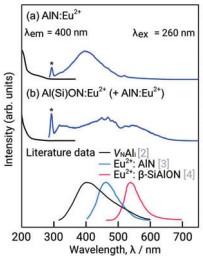
SEM images

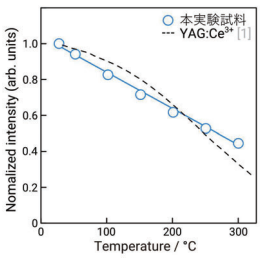


C_{Al} = 84.7%　　C_{Al} = 56.5%

・ The surface structure was faceted for 2H-AlN and uneven for γ-AlON.
・ The presence of Si in the film was confirmed by EDX.

Photoluminesence





・ AlN emitted defect-derived luminescence.
・ The intensity ratio of AlN was higher than that of YAG:Ce^{3+} at 300 °C.

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YNU Symposium2024
September 4-5, 2024, Yokohama, Japan

Effect of Ionic solution and surface condition on Zeta Potential and Electroviscous Effect of Microporous Alumina Membrane

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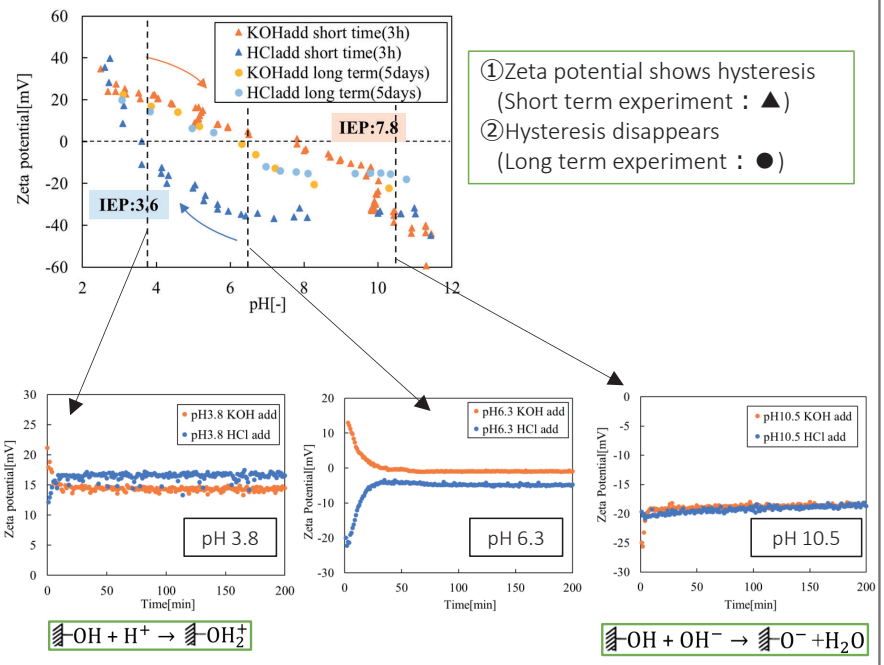
Abstract (100-200word, 16 point)

While membrane filtration process is a separation method based on the size difference between pore size and particulate materials, it is known that the surface charge condition of membrane pore and particulate materials will also affect on separation performances and fouling properties of membrane filtration processes. The charge condition at solid-liquid interface will depend on the instinct chemical property of solid, adsorption of solutes, and electrical double layer(EDL) developed near the surface. Although the charge condition of membrane pore can be characterized as zeta potential by measuring streaming potential, the physical meaning of the measured zeta potential is not clear because the zeta potential will reflect not only the surface charge condition but also the EDL overlapping in pore structure. In this study the effects of pH, electric conductivityand surface hydrophobicity on zeta potential and electroviscous effect of microporous alumina membrane (0.2μm pore size) were measured for very wide range of conditions. The zeta potential showed a hysteresis depending on history of pH changing when acid and alkali changes fast. .However. this hysteresis disappears when the experiment runs for a long period of time so its means that the rate of reaction is very low in a neutral pH range.

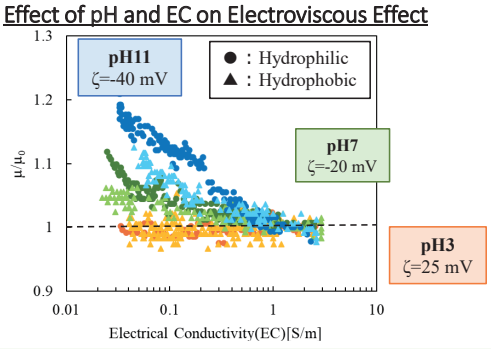
Effect of pH on Zeta Potential



①Zeta potential shows hysteresis
(Short term experiment：▲)
②Hysteresis disappears
(Long term experiment：●)

The reaction rate on the alumina surface is very low at neutral pH range.
(low ion concentration of H^+ and OH^-)

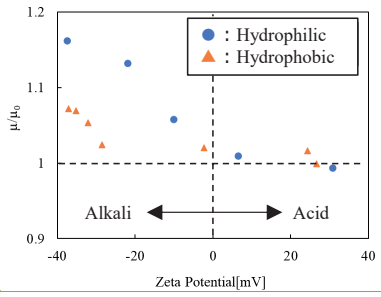
Effect of pH and EC on Electroviscous Effect



- Low ion concentration
- High pH
- Hydrophilic surface

} High Electroviscous Effect

Effect of Zeta Potential on Electroviscous Effect



Negative surface ➡ High Electroviscous Effect

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Sustainable Development Goals in Pharmaceutical Industry

Dhanush Krishnan A, Vaibhavi Singh, Vamshee Yashwanth
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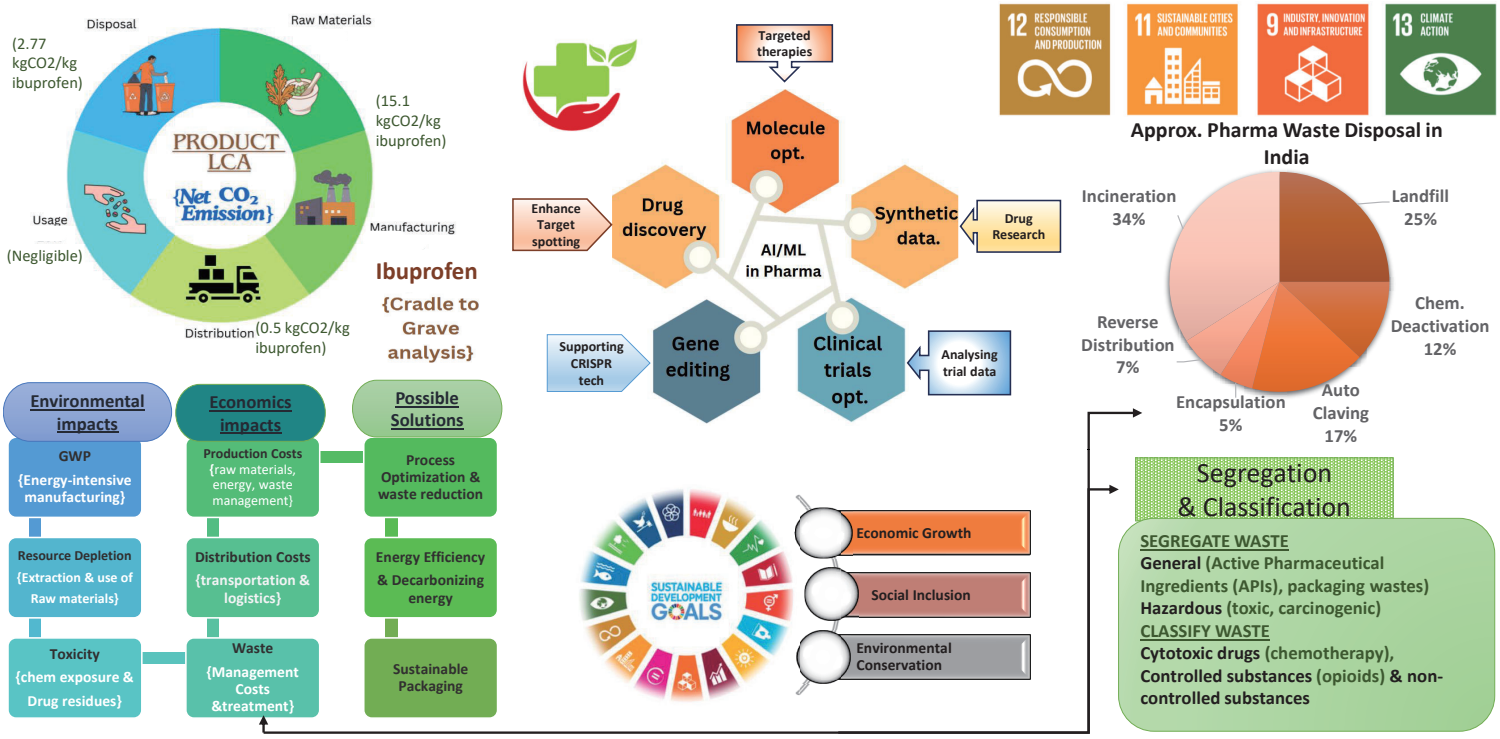
Abstract

The Pharmaceutical Industry's future is being shaped by the Sustainable Development Goals (SDGs), which are pushing the sector toward practices that support environmental stewardship, health, and well-being. The industry is in a unique position to support multiple SDGs because of its substantial influence on global health, including those related to good health and well-being (SDG 3), responsible consumption and production (SDG 12), and climate action (SDG 13). With the help of Artificial Intelligence, and by integrating sustainable practices, pharmaceutical companies can reduce their environmental footprint, improve access to essential medicines, and ensure ethical sourcing of materials. This involves adopting green chemistry, reducing waste, investing in renewable energy, and prioritizing the health of communities, especially in underserved regions. Adopting the SDGs will benefit the industry's reputation, guarantee long-term profitability, and have a positive social impact in addition to being in line with global sustainability efforts. A framework for ethical innovation and a way to help create a healthier, more sustainable future for the pharmaceutical sector can be provided by achieving the SDGs.



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Numerical analysis for the relationship between the structure and mass transport performance of PEM water electrolysis anode side PTL

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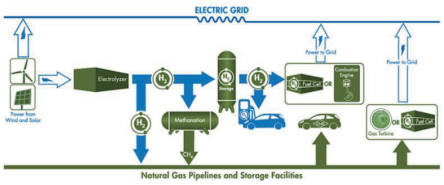
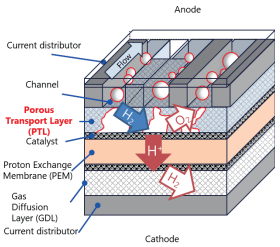
Abstract (100-200word, 16 point)

In recent years, the concept of power to gas, in which electricity is converted into hydrogen energy for storage and use, has emerged to promote the use of renewable energy for the realization of a sustainable society. Therefore, PEM water electrolysis is attracting attention as it is suitable for generating hydrogen using electricity generated from renewable energy sources, which is highly time-varying.

PEM water electrolysis is a system in which water is supplied to the anode side, electrolysis is performed, and the protons that pass through the PEM become hydrogen at the cathode. Efficient hydrogen production requires accelerated anode reactions, that is, more efficient mass transport on the anode side. Existing PTL structures, which are highly relevant to mass transport performance, are particulate and random, but the use of metal 3D printers has made it possible to print free PTL structures. The goal of this study is to optimize the anode-side PTL structure by numerical analysis using OpenFOAM.





Anode : $H_2O \rightarrow 2H^+ + \frac{1}{2}O_2 + 2e^-$
Cathode : $2H^+ + 2e^- \rightarrow H_2$

■ How to optimize PTL structure

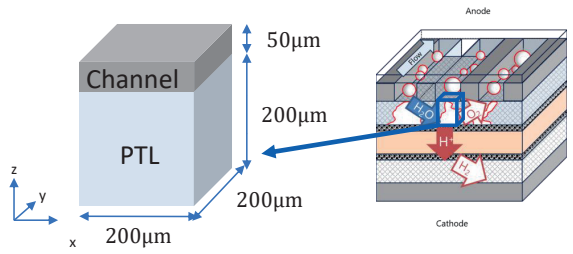
	Hole size	porosity
Effective electrode area		high
electron transfer resistance	small	
Mass transport performance	big	high

■ Numerical analysis using OpenFOAM

Structure of PTL $(200\mu m \times 200\mu m \times 200\mu m)$

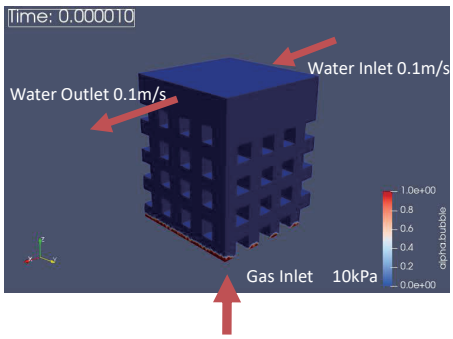
Channel $(200\mu m \times 200\mu m \times 50\mu m)$

→Divide into a cubic grid of $2\mu m$ on each side



■ Calculate pressure, volume fraction, and flow velocity using a arbitrary PTL structure fabricated by 3DCAD

Volume fraction of bubbles



■ Future Prospects

- Examination of boundary conditions
- Numerical analysis by changing PTL structure
- Determine the evaluation function for material transport performance within the PTL

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Disintegration of particle agglomerate by fluidic shear stress and ultrasonication

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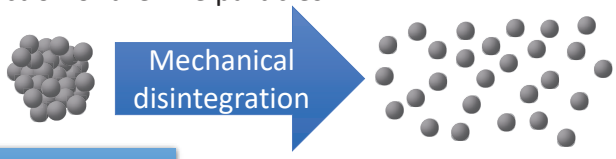
Abstract

The fine particles are used in various industry and the control of agglomeration and dispersion of fine particles are key technologies especially in the application of fine particles. The agglomeration and dispersion will be caused by the various physco-chemical interaction between particles and the size of agglomeration will depend on the balance of attractive force and repulsive force. Disintegration of is the process of applying mechanical force to make agglomerate into primary particles and the properties highly depend on the method of the energy application. In this study, the effects of fluidic shear stress provided by stirring and ultrasonic radiation on the disintegration properties were studied using the agglomerate of PMMA fine particle with primary particle size of 1 μm. The splitting dispersion was observed by applying shear stress on the agglomerate and the erosion dispersion was observed by radiating ultrasound. The difference in the disintegration properties will be caused by the difference in local size of energy distribution of fluidic shear stress and ultrasonic radiation.

Introduction

Disintegration is an operation to disperse agglomerates of primary particles without changing their specific surface area. It is a preliminary step in the use of pigments and fillers as raw materials and is an important operation to achieve the original function of the fine particles.



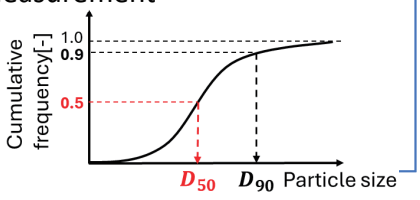
Experiment

Particle agglomerate
(PMMA: average primary particle size 1 μm)

Disperse in water

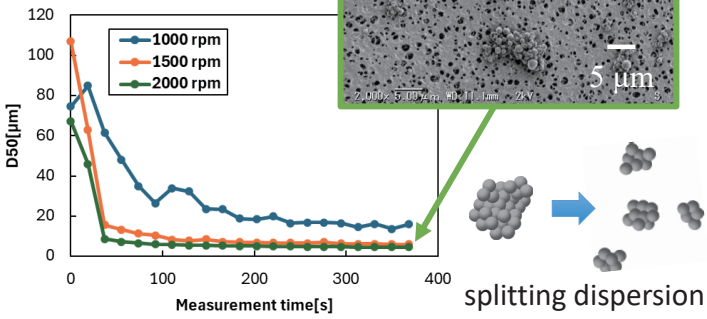
①Disintegration by stirring
②Disintegration by ultrasonication

- Particle size distribution measurement
- Zeta potential measurement
- SEM



Result

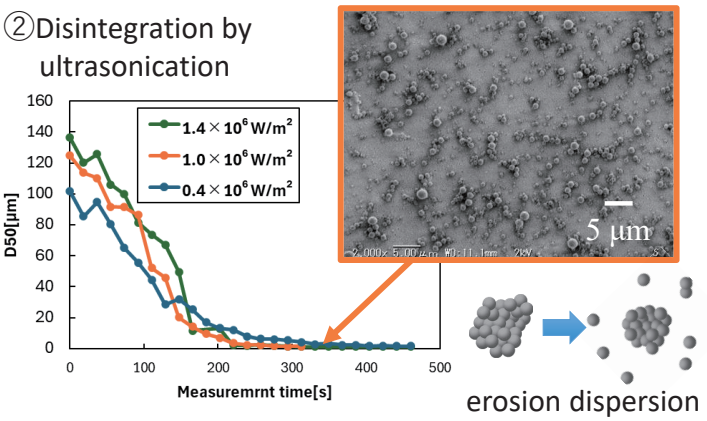
①Disintegration by fluidic shear stress



splitting dispersion

Disintegration by agitation stabilized at a D50 of μm.

②Disintegration by ultrasonication



erosion dispersion

Ultrasonic disintegration proceeded until the D50 reached the primary particle size.

GREEN HYDROGEN

Materials Research Directions Toward a Green Hydrogen Storage

ABSTRACT

A constellation of technologies has been researched with an eye toward enabling a hydrogen economy. Within the research fields of hydrogen production, storage, and utilization in fuel cells, various classes of materials have been developed that target higher efficiencies and utility. This Review examines recent progress in these research fields from the years 2011−2021, exploring the most commonly occurring concepts and the materials directions important to each field. Particular attention has been given to catalyst materials that enable the green production of hydrogen from water, chemical and physical storage systems, and materials used in technical capacities within fuel cells. The quantification of publication and materials trends provides a picture of the current state of development within each node of the hydrogen economy.

Presented by NAMYA LOOMBA
BE CHEMICAL MBA 4th YEAR

SCOPE AND RESULTS

Physical based storage

1.Compressed Hydrogen: Hydrogen is stored in tanks under extremely high pressures (700–800 bar) to improve volumetric density, requiring thick-walled tanks made of carbon fiber composites and polymer linings. While this method allows for quick charge and discharge times, it presents safety risks such as explosion, fire, and tank embrittlement.

2. Liquefied Hydrogen: Hydrogen can be liquefied to reduce its volume further, but this process is energy-intensive, complex, and costly, involving cooling to −253 °C and using vacuum-insulated tanks. Liquid hydrogen storage minimizes vaporization losses and requires closed-system transfer.

3. Cryo-compressed Hydrogen: This combines compression and liquefaction to achieve higher volumetric density. It involves compressing hydrogen and then cooling it in cryogenic tanks, which are lined with stainless steel to withstand high pressures and cycles. However, hydrogen leakage poses an environmental concern due to its potential to influence greenhouse gas concentrations.

Material-Based Storage

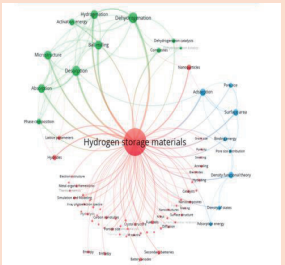
1.Physisorption Materials: Hydrogen is adsorbed weakly on materials like carbonaceous sorbents, allowing for lower storage pressures and temperatures compared to physical storage methods, though the low binding energy necessitates cryogenic temperatures to enhance storage capacities.

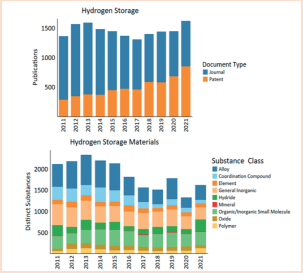
2. Chemisorption Materials: Hydrogen interacts chemically with materials, which may not be fully reversible due to high activation energy, with ongoing research and patents focused on improving hydride-based storage and other advanced materials.

3. Carbon-Based Materials: Carbon nanotubes (CNTs), fullerenes, and activated carbons (ACs) are promising for hydrogen storage due to their high surface area and porosity. Functionalizing CNTs with metal nanoparticles enhances hydrogen storage capacity, while fullerenes can store up to 7.7 wt% hydrogen. However, optimizing pore structure and surface area is crucial for maximizing storage efficiency.

4. Metal-Organic Frameworks (MOFs): MOFs, with their porous structures, offer high hydrogen storage capacities at cryogenic temperatures and high pressures. MOFs like MOF-5 and hybrid MOF/CNT composites show significant potential, with recent advancements focusing on improving their volumetric and gravimetric hydrogen storage through densification and compaction techniques.

catalyst substance class	substance	REG #	2021 publications	feature(s)
oxides	RuO_2	9002-89-5	185	standard for comparison for OER but also frequently used in nanocomposite electrocatalysts
	TiO_2	13463-67-7	421	catalyst support; frequently doped and/or heterostructured nanocomposites for both photocatalysis and electrocatalysis
general inorganics	C_3N_4	143334-20-7	477	facile synthesis into nanostructures, amenable to vacancy engineering for photocatalysis
	MoS_2	1317-33-5	308	exfoliatable semiconductor nanosheets for photocatalysis
elements	carbon	7440-44-0	917	prepared via various sources to control morphology and doping level of a (photo)electrocatalyst component
	platinum	7440-06-4	899	nanostructured or "single-atom" catalysts for decreased Pt loading in HER
	nickle	7440-02-0	681	Ni foam as an electrocatalyst component; in situ transformations into active nanocatalyst components; single-atom catalyst studies
coordination compounds	UiO-66(NH_2)	1260119-00-3	11	visible light-responsive porous photocatalyst component
	ZIF-67	46201-07-4	27	doped, surface-engineered, and/or calcined to produce novel Co-based (photo) electrocatalysts
alloys	iron−nickel alloy	11148-32-6	64	electrodepositable nanocomponent in overall water-splitting electrocatalysts
	cobalt nickel alloy	11101-13-6	43	nanocomposite electrocatalysts with other top materials
polymers	polyaniline	25233-30-1	15	conductive polymers in nanocomposite (photo)electrocatalysts
	polypyrrole	30604-81-0	13	





YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Collembola mortality due to the gas emission by mushrooms

Kein Mizukami, Taizo Nakamori
Yokohama National University

Abstract

- Studying prey defense of mushrooms let our understanding fungi breeding ecology. Gas emitted from mushrooms may contribute to protection themselves.
- The research Collembola escaped from Mushroom's gas and highly concentrated 1-Octen-3-ol (Nakamori and Suzuki, 2006; Sawahata et al., 2008).
- It possibly affects defense for animals which dive into mushrooms. Also it doesn't have proof yet that effects for animals which invade to eat mushrooms.
- Purpose of my study is validate lethal effects for Collembola by mushroom's gas in closed space. Also if it has validate lethal, does the strength of the effect vary among species of fungi?
- I examined under various concentration conditions using two types of fungi.

Figure1.
The collembola image

Figure2.
The image of mushrooms and collembola in a closed container for gas exchange

Result

- It was possible to confirm dead of Collembola both bottles Shiitake and Hiratake.
- The death rate differs from two fungi.

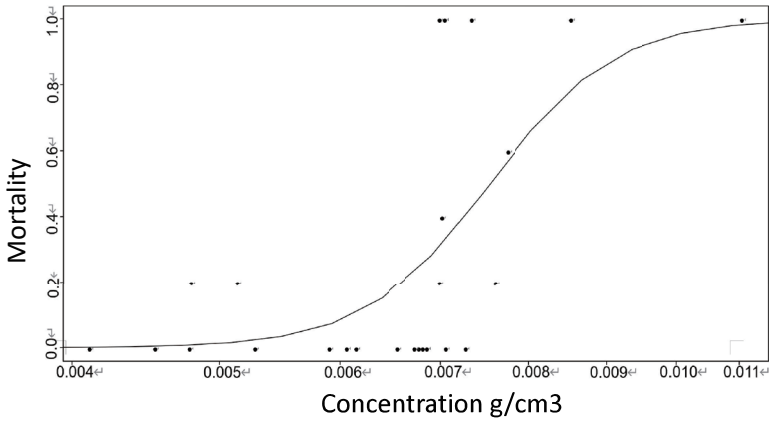


Figure3.
Mortality of collembola caused by Hiratake

Consideration

- Mushrooms gas maybe contribute to defense from adversary animals.
- Mount of draining gas and constituents are different among mushrooms.
- Not all mushrooms use gas.
- Due to global warming this action and soil's world may change.
- To confirming, it needs that studying mushrooms under some temperature conditions.

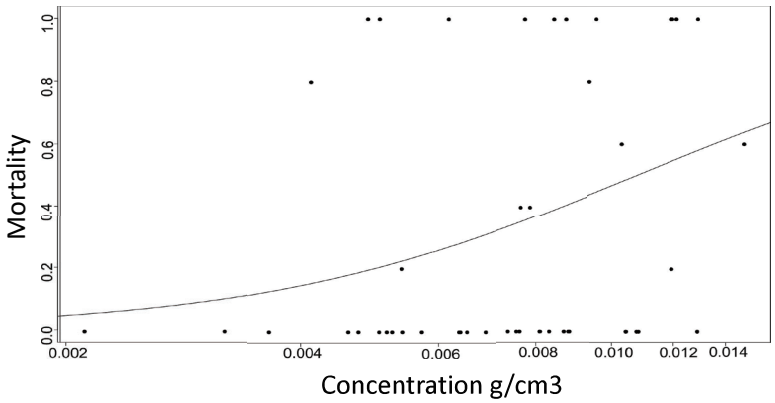


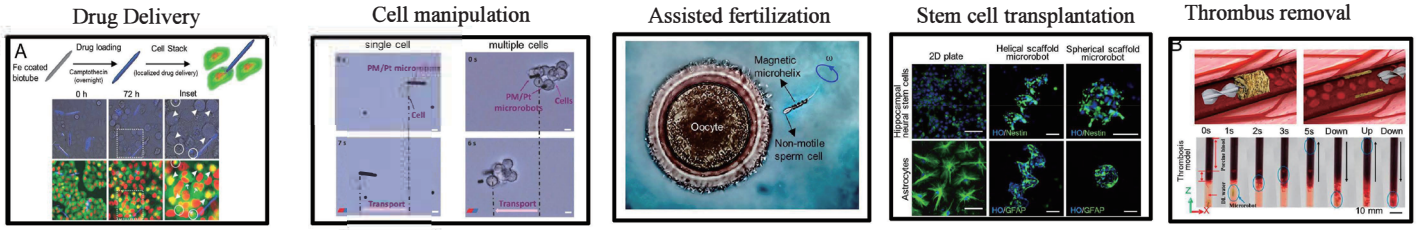
Figure4.
Mortality of collembola by Shiitake

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Adaptive Control design for Magnetically Actuated Micro/Nanorobots for the Drug Delivery Applications

Neeta Yadav, Abhilash Patel
IIT Kanpur, email: neetayadav23@iitk.ac.in

Magnetically actuated micro/nanorobots represent a groundbreaking advancement in biomedicine, materials science, and microengineering. These tiny machines, often smaller than a human cell, can perform complex tasks in confined and challenging environments. For these tasks, path tracking is a critical objective that can be achieved with closed-loop feedback controllers. However, traditional control methods may not be sufficient for the proper tracking because the micro/nanorobots moving inside body faces various uncertainties. To address this issue, a robust adaptive control method for the precise path tracking of microrobots is presented. A time delayed controller is designed, which uses past information to handle the uncertainties in the system dynamics. This controller design is validated in MATLAB based simulation and developed experimental setup in vitro. This controller design is able to track diverse reference trajectories. These results will help toward advance robotics applications in the healthcare field.



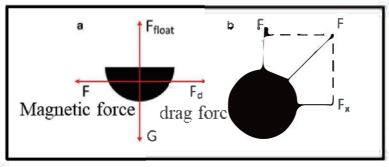


Fig.1 Force working on microrobot immersed in fluid

Dynamics of the microrobot, $m\ddot{x} + F_\sigma(x,\dot{x}) = F_m(t)$

Proposed control law, $F_m(t) = mu(t) + \hat{F}_\sigma(t)$

Estimation law, $\hat{F}_\sigma(t) \cong F_\sigma(t-h) = \vec{F}_m(t-h) - m\ddot{x}(t-h)$

x is position vector, F_σ is uncertain forces, F_m is magnetic force

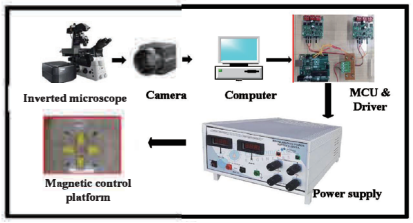


Fig. 2 Block representation of the maneuvering setup

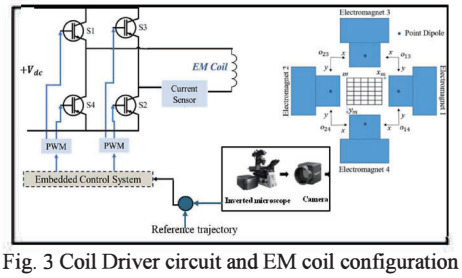
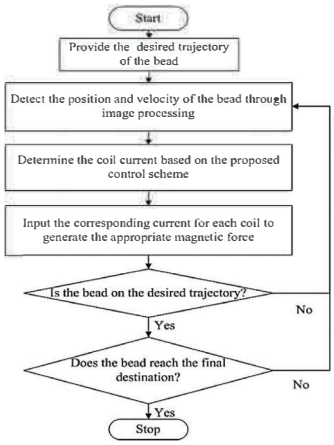


Fig. 3 Coil Driver circuit and EM coil configuration



Flow chart for the Experiments

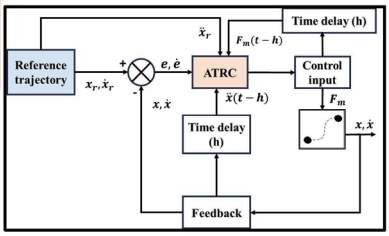


Fig. 4 Block diagram of time-delay controller

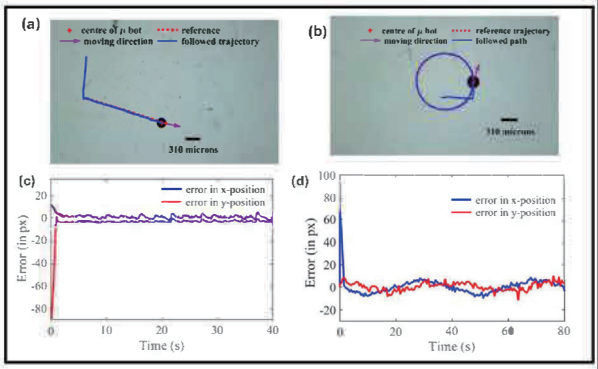


Fig. 5 Experimental results for linear and circular trajectory

P-40

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

Harnessing the Self-Sensing Properties of SMA for Artificial Proprioreception

Malik Arsala Nissar
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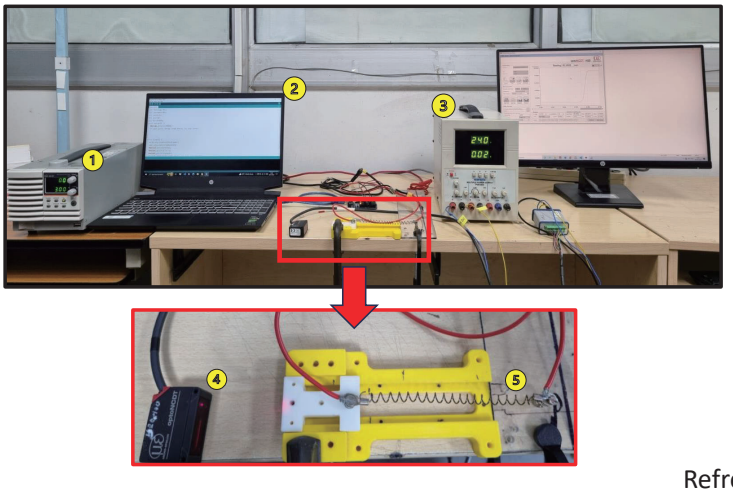
Abstract

This study introduces a bio-inspired metamaterial-based elbow joint powered by Shape Memory Alloy (SMA), designed to replicate an agonist-antagonist mechanism for artificial proprioception. Leveraging the self-sensing capabilities of SMA, the system accurately predicts joint displacement through an Artificial Neural Network (ANN). The research involved developing both a 1-DOF SMA slider and an SMA-powered bio-inspired elbow joint, with extensive electrical and visual data collection. Data was pre-processed and integrated for ANN training, achieving a prediction accuracy of 97.45% in flexion and 95.99% in extension. The results demonstrate the feasibility of using SMA for creating self-sensing robotic joints, with significant implications for rehabilitation and prosthetics. Future work will explore the application of this technology in more complex robotic systems.

ANN Model Workflow

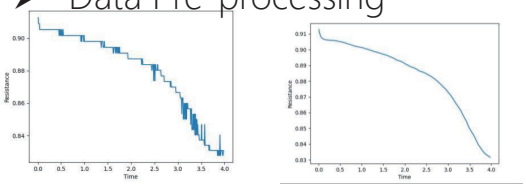
Experimentation & Data Collection → Data Handling → Data Interpolation & Integration → Artificial Neural Network

➢ Experimental Setup



1. Programmable DC Supply
2. Arduino Interface
3. Constant DC Supply
4. Laser Displacement Sensor
5. Shape Memory Alloy coil

➢ Data Pre-processing



Raw Data | Processed Data

Model Accuracy in Prediction : 94.8%

➢ ANN Result Benchmarking

Time (s)	Resistance (Ohm)	Voltage (V)	Experimental Displacement (mm)	Predicted Displacement (mm)	Error (%)
2.0520	0.835126897	4	83.71877	84.662834	1.127661
2.0555	0.834939795	4	83.71877	84.731460	1.209634
2.0575	0.834832879	4	83.72033	84.770400	1.254260

Refrences:
1. Kanhaiya Lal Chaurasiya, A. Sri Harsha, Yashaswi Sinha, Bishakh Bhattacharya, Design and development of non-magnetic hierarchical actuator powered by shape memory alloy based bipennate muscle

YNU Symposium2024
September 4 -5, 2024, Yokohama, Japan

3D Printed Artificial Coral Reef For Ecological Sustainability

Shivam, Sarvesh Kumar Mishra
Indian Institute of Technology Kanpur, E-mail: shivamp23@iitk.ac.in

Abstract: Coral reefs are vital to marine ecosystems, supporting biodiversity, protecting coastlines, and sustaining livelihoods. However, they are increasingly threatened by climate change, pollution, and overfishing, leading to significant declines in reef health worldwide. The development of 3D-printed artificial coral reefs presents a promising solution to restore and sustain these essential habitats. But there are certain challenges like printing material, parameters optimization, adaptability to biodiversity. This study explores the potential of using Fused material deposition (FDM) 3D printing technologies to create artificial coral structures that mimic the complex geometry and surface texture of natural reefs. By utilizing eco-friendly and biocompatible materials, these structures can promote the settlement and growth of marine organisms, particularly corals, thus enhancing reef resilience. First objective to test the structure at the terrestrial level compatibility for the plants, algae, and insects. Then customizing the design for the for the marine environment for restoration of coral ecosystem for the future work. This research highlights the role of 3D-printed artificial reefs in ecological sustainability, offering a scalable and innovative approach to marine conservation in the face of ongoing environmental challenges.

Artificial Coral Reef 3D Printed

Objective

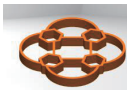
a) Develop 3D-Printed Coral Structures

b) Test terrestrial compatibility

c) Restoration marine coral reef

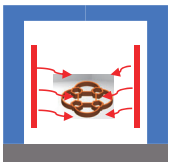
Methodology

- Design and pre-processing
- Process parameters
- Material Preparation
- Post-processing
- Environmental testing



Terracotta soil 1kg

100 ml water

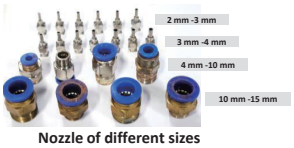


Heat treatment

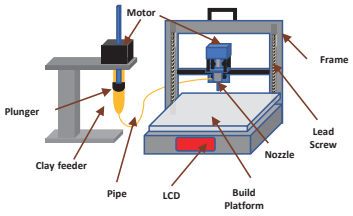
Process parameters	
Layer height	2 mm
Line width	2 mm
Print speed	60 mm/s
Material flow speed	40 mm/s
Infill density	0

Machine Setup

Components of Machine:



Nozzle of different sizes



Machine setup

Result and Discussion

- Creation of structure resembling coral reefs by FDM clay printing.
- Eco-friendly material (terracotta soil) which is available in the surroundings and compatible with living organisms.
- Customization of the design structure without a support

Terrestrial → Artificial Marine (aquarium) → Natural marine

Pre-Symposium Events

August 28 (Wed), 30(Fri) and September 2(Mon)

Overview Lecture, Campus Tour, Laboratory Visiting, Joint Meeting at the YNU Campus

August 29th (Thu)

Industrial Tour Day1

NOK CORPORATION
https://www.nok.co.jp/en/

NHK SPRING CO., LTD.
https://www.nhkspg.co.jp/en/

Fujitsu Limited
https://global.fujitsu/ja-jp

JFE Engineering Corporation
https://www.jfe-eng.co.jp/en/

August 31st (Sat)

Cultural Tour

The visiting places vary depending on the group.

September 3rd (Tue)

Industrial Tour Day2

CoorsTek GK
https://www.coorstek.co.jp/eng_index.html

Hakone GeoMuseum
https://www.hakone-geomuseum.jp/english/

Participants from India & Australia

India

IIT-Kanpur	**Dr. Sarvesh Mishra & 3 Students**
VIT	**3 Students**
Anna University	**Prof. R. Baskaran & 3 Students**
Panjab University	**Prof. Anupama Sharma & 7 Students**

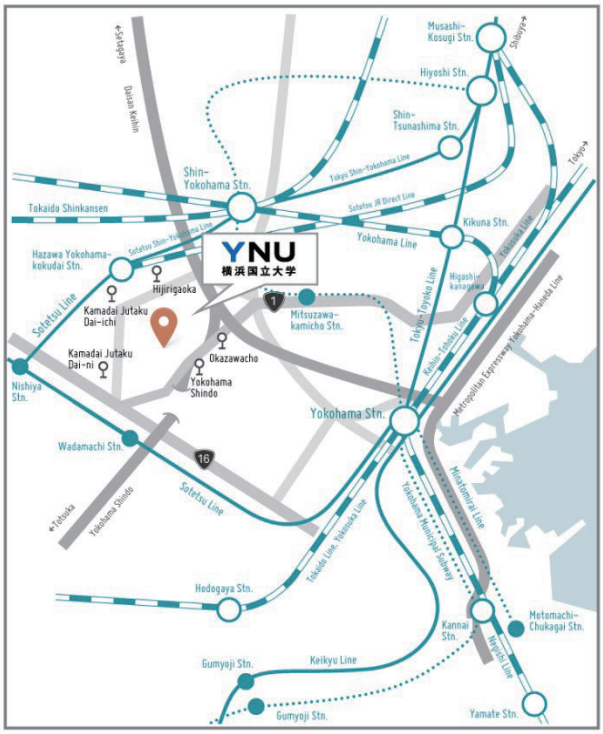
Australia

Griffith University	**2 Students**
University of Newcastle	**3 Students**

Campus Information (Access&Map)

How to reach YNU from Yokohama Station

https://www.ynu.ac.jp/english/about/access/access/



By Train

To the Main Entrance

The Nearest Station:

[Yokohama Municipal Subway]

Mitsuzawa-kamicho Station

About a 16 min. walk

Map covering from

Mitsuzawa-kamicho Station

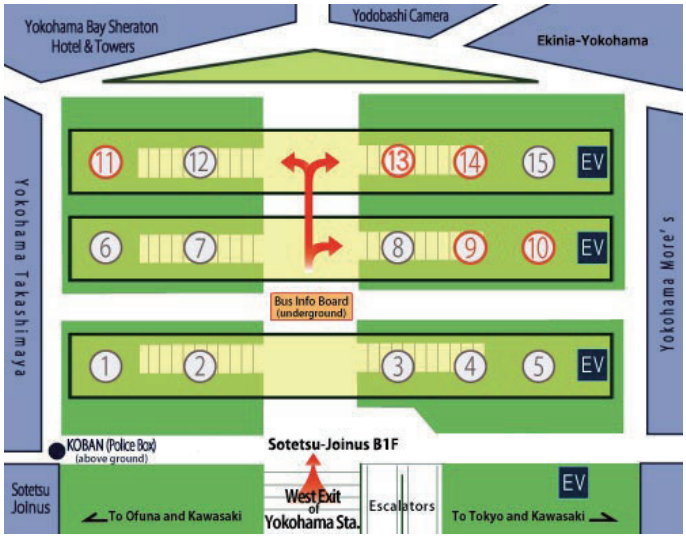
to the Main Entrance

https://www.ynu.ac.jp/english/about/access/train_front/

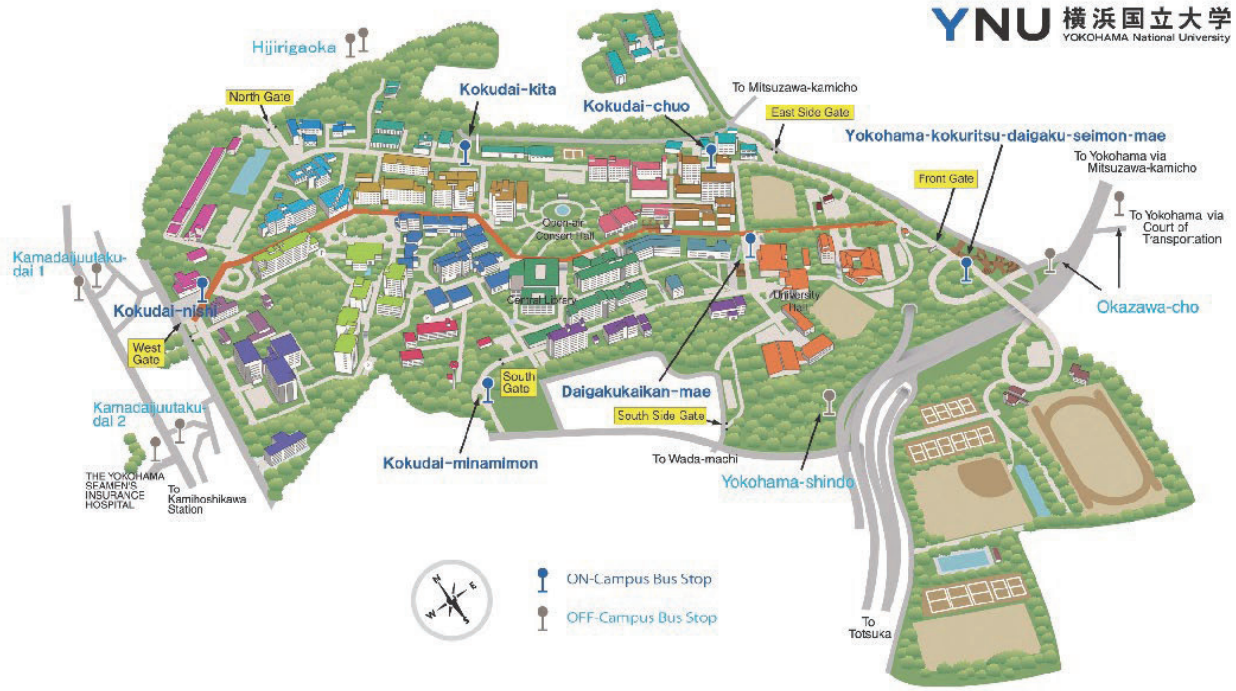
By Bus / Taxi

(The West Exit of Yokohama Station)

It takes 15-20 minutes from the bus terminal at the West Exit of Yokohama Station to YNU.



Campus Map



http://www.ynu.ac.jp/english/access/map_campus.html

Accommodations

YNU Minesawa International Student Dormitory

Address
305-1 Minezawa-cho, Hodogaya-ku,
Yokohama 240-0061 JAPAN

Commuting time to YNU
Five minutes on foot

Hotel Yokohama Camelot Japan

Address : 1-11-3 Kitasaiwai Nishi-ku Yokohama Kanagawa
Tel : 045-312-2111
Notes :

- Public transportation / each line Yokohama Station, 5-minute walk in the JOINUS underground shopping area (South Exit 12)

- car/Shuto Expressway ~ Yokohama Station West Exit IC ~ 3 minutes from Yokohama West Exit IC Come with Risona Bank and Tenri Building as landmarks

Organizing Committee

Advisory:

Motonari Tanabu, Vice President of YNU & International Strategy Org. Executive Director

Tatsunori Mori, Director, Grad. Sch. Env. & Info. Sci. (EnvInfoSci)

Osamu Umezawa, Director, Grad. Sch. Eng.

Kazushi Sanada, Dean, College Sci. & Eng.(Eng.)

Inaba Atsushi, Director of Student Affairs and International Strategy

Hiroyuki Tamaki, Manager, Global Promotion Division

Kumiko Takehara, Chief, International Planning Section

Tomoko Takeuchi, Specially Appointed Official, International Planning Section

Organizing Committee:

Hideaki Yoshitake, Prof. Eng., YNU Chairperson

Kazuho Nakamura, Assoc. Prof. Eng., YNU Secretary in General

Hiromi Kabashima, Prof. Internatioal Social Sci., YNU

Yusuke Maeda, Prof. Eng., YNU

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Taro Arakawa, Prof. Eng., YNU

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Aruna Singh, Prof., VIT, India

Varalakshmi, Prof., Anna University, India

Anupama Sharma, Prof., Panjab University, India

Bishakh Bhattacharya, Prof., IIT-Kanpur, India

Ajayan Vinu, Prof., The University of Newcastle, Australia

S Anuradha Jabasingh, Assoc. Prof., Addis Ababa University, Ethiopia

Acknowledgement

Grant:

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About the student exchange project

Supporting Fund: Ministry of Education, Culture, Sports, Science and Technology (MEXT)–Japan Society for The Promotion of Science (JSPS) “Inter-University Exchange Project” 2022 Support for Creation of Inter-University Exchanges in the Indo-Pacific Region

Program Name: “YOKOHAMA International Education Program for Leading Sustainability Transformation towards a Resilient Society with Industry-Government-Academia Network”

Partner Universities: <India> Anna Univ., IIT-Kanpur, Panjab Univ., VIT

< Australia > Griffith Univ., The Univ. of Newcastle

Program duration: 2022 – 2026 (Japanese fiscal year) Participating students: Graduate students, Undergraduate students

Number of participating students: 2 to 10 students are expected to participate from each university every year. Among the participating students, 2 or 3 students will be supported financially with air tickets between Japan, accommodation in Japan, every year:

Duration of visits: 1 to 1 month (Short term), 1 to 3 months (Middle or long term), 1 semester, etc. The duration will vary by grades or research topics.

Other assistance:

We would like to express our sincere gratitude to the Embassy of India Tokyo, Japan, for the nominal support and honor of the presence of the representative to the Special Symposium on AI for Transformation to a Sustainable Society.

We extend our heartfelt gratitude to all those who played a pivotal role in making this symposium a resounding success. The contributions by the following organizations, in various forms, have been invaluable and greatly appreciated among others.

- Toray Industries Inc.
- Nomura Securities Co., Ltd.
- KSGG (Kanagawa Systematized Goodwill Guide Club)
- OHSGG (Odawara Hakone Systematized Goodwill Guide Club)
- JASSO (Japan Student Services Organization)
- Alumni Association of Yokohama National University