Technical Program and Abstract Book

International Conference on Traditional and Advanced Ceramics

ICTA2025

15-17 October 2025

IMPACT Exhibition & Convention Center, Bangkok, THAILAND
In conjunction with ASEAN Ceramics & Stone 2025

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Technical Program

ICTA2025

The 5th International Conference on Traditional and Advanced Ceramics: ICTA2025 in conjunction with ASEAN Ceramics & Stone 2025

15-17 October 2025

Hall 5, Impact Exhibition & Convention Center, Bangkok, THAILAND

Day 1 | Wednesday 15 October 2025

Main Stage

08:30 - 10:00	Registration & Poster Set-up
10:00 - 10:45	ASEAN Ceramics & Stone 2025 and ICTA2025 Opening Ceremony
10:45 - 11:00	Coffee Break

ICTA2025 Stage

Session Chair: Assoc. Prof. Dr. Jiratchaya Ayawanna, School of Ceramic Engineering, Institute of Engineering, Suranaree University of Technology, Thailand

11:00 - 11:35	**Plenary Lecture I: Advanced Rare Earth Oxide Doping ZrO2 Based Ceramic Materials Sintering Behavior at Lower Temperature for Solid Oxide Fuel Cells** **Prof. Dr. Cheng-Xin Li** Xi'an Jiaotong University, P.R. China
11:35 - 12:00	**Keynote Lecture I: Refractory Bricks Manufactured with Aluminum Dross** **Prof. Makoto Nanko** Nagaoka University of Technology, Japan
12:00 - 13:00	Lunch

Main Stage

Panel Discussion by The Thai Ceramic Society

13:00 - 13:45	**Panel Discussion I: Market Dynamics & Opportunities in Ceramics in Southeast Asia** **Panellists:** • Dr. Wiphawan Limphaibool, Quality Ceramic Co. Ltd. • Mr. Metha Jarathanakorn, CIP Value • Assoc. Prof. Dr. Sirithan Jiemsirilers, The Thai ceramic Society • Dr. Pongsakorn Kantichaimongkol, Nexus impact corporation **Moderator:** Dr. Chaleeda Borompichaichartkul, Faculty of Science, Chulalongkorn University"
13:45 - 14:30	**Panel Discussion II: Decarbonization: Addressing Environmental Challenges and Solutions in the Ceramics Sector** **Panellists:** • Asst. Prof. Dr. Siriluk Chiarakorn, King Mongkut's University of Technology Thonburi • Mr. Varoon Varanyanond, Center of Excellent on Petrochemical and Materials Technolgy (Petromat) • Mr.Pathom Chaiyapruksaton, Senior Manager, Low Carbon Business Certification office, Thailand Greenhouse Gas Management Organization (Public Organization) **Moderator:** Dr. Pitak Laoratanakul, National Metal and Materials Technology Center (MTEC), National Science and Technology Development Agenc(NSTDA)
14:30 - 15:00	**Panel Discussion III: Green Building Materials & Sustainable Ceramics: Innovations in Eco-Friendly Production** **Panellists:** • Dr. Sakprayut Sinthupinyo, Green Circular Technology Directory, SCG Cement Co.Ltd. • Dr. Panupant Phapant, Head of Net Zero Transformation Building and Living Care Consulting • Mr. Atuk Chirdkiatisak, Managing Director, Compoundclay Co,.Ltd. **Moderator:** Dr. Nongnuch Poolsawad, Research Group Director of Technology and Informatics Institute for Sustainability, National Metal and Materials Technology Center (MTEC)
15:00 - 15:15	Coffee Break

ICTA2025 Stage

Session Chair: Dr. Sujitra Onutai, School of Materials Science and Engineering, Hainan University, PR China

Session Co-chair: Dr. Sitthisak Prasanphan, National Metal and Materials Technology Center (MTEC), Thailand"

15:15 - 15:40	**Keynote Lecture II: Development and Application of Geopolymer Technology in Taiwan** **Prof. Wei-Hao Lee** National Taipei University of Technology, Taiwan

Session G: Green Technology and Sustainable Materials

15:40 - 16:00	**Invited Lecture I (G-O-09): Effects of Zeolite-Added Porous Clay-Based Bedding Additive as Moisture/ Ammonia Sorbent on Broiler Performance and Welfare** **Wantanee Buggakupta** Faculty of Science, Chulalongkorn University, Thailand
16:00 - 16:15	**G-O-07: Salt Resistance of Metakaolin and Asphalt Waste Dust Based Geopolymer** **Paratee Sukkatorn** Institute of Engineering, Suranaree University of Technology, Thailand
16:15 - 16:30	**G-O-12: A Low-Carbon Alternative to Red Bricks: High-Pressure Geopolymer Bricks from Industrial By-Products** **Ti-Chun Li** Institute of Mineral Resources Engineering, National Taipei University of Technology, Taiwan
16:30 - 16:45	**G-O-10: Sustainable Lightweight Foams from Hazardous Aluminum Dross** **Chayapat Weerapakdee** Institute of Engineering, Suranaree University of Technology
16:45 - 17:00	**G-O-13: Performance of Cement-Laterite Aggregate Mixtures in Salt Solution Testing** **Pimchanok Sertsoongnern** Institute of Engineering, Suranaree University of Technology, Thailand
17:00 - 17:15	**G-O-15: Preparation of Calcium Phosphate Porous Granules Using Sponge As Template** **Neeranut Kuanchertchoo** Faculty of Science, Ramkhamhaeng University, Thailand
17:15 - 17:30	**G-O-16: Utilization of Ca sludge from the sugar industry to produce high purity calcium carbonate using precipitation method** **Charoen Panyo** National Metal and Materials Technology Center (MTEC), Thailand
18:00 - 20:00	**Banquet at Slot co-working Space and Cafe**

Day 2 | Thursday 16 October 2025

Session Chair: Assoc. Prof Dr. Rojana Pornprasertsuk, Faculty of Science, Chulalongkorn University, Thailand

09:00 - 09:25	**Keynote Lecture III: Thin Films Surface and Interfacial Modifications for Solid Oxide Cells** **Prof. Pei-Chen Su** Nanyang Technological University, Singapore
09:25 - 09:50	**Keynote Lecture IV: Magneto-Optical Neural Network Devices using, Bi-Substituted Magnetic Garnet Films** **Takayuki Ishibashi** Nagaoka Unoversity of Technology, Japan
09:50 - 10:10	**Invited Lecture II: Innovations in Zirconia Ceramics for Dental Restoration through Additive Manufacturing** **Dr. Nashrah Hani Jamadon** The National University of Malaysia, Malaysia
10:10 - 10:20	**Coffee Break**
10:20 - 10:45	**Keynote Lecture V: Biochar Carbon Removal And Opportunity For Carbon Negative Concrete** **Dr. Sakprayut Sinthupinyo** SCG Cement Co., Ltd., Thailand

Session A: Advanced Ceramics
Session Chair: Asst. Prof. Dr. Chiraporn Auechalitanukul, Faculty of Engineering, King Mongkut's University of Technology Thonburi, Thailand

10:45 - 11.00	**A-O-03: Cold Sintering-Assisted Low Temperature Fabrication of Dense $Ba_5Nb_4O_{15}$ Ceramics** **Apichayaporn Teandam** School of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand
11:00 - 11:15	**A-O-06: The Effect of Mechanical Surface Treatment on Shear Bond Strength between Novel Zirconia and Dentin** **Nurul Shayhiera Aminuddin** Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Malaysia

Session B: Building and Construction Materials
Session Chair: Assoc. Prof. Dr. Thanakorn Wasanapiarnpong, Faculty of Science, Chulalongkorn University, Thailand

11:15 - 11:30	**B-O-11: Comparative Study on the Enhancement of Soil-Cement Strength Using Bentonite and Polyurethane Foam** **Pornkanok Rattanapituk** School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand
11:30 - 11:45	**B-O-27: Exploration on Clay Mineral Activation Affecting Hydration of Limestone Calcined Clay Cement** **Ketsarin Ariya** Faculty of Science, Chiang Mai University, Thailand
11:45 - 13:00	**Lunch**

Session Chair: Assoc. Prof Dr. Rojana Pornprasertsuk, Faculty of Science, Chulalongkorn University, Thailand

13:00 - 13:30	**Keynote Lecture VI: Ceramic Derived All-solid-state sodium Ion Battery Prepared by Laser Processing** **Tsuyoshi Honmaa** Nagaoka University of Technology, Japan
13:30 - 14:00	**Keynote Lecture VII: High Energy and High Safety Rechargeable Batteries** **Dr. Jiaqian Qin** Faculty of Science, Chulalongkorn University, Thailand

Session E: Ceramics for Energy and Environmental Applications
Session Chair: Dr. Jiaqian Qin, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

14:00 - 14:15	**E-O-17: Synthesis of δ-MnO2/C composite from Spent Alkaline Batteries for Reuse in Zinc-ion Batteries** **Pakinee Thongrit** Synchrotron Light Research Institute, Thailand
14:15 - 14:30	**E-O-38: Efficiency Enhancement of PDMS Triboelectric Nanogenerator using donor doped calcium copper titanate dielectric fillers** **Kittipan Saichompoo** Faculty of Science, Srinakharinwirot University, Thailand"
14:30 - 14:45	**E-O-50: Mixed-Oxide Nanofibers for Catalyzing a Nitrate Reduction Reaction** **Chiraporn Auechalitanukul** Faculty of Engineering, King Mongkut's University of Technology Thonburi, Thailand"
14:45 - 15:00	**Coffee Break**

Session C: Ceramic Art and Design
Session Chair: Dr. Nithiwach Nawaukkaratharnant, Faculty of Science, Chulalongkorn University, Thailand

15:00-15:20	**Invited Lecture III (C-O-53): Glaze Layering for Creative, Artistic Works: Frozen Pond Effect** **Niti Yongvanich** Faculty of Engineering and Industrial Technology, Silpakorn University, Thailand
15:20 - 15:35	**C-O-25: Cultural Imprint on Clay: Preserving Bajau Identity through the Revival of Lapohan Pottery in Contemporary Design** **Norhayati Ayob** Universiti Malaysia Sabah, Malaysia

Session F: Glass and Coatings Technology
Session Chair: Asst. Prof. Dr. Apirat Theerapapvisetpong, Faculty of Science, Chulalongkorn University, Thailand

15:35 - 15:50	**F-O-45: Enhanced Red Emission of Gd2MoO6:Eu3+ Phosphor-in-Glass Embedded in SiO2-TeO2-Na2O-BaO Matrix for Solid-State Lighting** **Patarawagee Yasaka** Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Thailand
15:50 - 16:05	**F-O-46: Reddish orange emission from Eu3+ ion doped Boro-Tellurite Glass: Potential for Scintillation and Thermoluminescence Material Applications** **Kitipun Boonin** Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Thailand
16:30 - 17:30	**Poster Session**

Day 3 | Friday 17, October 2025

Exploring ASEAN Ceramics and ASEAN Stones 2025

Poster Presentation

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Session A: Advanced Ceramics

A-P-20: Wear Resistance of High Density Si3N4 – ZrO2 Ceramic Composites

Kamol Traipanya,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

A-P-24: Effect of Anodization Voltage and Heat Treatment on the Surface Crystallinity and Hydrophilicity of the Ti-6Al-4V

Phanawan Whangdee,
Department of Applied Physics, Faculty of Sciences and Liberal Arts, Rajamangala University of Technology Isan, Thailand

A-P-28: Structural and Functional Enhancement of PVA/Chitosan Hydrogels via Cu-Doped TiO_2 Nanoparticles for Potential Wound Dressing Applications

Kyi Pyar Min Lwin,
Department of Materials Engineering, Faculty of Engineering, Kasetsart University, Thailand

A-P-43: Influence of Diluent on Rheology, Polymerization, Debinding and Sintering of Alumina Ceramic via Resin Suspensions and LCD 3D Printing

Worachet Supasorn,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

Poster Presentation

ICTA2025

The 5th International Conference on Traditional and Advanced Ceramics: ICTA2025 in conjunction with ASEAN Ceramics & Stone 2025

Session B: Building and Construction Materials

B-P-08: Development of Permeable Ceramic Brick from Waste Porcelain Insulator and Fly Ash through Anorthite Phase Formation

Apirat Theerapapvisetpong,
Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

B-P-21: Fabrication of concrete roof tiles using mussel shell waste as coarse aggregate by casting technique

Pranee Junlar,
Department of science service, Thailand

B-P-22: Reducing Water Absorption of Cement Mortar by Using Modified Clay Brick Waste

Nuntaporn Kongkajun,
Department of Materials and Textile Technology, Faculty of Science and Technology and Thammasat University Research Unit in Sustainable Materials and Circular Economy, Thammasat University, Thailand

B-P-30: Use of Recovered Carbon Black from Spent Tires to Enhance Electrical Properties of Cement Composites

Parinya Chakartnarodom,
Department of Materials Engineering, Faculty of Engineering, Kasetsart University, Thailand

B-P-31: A Sustainable Construction Material: Geopolymer Composite from Fly Ash, Bagasse Ash, Sand and Asphalt Emulsion

Pakapond Chowandee,
Department of Materials and Textile Technology, Faculty of Science and Technology, Thammasart University, Thailand

B-P-32: Synthesis of Hydroxyapatite Powders by Chemical Precipitation with Transition Metal Ions Substitution for Solar Reflective Pigments

Thanakorn Wasanapiarnpong,
Center of Excellence on Petrochemical and Materials Technology, Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

B-P-39: Comparative Study On The Effects Of Alkali Activators And Alumina Additives On Properties Of Industrial Waste-Based Geopolymer Composites

Paing Set Soe,
Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

B-P-40: Utilization of solid waste from fluidized bed process for fabricating press-formed inorganic polymer-based brick

Nithiwach Nawaukkaratharnant,
Metallurgy and Materials Science Research Institute and Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

B-P-42: Fabrication of Porous Fly Ash/Bagasse Ash-based Geopolymer Insulation Brick

Chayanit Sripradit,
Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

Poster Presentation

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Session D: Ceramic Industrial Technology

D-P-29: **Effects of Mae-Than Ball clay, Lampang clay, Pottery Stone, and Quartz on Physical and Mechanical Properties for Porcelain Stoneware Products**

Phiraya Pukpobsuk,
Department of Industrial Technology and Innovation Management, Faculty of Industrial Technology, Lampang Rajabhat University, Thailand

D-P-56: **The Effect of Fluxing Agents on The Synthesis of Malayaite Ceramics Colour Pigment**

Lapasrada Paowan,
Department of Materials Science and Engineering and Industrial Technology, Silpakorn University, Thailand

Session E: Ceramics for Energy and Environmental Applications

E-P-18: **Synthesis of Manganese Dioxide from Spent Zinc-Carbon Batteries with Hydrothermal Process for Application in Zinc-Ion Batteries**

Apinya Suwaphapphattrarphon,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

E-P-26: **Efficient Direct Recycling of NMC111 Batteries Using LiI-LiOH Eutectic Salt**

Parame Janson,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

E-P-33: **Influence of Synthesis Method on the Structural and Visible-Light Photocatalytic Activity of BiVO4**

Phakapol Lainok,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

E-P-37: **Fabrication and Performance Evaluation of Highly Porous Clay-Based Ceramics for the Removal of Methylene Blue Dye from Water**

Montree Hankoy,
Department of Physics, School of Science and Devices and Systems for Energy and Environment Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand

E-P-55: **Preparation of Zeolite 13X from Ceramic Wastes for Carbon Dioxide Capture**

Kittiphum Wong,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

E-P-59: **Mineral Waste-Derived Zeolites as Low-Cost Adsorbents for CO_2 Capture**

Panida Wimuktiwan,
National Metal and Materials Technology Center, Thailand

E-P-60: **Investigation of Potential Interaction and Oxide Dispersion in Cesium Dihydrogen Phosphate -cTitanium Dioxide Composites Prepared via various Methods**

Sunithi Ratana,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

Session F: Glass and Coatings Technology

F-P-47: **Reddish-orange luminescence of new Sm3+-doped borate glass for X-ray imaging**

Nuanthip Wantana,
Center of Excellence in Glass Technology and Materials Science (CEGM) and Physics Program, Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Thailand

Poster Presentation

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Session G: Green Technology and Sustainable Materials

G-P-14: Effect of synthesis parameters of zeolite 13X from porcelain insulator waste by alkali fusion method on the carbon dioxide absorption properties

Kittipong Sinwanasarp,
Center of Excellence on Advanced Materials for Energy Storage and Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

G-P-19: Optimizing Ceramic Engobe Performance through Sustainable Material Integration: Effects on Physical and Mechanical Properties under Single-Firing

Nophawan Dechboon,
Faculty of Art and Architecture, Rajamangala University of Technology Lanna, Thailand

G-P-35: Microwave-Assisted Green Synthesis of TiO_2 Nanoparticles via Mangifera indica Extract

Sudarat Tanjumras,
Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand

G-P-36: Facile Microwave-Assisted Green Synthesis of Zinc Oxide Nanoparticles using Garlic Peel Waste (Allium sativum L.) Extract

Chutipon Tongleak,
Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand

G-P-41: Ecofriendly Synthesis and Characterization of Magnesium Oxide Nanoparticles Using Aloe vera Extract as a Reducing and Stabilizing Agent

Patharaporn Robroocharoen,
Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Thailand

G-P-52: Green Synthesis and Optimized Annealing Temperature Effects on Zinc Oxide Nanoparticles Using Mango Peel Extract

Wantana Koetniyom,
Lasers and Optics Research Center (LANDOS) and Faculty of Applied Science, King Mongkut's University of Technology North Bangkok, Thailand

G-P-54: Designing Geopolymer-Zeolite Hybrids: Structural Evolution and Phase Control in Alkali-Activated Metakaolin

Sujitra Onutai,
Key Laboratory of Advanced Materials of Tropical Island Resources of Ministry of Education, School of Materials Science and Engineering, Hainan University, PR China

G-P-57: The Synthesis of Malayaite-base pigment from wastes

Teerapong Manakit,
Department of Materials Science and Engineering and Industrial Technology, Silpakorn University, Thailand

G-P-58: Effects of Alpha-Gypsum Plaster Cement on Casting of Activated Charcoal Prepared from Vetiver Grass Leaves for Odor Absorption Applications

Uraiwan Leela-adisorn,
Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand

Plenary Lecture

PL - 01

Advanced rare earth oxide doping ZrO_2 based ceramic materials sintering behavior at lower temperature for solid oxide fuel cells

Cheng-Xin Li *

School of Materials Science and Engineering, Xi'an Jiaotong University, Xi'an city, Shaanxi Province, 710049, P.R. China
*E-mail address: licx@xjtu.edu.cn

Keywords: Solid oxide fuel cells, Electrolyte, Zirconia, Rare earth oxide

Scandia-stabilized zirconia (ScSZ) is the electrolyte of choice for low- and mid-temperature SOFCs because Sc^{3+} matches Zr^{4+} in size, yielding high O^{2-} conductivity and a cubic fluorite structure. Yet between 500–650 °C the cubic phase transforms to the rhombohedral phase, causing abrupt conductivity loss and long-term aging. Co-doping with Yb_2O_3 widens the cubic stability window and redistributes oxygen vacancies via size matching, while adding Al_2O_3 and Bi_2O_3 enables low-temperature sintering. Al_2O_3 scavenges SiO_2 grain-boundary impurities and lowers boundary resistance, achieving 97.2 % density at 1350 °C; Bi_2O_3 forms a transient liquid phase that reduces shrinkage onset by ~200 °C and yields 97.1 % density. This "rare-earth + sintering-aid" synergy suppresses grain growth, cuts energy use, and retains 0.12 S cm^{-1} at 750 °C in 1Yb10ScSZ-0.3Al without forming low-conductivity second phases.

Keynote Lecture

KL - 01

Refractory Bricks Manufactured with Aluminum Dross

Makoto Nanko[a, *], Chayapat Weerapakdee[a, b], Kaito Suzuki[a], Seiryu Suzuki[a], Yen-Ling Kuo[a], and Takahiro Suzumura[c]

[a]*Nagaoka University of Technology, Nagaoka, Niigata, 940-2188, Japan*

[b]*School of Ceramic Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand*

[b]*Suzumura Co. Ltd., Toyota, Aichi, 471-0837, Japan*

*E-mail address nanko@mech.nagaokaut.ac.jp

Keywords: Refractory, Alumina, $MgAl_2O_4$, Aluminum dross

Aluminum and its alloys are important materials with low density, excellent mechanical properties and high electric and thermal conductivities. In particular, the market of aluminum alloys in automobile industry is growing up year by year. In the point of view on effective usage of mineral resource, recycling of aluminum and its alloys have been promoted. During smelting process of aluminum and its alloys, aluminum dross is formed by oxidizing those melts with flux such as $MgFe_2$. Aluminum dross consists of mainly aluminum oxide and hydroxide, metallic aluminum, flux and its oxidation products and aluminum nitride (AlN). Because of chemical reaction between oxygen or humidity in air with metallic Al and AlN, aluminum dross evolves H_2 and ammonia (NH_3) with heat generation. Disposal of aluminum dross requires proper treatments to remove metallic Al and AlN. In the present study, recycling of aluminum dross is proposed to fabricate refractory bricks with conventional ceramic processing. Al_2O_3 and MgO are typical oxides for refractory bricks. Use of aluminum dross can reduce the production cost of refractory bricks. Sintered aluminum dross consists of α-Al_2O_3, $MgAl_2O_4$ and $CaAl_{12}O_{19}$ with small amount of impurities such as Ca_2SiO_4. In order to achieve the industrialization of recycling of aluminum dross into refractory bricks, impurity managements are very important. Impurities of SiO_2, CaO and Cu_2O affect strongly sintering behavior of aluminum dross as well as thermal and chemical stability of the refractory bricks.

KL - 02

Development and Application of Geopolymer Technology in Taiwan

Wei-Hao Lee[a, *]
[a]*Institute of Mineral Resources Engineering, National Taipei University of Technology, Taipei City, 10608, Taiwan.*
(12-point italic)
* whlee@ntut.edu.tw

Keywords: Geopolymer technology, Precast Concrete Products, Geopolymer based Ceramic Composites, Circular Economy

Geopolymers are inorganic polymer materials formed by the reaction of aluminosilicate raw materials (such as fly ash, slag, or metakaolin) with an alkaline activator. Compared with traditional Portland cement, materials prepared by geopolymer technology have excellent engineering properties, such as high early strength, room temperature hardening, good fire resistance and heat insulation ability, nice acid/alkali resistance ability, nice durability, and low carbon emissions. Due to their eco-friendly production and excellent performance characteristics, geopolymers have been gradually attracting world attention as potentially revolutionary green materials.

This presentation introduces the latest advances in geopolymer technology in Taiwan, focusing on innovative material integration and sustainable development. Key projects and commercial applications led by National Taipei University of Technology will be highlighted, showcasing breakthroughs and the scalability potential of geopolymer products. In line with Taiwan's circular economy goals, special emphasis will be placed on applying these high-value materials.

In presentation includes the development and application of geopolymer technology in ready-mixed concrete, the development of precast high early-strength geopolymer concrete, the application of geopolymer technology on waste reutilization, and the research progress of geopolymer-based Ceramic Composites.

Finally, the focus of future research will be introduced, using geopolymer technology on 3D printing, producing porous adsorption carriers, and developing ultra-high temperature refractory materials. We hope to continue to expand the diversified application potential of geopolymer technology.

KL - 03

Thin Films Surface and Interfacial Modifications for Solid Oxide Cells

Ji Yoon Shin[a], Haoyang Li[a,b], and Pei-Chen Su[a,b]*
[a]*School of Mechanical and Aerospace Engineering and*
[b]*Energy Research Institute, Nanyang Technological University, Singapore*
*peichensu@ntu.edu.sg

Keywords: Ceramic Electrodes, Perovskite, Surface Engineering, Solid Oxide Cells, Atomic Layer Deposition

The development of high-performance and durable ceramic electrodes is central to advancing solid oxide cell (SOC) technology for energy conversion. Perovskite oxides, such as $Sr_2Fe_{1.5}Mo_{0.5}O_{6-\delta}$ (SFMO), are promising electrode materials but face challenges like chemical instability and surface degradation during operation. This work aim to addresses these challenges by employing ceramic processing and surface engineering techniques to modify and enhance perovskite electrodes.

We utilize atomic layer deposition (ALD) and solution infiltration to apply nanoscale coatings and create highly defective surface layers on SFMO electrodes. These modifications are designed to suppress detrimental phenomena such as Sr cation segregation, a common degradation mechanism in ceramic perovskites. Our results demonstrate that the engineered surfaces significantly improve electrochemical performance by enhancing the kinetics of the oxygen reduction reactions (ORR) and reducing polarization resistance.

The talk will discuss the interplay between surface chemistry, oxygen vacancy concentration, and electrochemical activity in these modified ceramic interfaces. This work highlights the critical role of advanced surface modification technologies in developing more efficient and robust ceramic-based energy devices, underscoring the potential of interfacial engineering in ceramic science for sustainable energy applications.

KL - 04

Magneto-Optical Neural Network Devices using Bi-Substituted Magnetic Garnet Films

Takayuki Ishibashi*, Hotaka Sakaguchi , Kanata Watanabe, Tomonao Matsuya, and Fatima Zahra Chafi
Nagaoka University of Technology, Nagaoka, Niigata 940-2188, Japan
* t_bashi@mst.nagaokaut.ac.jp

Keywords: Magnetic garnet, Mangeto-optical effect, Metal-organic decomposition, Neural network device

We proposed a magneto-optical neural network device that combines the high speed and parallel processing capabilities of optical-based diffractive deep neural network devices (D^2NNs) with the advantages of magneto-optic materials, such as their optical activity and non-volatile magnetic properties. To realize such devices, we prepared epitaxial bismuth-substituted magnetic garnet films on a $Gd_3Ga_5O_{12}$ (111) single-crystal substrates using the metal-organic decomposition method that we developed. The chemical formula of the fabricated bismuth-substituted magnetic garnet is $Y_{0.5}Bi_{2.5}Fe_4GaO_{12}$. To utilize a large magneto-optical effect, the rare earth ions in the dodecahedral site was substituted with a bismuth ions, and with the bismuth composition of 2.5, a large Faraday rotation angle of up to 20 degrees/μm in the visible light region is obtained. Furthermore, to achieve perpendicular magnetization, iron ions were substituted with non-magnetic gallium ions. By writing magnetic domain patterns into the prepared $Y_{0.5}Bi_{2.5}Fe_4GaO_{12}$ thin film by the thermos-magnetic recording technique, spatial light modulation is realized. To realize a neural network device with a garnet film, the magnetic domain patterns are determined by learning simulation. By arranging magnetic domains of several microns in a 112×112 array, we attempted handwritten digit classification, and we have achieved an accuracy of 83.4% for 500 handwritten digits. These results demonstrate that neural network devices utilizing magneto-optical effects have high computational performance.

KL - 05

Biochar Carbon Removal And Opportunity For Carbon Negative Concrete

Sakprayut Sinthupinyo,*, Niput Puthipad, Benjaluk Na Lampang

SCG Cement, Bangkok, Thailand

**E-mail: sakprays@scg.com*

Keywords: Biochar, Carbon Removal, Concrete, Carbon Credits

Abstract

Among carbon dioxide removal technology, biochar offers a scalable solution that not only stabilizes carbon but also creates value-added applications. This paper explores the concept of biochar-based carbon removal and its integration into construction materials to achieve carbon-negative products. Biochar is produced through pyrolysis of agricultural residues, locking biogenic carbon into a stable form. When incorporated into cementitious systems—particularly as an additive or partial replacement in concrete—biochar provides dual benefits: permanent carbon sequestration and enhanced material properties. The highly porous structure of biochar contributes to internal curing by storing and gradually releasing water during hydration, which improves cement hydration efficiency, reduces autogenous shrinkage, and enhances long-term durability. Furthermore, the biochar surface can serve as nucleation sites for hydration products, potentially accelerating early-age strength development and refining pore structure.

We present the scientific basis of biochar carbon permanence and its function in cement hydration mechanisms. Furthermore, we examine opportunities for carbon-negative concrete, including techno-economic feasibility, environmental co-benefits, and scaling potential in regions with abundant agricultural residues. This integration of biochar into the construction sector represents a promising pathway to decarbonize materials while generating certified CDR credits, positioning biochar concrete as a cornerstone for future climate-positive infrastructure.

KL - 06

Ceramic Derived All-solid-state sodium Ion Battery Prepared by Laser Processing

Tsuyoshi Honma[a, *], **Fumitaka Sato**[a],
[a] *Department of Materials Science and Bioengineering, Nagaoka University of Technology, 940-2188, Niigata, Japan*
*honma@mst.nagaokaut.ac.jp

Keywords: Glass-ceramics, Laser processing, Additive manufacturing, batteries

In oxide-based all-solid-state batteries, grain boundaries limit ion conduction, making it essential to develop strategies for creating well-bonded interfaces. One promising approach is to employ glass-ceramic materials that undergo softening and flow at elevated temperatures, enabling close contact with solid electrolytes before crystallization. Additionally, laser irradiation offers a powerful technique for localized heating of oxide glasses, inducing melting and micro-crystalline structures through highly localized thermal fields. In this study, tin–iron–sodium–silicate (yFe-SNS) glasses with compositions $55SnO–15Na_2O–yFe_2O_3–(30–y)SiO_2$ (y = 0–9 mol%) were synthesized by melt-quenching and subsequent mechanochemical processing. These glasses were investigated as anode materials in combination with a NASICON-type solid electrolyte, $Na_3Zr_2Si_2PO_{12}$ (NZSP). For electrode fabrication, 6.75Fe-SNS powders were mixed with a polyimide binder (85:15 wt.%) and N-methyl-2-pyrrolidone to form an ink, which was then applied to NZSP substrates via screen printing.

The coated solid electrolytes were subjected to laser irradiation using a pulsed Yb doped fiber laser (λ = 1064 nm, P = 3 W) with a 60 μm spot diameter. Laser scanning speeds varied from 100 mm/s upward, and processing was carried out over areas of 20 × 20 mm^2 with a hatch spacing of 40 μm. Depending on laser energy input, the anode material formed either droplet-like structures or well-wetted, dense interfaces with the NZSP surface. a favorable hetero-interface was achieved between the Fe-SNS glass-derived anode and the NZSP electrolyte by laser irradiation. This enabled the construction of an all-solid-state sodium-ion battery, which successfully demonstrated operation under these processing conditions. The results confirm that laser-assisted interface engineering is an effective means to realize dense bonding and enhance electrochemical performance in oxide-based all-solid-state sodium-ion batteries.

KL - 07

High Energy and High Safety Rechargeable Batteries

Jiaqian Qin *
Department of Materials Science, Faculty of Science, Chulalongkorn University
*E-mail address Jiaqian.q@chula.ac.th

Keywords: Rechargeable batteries, Li ion battery, Solid-state battery, Aqueous Zn ion battery

The growing demand for safe, high-performance energy storage systems has accelerated research into next-generation battery technologies. Among these, solid-state lithium-ion batteries (SSLBs) and aqueous zinc-ion batteries (AZIBs) have emerged as promising candidates due to their complementary strengths. SSLBs offer high energy density and improved safety by replacing flammable liquid electrolytes with solid-state materials, making them ideal for compact, long-lasting applications. In contrast, AZIBs provide a cost-effective and environmentally friendly solution, utilizing water-based electrolytes and abundant zinc resources to deliver reliable performance with enhanced safety and sustainability.

While lithium-ion batteries (LIBs) have dominated the secondary battery market, their dependence on scarce elements like lithium and cobalt, along with safety risks from flammable organic electrolytes, limits their scalability for grid-level storage. AZIBs address these concerns with zinc's natural abundance (75 ppm in Earth's crust), high theoretical capacity (819 mAh g^{-1}), and low redox potential (−0.763 V vs. SHE). Aqueous electrolytes further contribute to safety and high ionic conductivity (~1 S cm^{-1}).

Typical ZIBs consist of zinc metal anodes, (in)organic cathodes, neutral or mildly acidic aqueous electrolytes, and separators. However, challenges such as cathode limitations, electrolyte instability, separator inefficiency, and zinc anode issues—including corrosion, hydrogen evolution, and dendrite formation—hinder their commercial viability.

This work investigates the design principles, electrochemical behavior, and material innovations of both SSLBs and AZIBs. Through advanced characterization and modeling, key challenges such as interfacial stability, ion transport, and electrode compatibility are addressed, offering strategic insights for the development of safer, high-performance energy storage systems.

Invited Lecture

IL - 01

Effects of Zeolite-Added Porous Clay-Based Bedding Additive as Moisture/Ammonia Sorbent on Broiler Performance and Welfare

Wantanee Buggakupta[a,b*], Nithiwach Nawaaukaratharnant[b,c], Nguyen Thai Thao Nhi[d], Chackrit Nuengjamnong[e] and Kris Angkanaporn[d]

[a]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand*
[b]*Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand*
[c]*Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok 10330, Thailand*
[d]*Department of Physiology, Faculty of Veterinary Science, Chulalongkorn University, Bangkok 10330, Thailand*
[e]*Department of Animal Science, Faculty of Veterinary Science, Chulalongkorn University, Bangkok 10330, Thailand*
*Wantanee.b@chula.a.cth

Keywords: Broiler, Zeolite, Porous ceramic composite, ammonia adsorption

In modern broiler production, to maintain both environmental quality and animal welfare has become increasingly vital. In the housing system, a bedding material is one of the key factors contributing to litter condition, air quality and animal comfort. Ammonia emission from chicken manure is a serious problem for broiler production, especially it causes footpad dermatitis. This study aimed to develop and evaluate a novel bedding material composing of ball clay, rice husk ash and zeolite, in order to enhance physicochemical performance and improve broiler welfare outcomes. In vitro analysis was conducted on a clay-based composite made from ball clay, rice husk ash and zeolite 13X with various compositions. The mixtures were thoroughly mixed and extruded into rod-shape pellets, dried and fired at 600^{o}C. Their characteristics and properties, including phase content, microstructure, strength, density, specific surface area, water absorption and ammonia adsorption capacity, were examined. The selected composition was up-scaled for In vivo analysis. The pellets were extensively produced to apply from 0, 10, 20 to 40 % layering onto a 5 cm-thick conventional bedding material, rice husk, in chicken broiler. Broiler performance and chicken welfare, such as body weight, average daily gain, feed conversion ratio, litter condition and footpad dermatitis, were carefully monitored over a 40-day grow-out period. This study demonstrated that the introduced zeolite-containing porous clay-based bedding of 10 and 20% add-on offered a welfare-enhancing option to conventional rice husk. Less footpad lesion, lowered pH and ammonia emission was noticeably detected. The introduced pellets could reduce ammonia levels and also provide comfort to chickens. Moreover, its potential of environmental improvement of the pellets during-use and post-use as fertilizers could make it even more sustainable poultry production systems.

IL - 02

Innovations in Zirconia Ceramics for Dental Restoration through Additive Manufacturing

Nashrah Hani Jamadon[a, *]

[a]*Centre for Materials Engineering and Smart Manufacturing (MERCU), Department of Mechanical and Manufacturing Engineering, Faculty of Engineering and Built Environment, The National University of Malaysia, 43600 Bangi, Selangor, Malaysia*

Keywords: Zirconia ceramics, dental restoration, additive manufacturing, direct ink writing (DIW)

Ceramic-based dental materials continue to evolve, driven by the demand for durability, aesthetics, and biocompatibility. This research presents the development of a locally produced novel 3 mol% yttria-stabilized zirconia (3YSZ) block for dental restoration. Through colloidal processing, slip casting, and optimized sintering, a homogenous microstructure with improved mechanical properties was achieved. Recent research highlights the influence of nanoparticle size, surface modification, and primer treatments on shear bond strength, alongside microstructural characterization using FESEM, TEM, and XRD. The machinability of zirconia blocks into crown geometries, combined with finite element analysis of veneering techniques, provides insights into performance under functional loading. Current findings demonstrate promising wear resistance, bond strength, and clinical adaptability of the novel zirconia system. Looking forward, scaling to commercial-sized blocks and integrating extrusion-based additive manufacturing, particularly Direct Ink Writing (DIW), will further advance personalized dental restorations, bridging material innovation with digital dentistry for the next generation of patient-specific solutions.

IL - 03

Glaze Layering for Creative, Artistic Works: Frozen Pond Effect

Niti Yongvanich *, **Supisara Yuennan**
Department of Materials Science and Engineering, Faculty of Engineering and Industrial Technology, Silpakorn University, Nakornpathom, 73000,
*niti.yongvanich@gmail.com

Keywords: Frozen pond; Running hot chowder; Glaze; Creative; Ceramics.

With creativity and curiosity, development of new kinds of ceramic glaze is virtually limitless. Recently, a new technique called “Frozen Pond” or “Running Hot Chowder” has been getting a lot of attention among potters and ceramists. This novel glaze yielded appearance reminiscent of a frozen body of water. However, no homemade recipe was revealed as almost all artists stated that they use commercial glazes for this effect. These glazes come with a price as they have to be imported into Thailand. Inspired by this weird effect, we believed that, by using some theories of materials science, one could perform an investigation to test a hypothesis. After several trial and error, we could come up with the design utilizing two types of glaze that could be used together to somewhat create this frozen pond effect. Physical properties such as viscosity, surface tension and maturation point were likely to have an impact on the appearance of separation between the two glazes. The next step is to perform tests using different colorants to broaden the possibility of this creative work.

Oral Presentation

AO - 03

Cold Sintering-Assisted Low Temperature Fabrication of Dense $Ba_5Nb_4O_{15}$ Ceramics

Apichayaporn Teandam[1,2], Phakkhananan Pakawanit[3], Phitsamai Kamonpha[4], Liang Fang[5], Ying Tang[5], Wanwilai Vittayakorn[6], Naratip Vittayakorn[2,7], Usa Sukkha[2,8*] and Phieraya Pulphol[1,2*]

[1]Department of Materials Science, Faculty of Science, Srinakharinwirot University, Bangkok, 10110, Thailand

[2]Advanced Materials Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand

[3]Synchrotron Research and Applications Division, Synchrotron Light Research Institute, Nakhon Ratchasima, 30000, Thailand

[4]Ministry of Higher Education, Science, Research and Innovation, Bangkok, 10400, Thailand

[5]Guangxi Universities Key Laboratory of Non-ferrous Metal Oxide Electronic Functional Materials and Devices, College of Materials Science and Engineering, Guilin University of Technology, Guilin, 541004, China

[6]Department of Nanoscience and Nanotechnology, School of Integrated Innovative Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand

[7]Department of Chemistry, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand

[8]Department of General Science and Liberal Arts, King Mongkut's Institute of Technology Ladkrabang, Prince of Chumphon Campus, Chumphon, 86160, Thailand

**Email: phieraya@g.swu.ac.th and usa.suk@kmitl.ac.th*

Keywords: $Ba_5Nb_4O_{15}$ ceramic, Cold sintering process, transient liquid phase, low-temperature densification

This study presents a novel approach for fabricating $Ba_5Nb_4O_{15}$ (BNO) ceramics at low sintering temperatures via the cold sintering process (CSP), using $Ba(OH)_2{\cdot}8H_2O$ (BOH) as a transient liquid phase. CSP was performed under an external pressure of 10 MPa with the sintering temperatures ranging from 150°C to 300°C. In this work, BNO ceramics cold sintered at 250°C for 1 h achieved a relative density of 92% which represents the feasibility of low-temperature densification. X-ray diffraction (XRD) analysis revealed the formation of $BaCO_3$ at every sintering temperature of the cold sintered samples. The present of $BaCO_3$ resulted from the reaction between BOH and atmospheric CO_2 during CSP. Post-annealing at above 1000°C for 3 h successfully eliminated the $BaCO_3$ phase. The microstructure of the cold-sintered BNO-BOH ceramics was examined using Scanning Electron Microscopy (SEM), while Synchrotron X-ray Tomographic Microscopy (SR-XTM) was employed to analyze the internal features of the samples. Furthermore, electrical properties including dielectric constant and dielectric loss were also characterized. The cold sintering process provides an effective strategy to reduce the sintering temperature while achieving high relative density. This method offers a promising alternative for the fabrication of advanced ceramics.

AO - 06

The Effect of Mechanical Surface Treatment on Shear Bond Strength between Novel Zirconia and Dentin

Nurul Shayhiera Aminuddin (Presenter)[a], Muhammad Sufiyan Amril[a], Nashrah Hani Jamadon[a,b,*], Mariyam Jameelah Ghazali[a,b], Hsu Zenn Yew[c]

[a]Department of Mechanical and Manufacturing Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor Darul Ehsan, Malaysia.

[b]Centre for Materials Engineering and Smart Manufacturing (MERCU), Department of Mechanical and Manufacturing Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia.

[c]Department of Restorative Dentistry, Faculty of Dentistry, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia.

*Corresponding e-mail: nashrahhani@ukm.edu.my

Keywords: Zirconia-based restoration, surface treatment, surface roughness, shear bond strength.

Dental restoration required a strong and durable bond between zirconia and dentine. However, the zirconia-based restorations remains challenging due to its chemically inert and densely crystalline structure, which resists conventional etching techniques. This study investigates the effect of mechanical surface treatments and adhesive systems on the shear bond strength (SBS) between dentine and zirconia blocks fabricated through a novel colloidal processing and slip casting technique, designed by UKM researcher to reduce powder agglomeration and enhance structural uniformity. The novel zirconia were divided into three groups: no surface treatment, diamond grinding, and airborne particle abrasion with 50 µm alumina. Surface roughness measurements revealed values of 0.13 ± 0.02 µm for untreated surfaces, 0.04 ± 0.02 µm for diamond-ground, and 0.16 ± 0.06 µm for air-abraded specimens. Each zirconia then was bonded to prepared human dentine using two adhesive systems: a self-etch resin cement (RelyX U200) and a universal adhesive in self-etch mode (Single Bond Universal + RelyX Ultimate Clicker). After storage in distilled water, SBS testing was performed using a universal testing machine at a crosshead speed of 1 mm/min. Results indicated that both surface treatment and adhesive system significantly impacted bond strength. The universal adhesive system yielded higher SBS values across all groups, with the highest observed for air-abraded zirconia (34.90 MPa), followed by untreated (25.70 MPa) and diamond-ground (24.58 MPa). In contrast, RelyX U200 showed lower SBS values: 16.26 MPa (air-abraded), 12.88 MPa (diamond-ground), and 11.18 MPa (untreated). Airborne particle abrasion enhanced micromechanical interlocking, while the universal adhesive's functional monomers likely promoted chemical bonding. In conclusion, combining airborne particle abrasion with a universal adhesive system significantly improves the novel zirconia–dentine bonding, emphasizing the importance of both surface treatment and adhesive selection for optimal clinical outcomes.

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BO - 11

Comparative Study on the Enhancement of Soil-Cement Strength Using Bentonite and Polyurethane Foam

Pornkanok Rattanapituk (Presenter)[a], Jiratchaya Ayawanna[b], Lindung Zalbuin Mase [c], and Salisa Chaiyaput[a,*]

[a]*Department of Civil Engineering, School of Engineering, King Mongkut's Institute of Technology Ladkrabang 10520, Thailand*

[b]*School of Ceramic Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand*

[c]*Department of Civil Engineering, Faculty of Engineering, University of Bengkulu, Bengkulu 38371, Indonesia*

*E-mail: salisa.ch@kmitl.ac.th (corresponding author)

Keywords: Additive, Bangkok soft clay, ground improvement, soil stabilization.

The construction of buildings and infrastructure on soft ground, such as soft Bangkok clay, presents significant geotechnical challenges due to its high compressibility, high settlement, and low bearing capacity. Consequently, soil cement stabilization is one technique which is widely applied to improve the strength of soft ground. This study evaluated the effect of bentonite and polyurethane foam as additives to increase the strength of soil cement. The primary purpose was investigated by compressive strength and tensile strength tests. Moreover, the Scanning Electron Microscopy (SEM) analysis was employed to examine the microstructure to support the primary purpose. The control sample was a soil-cement mixture with 80% soil by weight and 20% cement by weight. The concentrations of bentonite and polyurethane foam at 10%, 20%, and 30% by weight of soil cement were studied and mixed into the soil cement. The results showed that adding bentonite and polyurethane foam can increase the strength of soil cement. The suitable ratio of bentonite and polyurethane foam was 30% by weight of soil cement and 10% by weight of soil cement, respectively. In addition, bentonite significantly increased compressive strength and provided a slight improvement in tensile strength. Conversely, adding polyurethane foam to soil cement increased compressive strength and a slight increase in tensile strength. These findings indicate that soil-cement stabilization with bentonite and polyurethane foam can significantly improve compressive strength, especially for bentonite-stabilized soil cement. This approach represents a crucial direction for developing more efficient and sustainable soil-cement stabilization techniques.

BO - 27

Exploration on Clay Mineral Activation Affecting Hydration of Limestone Calcined Clay Cement

Ketsarin Ariya[a], Sunatcha Seerat[a] , Maneerat Thala[a], Worapong Thiemsorn[a,b] and Kedsarin Pimraksa[a,b,*]

[a]*Department of Industrial Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand*

[b]*Center of Excellence in Materials Science and Technology, Faculty of Science, Chiang Mai University, Chiang Mai, 50200 Thailand*

*E-mail: Kedsarin.p@cmu.ac.th

Keywords: Kaolinite; Montmorillonite; Dehydroxylation; Cement hydration

Two kaolinitic clays (1:1 phyllosilicate structure) from Thailand, with different crystallinity are investigated under thermal and mechanical activations in terms of their physical and mineralogical changes. Montmorillonitic clay (2:1 structure) is also investigated as a comparative study. The thermal activation is performed at 600, 700, 800, and 900°C for the kaolinitic clays and at 730, and 830 °C for the montmorillonite, according to their physical and chemical changes using DTA-TG. Dehydroxylation changes of the thermally activated clays are characterized using X-ray diffraction, Fourier transformed infrared spectrometry and particle size distribution. After thermal treatment, the calcined clay undergoes mechanical activation using ball mill to obtain the particle size less than 10 μm. The observation on the reactivity of the calcined clays is performed with a replacement of Portland cement (PC) clinker using the composites comprising of 50 wt% clinker, 30 wt% calcined clay, 15 wt% limestone, and 5 wt% gypsum at curing periods of 7, and 28 days. The highest compressive strength could be obtained at 800 °C which kaolinitic, and at 830 °C which montmorillonitic structures are completely collapsed. The results show that after calcination, kaolinite with higher crystallinity provide the lower strength (48 MPa) than that with lower crystallinity containing 49 MPa, while the calcined montmorillonite shows the highest strength (54 MPa) amongst them. The calcined clays undergo pozzolanic reaction combined with the hydration of the PC to form calcium (alumino)silicate hydrate, monocarboaluminate and ettringite minerals as binding phases. After hydration, calcined kaolinite with lower crystallinity provides higher calcium aluminosilicate hydrate than that with the higher crystallinity. The calcined montmorillonite containing higher SiO_2 content shows the highest calcium silicate hydrate binding phases supporting the highest strength development. In addition, the finer particle size of montmorillonite plays an additional role on the strength development.

CO - 25

Cultural Imprint on Clay: Preserving Bajau Identity through the Revival of Lapohan Pottery in Contemporary Design

Norhayati Ayob[a,]
[a]*Universiti Malaysia Sabah, Jalan UMS, Kota Kinabalu, Sabah, Malaysia.*

*n_hayati@ums.edu.my

Keywords: Bajau pottery, traditional clay body, cultural heritage, ceramic innovation, contemporary design.

Lapohan pottery represents a unique form of traditional ceramic practice developed by the Bajau community of Pulau Selakan, Sabah, Malaysia. This indigenous technique, passed down through generations, embodies not only functional craftsmanship but also intangible cultural values, visual language, and local identity. However, the tradition faces threats due to material limitations, such as poor plasticity, low thermal resistance, and high shrinkage rates, which hinder its suitability for contemporary ceramic production. This study aims to revitalize Lapohan pottery by enhancing its clay body composition and integrating its traditional aesthetics into modern ceramic design. Through a series of material experiments, locally available additives and fillers were introduced to the original clay formulation to improve workability and firing performance. Laboratory analyses were conducted to assess key physical and mechanical properties, including plasticity index, drying shrinkage, porosity, and structural integrity post-firing. In parallel, traditional Bajau motifs and vessel profiles were studied, documented, and reinterpreted into functional and decorative ceramic products that reflect contemporary lifestyle needs. The findings show that the improved clay body achieves higher performance standards while retaining its cultural essence. Furthermore, the recontextualization of Bajau design elements in new ceramic forms demonstrates that traditional visual heritage can be preserved and expressed meaningfully within modern contexts. This approach not only safeguards endangered intangible knowledge but also opens new opportunities for artisanal innovation and economic sustainability in rural creative communities. The study contributes to ongoing discussions in material culture, sustainable craft, and heritage-based design, offering a replicable model for culturally grounded ceramic innovation. By bridging traditional knowledge with contemporary practice, this research reinforces the role of ceramics as both a medium of cultural expression and a driver of creative continuity in the face of globalization and cultural.

EO - 17

Synthesis of δ -MnO_2/C composite from Spent Alkaline Batteries for Reuse in Zinc-ion Batteries

P. THONGRIT[a], P. VANAPHUTI[b], T. WATANABE[c], L. NOEROCHIM[d], J. QIN[e], P. PATTANANUWAT[f], S. KHEAWHOM[g], R. PORNPRASERTSUK[f,*]

[a]*Synchrotron Light Research Institute, 111 University Avenue, Muang District, Nakhon Ratchasima 30000, Thailand*

[b]*Department of Chemistry, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand*

[c]*Department of Mechanical Engineering and Science, Kyoto University, Kyoto 615-8540, Japan*

[d]*Department of Materials and Metallurgical Engineering, Faculty of Industrial Technology and Systems Engineering, Institut Teknologi Sepuluh Nopember, Jl. Arif Rahman Hakim, Kampus ITS Keputih-Sukolilo, Surabaya 60111, Indonesia*

[e]*Research Unit of Advanced Materials for Energy Storage, Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok 10330, Thailand,*

[f]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand*

[g]*Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok 10330, Thailand*

*Rojana.p@chula.ac.th

Keywords: δ-MnO_2/C composites, **Hydrothermal synthesis**, **Zinc-ion batteries**.

Alkaline battery waste remains a growing environmental concern due to widespread usage and limited recycling efficiency. This study offers a sustainable solution by upcycling spent electrodes into δ-MnO_2/C composites via a hydrothermal method. The resulting materials demonstrate strong potential as high-performance cathodes for ZIBs. In this work, δ-MnO_2/C composite materials are synthesized from recycled alkaline battery electrodes using a one-step hydrothermal process at 160°C. To make the composites, $KMnO_4$ and spent electrode powder were mixed in precursor ratios ranging from 6:1 to 2:3. The successful formation of δ-MnO_2/C was confirmed by X-ray diffraction and morphological analysis in all samples. A mixed δ-/α-MnO_2/C phase was observed at the 2:3 ratio. The manganese content and surface area of the resultant nanoflower-like microstructures were found to be precursor-dependent; BET measurements showed that the 6:1, 3:1, 1:1, and 2:3 ratios produced 63.96, 69.62, 45.77, and 50.87 m^2/g, respectively. As the $KMnO_4$ proportion decreased, the corresponding carbon content rose from 0.75% to 1.35%. The 2:3 composite's manganese utilization efficiency peaked at 62.77%. Utilizing two electrolytes, aqueous $ZnSO_4$ and non-aqueous $Zn(OTf)_2$ in dimethyl sulfoxide (DMSO), the synthesized δ-MnO_2/C composites were assessed as cathode materials. The 3:1 ratio composite outperformed its aqueous counterpart in the DMSO electrolyte, exhibiting the highest specific capacity and improved cycling stability. This work demonstrates the potential of δ-MnO_2/C composites sourced sustainably for advanced ZIB applications.

EO - 38

Efficiency Enhancement of PDMS Triboelectric Nanogenerator using donor doped calcium copper titanate dielectric fillers

Kittipan Saichompoo[a], Thitirat Rattanawongwiboon[b], Wilasinee Kingkam[b], Sudarat Issarapanacheewin[c], Phakkhananan Pakawanit[d], Naratip Vittayakorn[e] and Thitirat Charoonsuk[a*]

[a]Department of Materials Science, Faculty of Science, Srinakharinwirot University 114 Sukhumvit 23, Bangkok 10110, Thailand

[b]Nuclear Technology Research and Development Center, Thailand Institute of Nuclear Technology (Public Organization), Ongkharak, Nakhon Nayok 26120, Thailand

[c]Radioactive Waste Management Center, Thailand Institute of Nuclear Technology (Public Organization), Ongkharak, Nakhon Nayok 26120, Thailand

[d]Synchrotron Research and Applications Division, Synchrotron Light Research Institute, 111 University Avenue, Muang District, Nakhon Ratchasima, 30000, Thailand

[e]Advanced Materials Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand

[*]Email: thitiratc@g.swu.ac.th

Keywords: Triboelectric nanogenerator, Polydimethylsiloxane (PDMS), calcium copper titanate, donor doping.

Flexible triboelectric nanogenerator (F-TENG) have been greatly interested in this era as a power source of wearable electronic devices and being self-charged sensors. The development of F-TENG devices has experienced rapid advancement so far. Herein, to maximize electrical output of the polydimethylsiloxane (PDMS)-based F-TENG, the incorporating $Ca_{0.95}Y_{0.05}Cu_3Ti_4O_{12}$ (CCTYO) into PDMS has been proposed. The Y^{3+} donor ions was doped in CCTO to optimize dielectric properties before loading into PDMS matrix to make PDMS/CCTYO composite film. The influence of the loaded CCTYO amounts on molecular structure, morphologies, dielectric properties and electrical output, including open-circuit voltage (V_{OC}), short-circuit current (I_{SC}) and maximum output power (P_{max}), for PDMS/CCTYO was investigated. As compared with loading undoped CCTO, the additional Y^{3+} can improve the performance of PDMS/CCTYO composite film by increasing the dielectric constant (ε_r) along with decreasing the loss tangent (tan δ < 0.01). Also, at approximate condition of loaded CCTYO, the signal output could be enhanced. The 0.75 wt% of CCTYO loading could make PDMS/CCTYO F-TENG to achieve V_{OC} of ~76.4 V and I_{SC} of ~130.0 μA, which were higher than pristine PDMS for 2.7 and 4.3 times.

EO - 50

Mixed-Oxide Nanofibers for Catalyzing a Nitrate Reduction Reaction

Chiraporn Auechalitanukul[a, *], Ryan McCuiston[a], Jakkapat Jeephet[a], Natthawat Phochanapun[a], and Woradorn Phromphon[a]
[a]Department of Tool and Materials Engineering, Faculty of Engineering, King Mongkut's University of Technology Thonburi, Bangkok, 10140, Thailand
*chiraporn.aue@kmutt.ac.th

Keywords: Electrocatalyst, Electrospinning, Nanofiber, Nitrate reduction.

Mixed-oxide nanofibers were synthesized and their performance as catalysts for the reduction of nitrate to ammonia was evaluated. Ammonia is a vital chemical for the agricultural and industrial sectors and holds significant potential as an energy source. The synthesis of ammonia via nitrate reduction requires less energy and emits less carbon dioxide compared to the conventional Haber-Bosch process. In this study, electrospinning was used to fabricate Cu/Co containing nanofibers, followed by calcination at 400, 500, 600, and 700 °C to create oxides. The effect of calcination temperature on the nanofiber characteristics was studied using XRD and FESEM. The catalytic performance of the nanofibers was assessed using chronoamperometry and UV-Vis spectroscopy. Copper containing nanofibers were electrospun using a mixture of polyacrylonitrile and copper acetate. The nanofibers were then treated with a hexacyanocobaltate solution to add cobalt. The calcined fibers were found to contain a mixture of copper oxides (CuO and Cu_2O) and cobalt oxides (CoO and Co_3O_4), the amount depending on the calcination temperature. The nanofibers calcined at 600 °C achieved the highest Faradaic efficiency and had an ammonia yield enhancement of 18.252 times based on catalyst mass, compared to a bimetallic electrodeposited catalyst. It is suggested this was a result of the high surface area of the nanofibers. Although nanofibers calcined at 400 and 500 °C also had high surface areas, the amount of cobalt oxide they contained was too low to aid catalytic activity. At 700 °C, the surface area decreased due to pore blockage, which reduced the catalytic performance. The development of mixed-oxide nanofibers may contribute to nitrate reduction in wastewater, pollution mitigation, and ammonia production, with potential applications in wastewater treatment systems and small-scale ammonia production in areas lacking infrastructure.

FO - 45

Enhanced Red Emission of $Gd_2MoO_6:Eu^{3+}$ Phosphor-in-Glass Embedded in SiO_2-TeO_2-Na_2O-BaO Matrix for Solid-State Lighting

Winut Wongwan[a,b], Patarawagee Yasaka[a,b*], Anon Angnanon[c,d] and J. Kaewkhao[a,b]

[a]*Center of Excellence in Glass Technology and Materials Science (CEGM), Nakhon Pathom Rajabhat University, Nakhon Pathom, 73000, Thailand*

[b]*Physics Program, Faculty of Science and Technology, Nakhon Pathom Rajabhat University, 73000, Thailand*

[c]*Office of Research Administration, Chiang Mai University, Chiang Mai, 50200, Thailand*

[d]*Center of Radiation Research and Medical Imaging, Department of Radiologic Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai,50200, Thailand*

*E-mail address corresponding author pyasaka@webmail.npru.ac.th, pyasaka@hotmail.com

Keywords: Phosphor-in-glass, photoluminescence, Europium.

Gd_2MoO_6: Eu^{3+} phosphor-in-glass composites were synthesized using the microwave-assisted melting method with a glass matrix composed of $40TeO_2$: $30B_2O_3$: 20ZnO: $10Li_2O$. The effects of varying phosphor concentrations (0.00-10.00 wt%) on structural, optical, and luminescence properties were investigated. Characterization included X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR) for structural analysis. Optical studies covered density, refractive index, and absorption spectra in the 200-2500 nm range. Photoluminescence emission under 465 nm excitation (580-720 nm) and decay lifetime measurements were performed to evaluate radiative behavior. This work aimed to assess the potential of the developed materials for solid-state lighting and radiation detection applications.

FO - 46

Reddish orange emission from Eu^{3+} ion doped Boro-Tellurite Glass: Potential for Scintillation and Thermoluminescence Material Applications

Seubsakun Khondara[a, b], Patarawagee Yasaka[a, b], Kitipun Boonin[a, b, *], Nuttawadee Intachai[c], Suchart Kothan[c] and Jakrapong Kaewkhao[a, b]

[a]*Physics Program, Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Nakhon Pathom 73000, Thailand*

[b]*Center of Excellence in Glass Technology and Materials Science (CEGM), Nakhon Pathom Rajabhat University, Nakhon Pathom 73000, Thailand*

[c]*Center of Radiation Research and Medical Imaging, Department of Radiologic Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, 50200, Thailand*

*E-mail: Kboonin@hotmail.com

Keywords: Photoluminescence, Radioluminescence, Thermoluminescence, Borotellurite Glass, Europium oxide,

This research synthesized (35-x)TeO_2 : 30B_2O_3 : 20BaO : 10ZnO : 5La_2O_3 : xEu_2O_3 glasses doped with europium oxide (Eu_2O_3) in various concentrations, where x = 0, 1, 2, 3, 4, 5, 6, and 7 mol%. The glasses were prepared using conventional melt-quenching techniques at 1150 °C for 1.5 hours and annealed at 350 °C for 3 hours. The physical, structural, photoluminescence (PL), radioluminescence (RL), and thermoluminescence (TL) properties were studied to elucidate the behavior of the materials. The results show that the prepared glasses exhibit multi-peaks absorbance with increasing absorption intensity as the Eu_2O_3 concentration increases. The PL spectra displayed a strong emission peak at 614 nm under 394 nm excitation, corresponding to the $^5D_0 \rightarrow {}^7F_2$ transition. The emission intensity increased with increasing Eu_2O_3 concentration up to 6 mol%, after which concentration quenching was observed. The CIE 1931 chromaticity diagram indicated that the PL emission of the Eu_2O_3-doped glasses was in the reddish orange region. The RL emission characteristics were consistent with those observed in the PL spectra. Furthermore, TL parameters such as activation energy (E) and frequency factor (s) were calculated using Chen's peak shape method. The accuracy of the glow curve fitting was evaluated using the Figure of Merit (FOM). The synthesized glasses show potential for applications in scintillation and thermoluminescence dosimetry.

GO - 07

Salt Resistance of Metakaolin and Asphalt Waste Dust Based Geopolymer

Paratee Sukkatorn[a], Salisa Chaiyaput[b], Pornsuda Kotkhangphlu[a], Pimchanok Sertsoongnern[a] and Jiratchaya Ayawanna[a],*

[a] *School of Ceramic Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand*

[b] *Department of Civil Engineering, School of Engineering, King Mongkut's Institute of Technology, Bangkok, 10520, Thailand*

*Corresponding author e-mail: jiratchaya@sut.ac.th

Keywords: Geopolymer, Metakaolin, Asphalt Waste Dust, and Portland Cement

Conventional Portland cement concrete suffers from durability problems in salt-contaminated environments, where corrosion, expansion, and cracking are common. Dissolved salts are particularly aggressive and act as direct agents of concrete deterioration. The study focuses on synthesizing geopolymer materials made of metakaolin (MK) and asphalt waste dust (AD) to evaluate their influence on salt resistance performance, aiming to develop a new type of construction material similar to cement-free concrete. The tested properties included both physical and chemical characteristics, which were analyzed using techniques such as x-ray diffraction (XRD), x-ray fluorescence (XRF), atomic absorption spectroscopy (AAS), and field-emission scanning electron microscopy (FESEM). In addition, compressive strength and weight loss after salt exposure were measured to evaluate the mechanical and durability performance of the geopolymer samples. Geopolymer samples were prepared with 10%, 30%, 50%, and 70% AD replacing MK by weight. The alkaline activator (Na_2SiO_3/NaOH) was used with a fixed ratio. Specimens were cured under sealed conditions for 2, 7, and 28 days, followed by immersion in salt solution for 90 days. The test results showed that up to 30% by weight of AD and at least 70% by weight of MK were appropriate ratios for geopolymer synthesis. Cement samples lost compressive strength and weight, while the compressive strength was enhanced by the geopolymer after soaking in salt solution for 90 days. The best corrosion resistance, compressive strength, and maintained weight were demonstrated by geopolymer at a 10% by weight of AD after 28 days of curing.

GO - 10

Sustainable Lightweight Foams from Hazardous Aluminum Dross

Chayapat Weerapakdee(Presenter)[a, *], Makoto Nanko[b], Yen-Ling Kuo[b], Kaito Suzuki[b], Seiryu Suzuki[b], Siriwan Chokkha[a] and Sukasem Watcharamaisakul[a]

[a] *School of Ceramic Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand*

[b] *High Temperature Materials Laboratory, Mechanical Engineering, Nagaoka University of Technology, Nagaoka, Niigata, 940-2188, Japan*

*chayapatwee@gmail.com

Keywords: Aluminum Dross, Ceramic Foam, Sustainable Materials, Industrial Waste Upcycling

Aluminum dross, a hazardous byproduct of the aluminum industry, presents a serious environmental challenge and high disposal cost. It is rich in alumina but also contains reactive metallic aluminum, making safe management problematic. However, current disposal and reuse methods are still limited and often uneconomical. This research investigates a sustainable approach to upcycle this waste into value-added ceramic foams, transforming a liability into a useful resource. The primary objective was to fabricate lightweight foams from secondary aluminum dross (SAD) for refractory applications. The fabrication process mixed SAD powder with a polyvinyl alcohol (PVA) solution as a binder to improve green body strength, and added polyethylene (PE) powder as a sacrificial pore-forming agent. The homogenized mixture was pressed into pellets and sintered at 1400°C. The effect of PE content, varied from 30 to 70 vol%, on the final properties was systematically investigated. Density and porosity were measured via the Archimedes method. Phase analysis used X-ray diffraction (XRD). Microstructure was analyzed by using scanning electron microscopy (SEM). Results demonstrate a clear inverse relationship between PE content and bulk density, with higher PE raising open porosity. A PE content of 70 vol% resulted in a bulk density below 1.0 g/cm³, satisfying the Japanese Industrial Standard (JIS) for lightweight refractory bricks. XRD analysis confirmed the in-situ formation of a stable ceramic matrix composed of $\alpha-Al_2O_3$, spinel ($MgAl_2O_4$), and $CaAl_{12}O_{19}$. Although the foams exhibited lower compressive strength than pure alumina, their properties suit thermal insulation where high load-bearing capacity is not critical. This study shows a practical way to recycle aluminum dross and boost the circular economy by turning hazardous waste into useful material. Future work could strengthen the foams further and scale up production for industry.

GO - 12

A Low-Carbon Alternative to Red Bricks: High-Pressure Geopolymer Bricks from Industrial By-Products

Ti-Chun Li[a, *], Wei-Hao Lee[b] Huang Chih-Ying[c], Shiang-En Yang[c], Zhi-Xuan Lin[c]
[a] *Doctoral student, Institute of Mineral Resources Engineering, National Taipei University of Technology, 1, Sec. 3, Zhong-Xiao E. Rd., Taipei 10608, TAIWAN.*
[b] *Associate Professor, Institute of Mineral Resources Engineering, National Taipei University of Technology, 1, Sec. 3, Zhong-Xiao E. Rd., Taipei 10608, TAIWAN.*
[c] *College Students, Department of Materials and Mineral Resources Engineering, National Taipei University of Technology, 1, Sec. 3, Zhong-Xiao E. Rd., Taipei 10608, TAIWAN.*

* Corresponding Author E-mail: Lihart0912252702@gmail.com

Keywords: Geopolymer, EAF reduction slag, Compressed Brick

With growing global awareness of environmental sustainability, many traditional industries are under increasing pressure to reduce energy consumption and carbon emissions. Although compressed brick is increasingly replacing conventional red bricks, the binders used in these products are mostly cement-based, and cement remains a major contributor to CO_2 emissions. Therefore, developing low-energy, eco-friendly alternatives has become a pressing challenge.
Geopolymer technology is a promising method that uses silicon-rich and aluminum-rich materials, ranging from natural minerals to industrial by-products, which react with alkaline solutions under ambient conditions to form solid binders. This study used various proportions of ground granulated blast furnace slag (GGBFS) and electric arc furnace (EAF) reduction slag as precursors. However, EAF reduction slag contains f-CaO and f-MgO, which can cause expansion when exposed to moisture, limiting its direct application in construction. To address this, geopolymer technology was combined with high-pressure forming to stabilize volume changes and develop green compressed brick. Compressed brick made with 70% EAF reduction slag and 30% GGBFS showed excellent mechanical properties, achieving a compressive strength of 30.2 MPa. Abrasion loss was less than 0.1 $cm^3/50\ cm^2$, and TCLP test results met regulatory standards. Autoclave tests showed no signs of instability. Additionally, CO_2 emission calculations revealed that the geopolymer compressed brick reduced CO_2 emissions by approximately 50% compared to commercial cement-based compressed brick. These results demonstrate that when applied to EAF reduction slag and GGBFS, geopolymer technology offers strong potential as a sustainable, low-carbon alternative to traditional cementitious binders in compressed brick manufacturing.

GO - 13

Performance of Cement–Laterite Aggregate Mixtures in Salt Solution Testing

Pimchanok Sertsoongnern[a], Khachonyod Charoenwong[a], Patipan Chuenchom[a], Kittapart Yainonsung[a], Prasopchok Sawatdee[a], Salisa Chaiyaput[b] and Jiratchaya Ayawanna[a, *]

[a]School of Ceramic Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand
[b]Department of Civil Engineering, School of Engineering, King Mongkut's Institute of Technology, Ladkrabang, Bangkok, 10520, Thailand,
E-mail address corresponding author: jiratchaya@sut.ac.th

Keywords: Mixed cement, Laterite aggregate, Compressive strength, Salt resistance

The study aimed to develop and evaluate the performance of cement mixed with porous aggregates for use in areas with high salt concentrations. The porous aggregates were produced from a calcined aggregate made of 70 wt% laterite with 30 wt% sawdust and then sieve-screened into three size ranges: > 2.31 mm, > 1 mm, and < 1 mm. The mixed size of 20 wt% laterite aggregate was mixed with 80 wt% cement in order to compare with 100% cement in salt solution testing. All samples were immersed in $MgSO_4$ and NaCl solutions and cured at ambient temperature for 30 days to evaluate performance in terms of compressive strength, weight change, expansion, chemical analysis, and microstructural characteristics. Although 100% cement had the highest compressive strength, its strength decreased significantly after 30-day immersion in $MgSO_4$ and NaCl solutions. On the other hand, cement combined with laterite aggregates increased compressive strength when immersed in $MgSO_4$ solution. The aggregate sizes of > 2.31 mm, > 1 mm, and < 1 mm resulted in the best compressive strength in cement under $MgSO_4$ immersion (39.2 MPa), with minimal weight change and expansion. Meanwhile, after 30 days of immersion in NaCl solution, the compressive strength of all cements mixed with aggregates decreased. The three mixed-size aggregates still exhibited the highest compressive strength (31.9 MPa), the lowest weight change, and minimal expansion. This shows that the cement mixtures with 20 wt% aggregates have a distinct ability to withstand sulphate and chloride solutions due to the porous structure created by the mixed aggregate sizes. Especially the formulation with three sizes that have good performance, and a qualifying strength that exceeded the ASTM C1157 hydraulic cement and ASTM C150 Type V cement specifications.

GO - 15

Preparation of Calcium Phosphate Porous Granules Using Sponge As Template

***Neeranut Kuanchertchoo*[a*], *Linda Bungaruang*[b], *Chalermkwan Makornpan*[a]**
[a]*Department of Chemistry, Faculty of Science, Ramkhamhaeng University, Bangkok, 10240, Thailand*
[b]*Department of Chemistry, Faculty of Science, Ramkhamhaeng University, Bangkok, 10240, Thailand*
* neeranutk@gmail.com

Keywords: Cattle bone, Whitlockite, $Ca(PO_3)_2$ glass, Porous granules

Cattle bone powder was chemically purified to get nanosized hydroxyapatite (n-HA). n-HA slip was prepared with $Ca(PO_3)_2$ glass powder in amounts of 3%, 5%, and 10% to strengthen the porous structure. A polymeric sponge, as a porous template, was impregnated with n-HA slip for preparing calcium phosphate granules. After burning out the polymeric sponge, the n-HA granules were gradually sintered to alter the desired phase. The obtained products had an interconnecting pore with a pore size > 100 µm. The granules contained whitlockite and calcium phosphate phases at 1000 and 1200°C. The granules were likely to be used as biomaterials.

GO - 16

Utilization of Ca sludge from the sugar industry to produce high purity calcium carbonate using precipitation method

Charoen Panyo[a,*], Watcharee Sornlar[a], Parinya Somrang[a], Witaya Shongkittikul[a], Anucha Wannagon[a]

[a]National Metal and Materials Technology Center, National Science and Technology Development Agency,114 Thailand Science Park, Phahonyothin Rd., Khlong Nueng, Khlong Luang, Pathum Thani, 12120, Thailand

*charoen.pan@ncr.nstda.or.th

Keywords: precipitated calcium carbonate, Ca sludge, sugar industry

Ca sludge from sugar refining process is filter pressed and disposed of in landfills. The purpose of this research is to improve the utilization of Ca sludge generated by the sugar industry in Thailand. Ca sludge is mainly composed of $CaCO_3$; it is a potential source to produce precipitated calcium carbonate (PCC) through precipitation method. The $CaCl_2$ solution for precipitation was prepared by mixing Ca sludge with 2 M HCl. The precipitation process using 1 M $CaCl_2$ solution was mixed by Na_2CO_3 with molar ratio of 1:1, 1:2, and 1:3. In the precipitation process, 1 g/l of polyethylene glycol 400 (PEG 400) was added to disperse PCC particles in the solution. A comprehensive evaluation of the obtained PCC powder was carried out using various techniques such as the Particles Size Analyzer, TG/DTA, XRF, XRD, SEM/EDS. The yield of PCC is about 80-90%, with fine powder and exhibiting high purity. These findings propose valuable insights into Ca sludge resource utilization and sustainable management practices, presenting an innovative approach for the sugar industry sector. It is speculated that the fabricated PCC powders hold potential for additive applications, such as rubber and PVC products.

Poster Presentation

AP - 20

Wear Resistance of High Density Si_3N_4 - ZrO_2 Ceramic Composites

Kamol Traipanya[a,*], Thanakorn Wasanapiarnpong[a,b,c] and Charusporn Mongkolkachit[d]

[a]Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Pathumwan, Bangkok 10330, Thailand

[b]Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University Research Building, Phayathai Road, Pathumwan, Bangkok 10330, Thailand

[c]Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Bangkok, 10330, Thailand

[d]National Metal and Materials Technology Center, National Science and Technology Development Agency, Khlong Luang, Pathumthani 12120, Thailand

*traipanya@hotmail.com

Keywords: Silicon nitride, Zirconia, Pressureless sintering, Abrasion Resistance

Silicon nitride (Si_3N_4) and zirconia (ZrO_2) ceramics are well-known for their excellent wear resistance, high hardness, and high mechanical strength. This research focuses on the development and investigation of Si_3N_4-ZrO_2 ceramic composites. Test specimens of silicon nitride were prepared by pressureless sintering at 1550 ºC, 1600 ºC, and 1650 ºC for 2 hours in a nitrogen atmosphere, using SiO_2, MgO, and Y_2O_3 as sintering additives. The bulk density of the sintered samples revealed that a weight ratio of SiO_2:MgO:Y_2O_3 at 3:3:5 promoted densification and showed a tendency to increase with the addition of ZrO_2 (3mol% yttria stabilized zirconia). However, the hardness of Si_3N_4 containing 5 wt% ZrO_2 was 14.63 GPa and showed a decreasing trend as the ZrO_2 content increased up to 50 wt%. In the case of 75 wt% ZrO_2, the hardness dropped to 10.18 GPa when it sintered at 1600 ºC. The flexural strength of sintered Si_3N_4 reached 924.42 MPa, which was comparable to that of pure ZrO_2 at 977.93 MPa. High stress abrasion resistance testing according to ASTM B611 showed that the sample containing 5 wt% ZrO_2 exhibited the lowest volume loss of 18.97 mm^3. In comparison, Si_3N_4 showed a volume loss of 25.10 mm^3 under the same conditions, indicating that a small addition of 5 wt%ZrO_2 can enhance wear resistance. On the contrary, the sample with 75 wt% ZrO_2 had the highest volume loss of 638.73 mm^3, while the 100 wt% ZrO_2 sample showed a loss of 543.74 mm^3. These results support the observation that pure ZrO_2 may not provide superior wear resistance compared to optimally formulated Si_3N_4-ZrO_2 composites.

AP - 24

Effect of Anodization Voltage and Heat Treatment on the Surface Crystallinity and Hydrophilicity of the Ti-6Al-4V

Phanawan Whangdee[a, *], Peerawat Laohana[b], Saranisorn Srikam[b], Wittawat Saenrang[b], Nampueng Pangpaiboon[c] and Dujreutai Pongkao Kashima[d]

[a]*Department of Applied Physics, Faculty of Sciences and Liberal Arts, Rajamangala University of Technology Isan, Nakhon Ratchasima, 30000, Thailand*

[b]*School of Physics, Institute of Science, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand*

[c]*Department of Industrial Physics and Medical Instrumentation, Faculty of Applied Science, King Mongkut's University of Technology North Bangkok, Bangkok, 10800, Thailand*

[d]*Research Unit of Advanced Ceramics, Department of Materials Science, Faculty of Science, Chulalongkorn University, Patumwan, Bangkok, 10330, Thailand*

*phanawan.wh@rmuti.ac.th

Keywords: Hydrophilicity, Heat Treatment, Crystallinity, TiO_2.

The formation of superhydrophilic surfaces on Ti-6Al-4V was achieved through anodization at different voltages, followed by heat treatment at 1000 °C for 2 h. This treatment not only enhanced surface crystallinity but also induced morphological changes. A comprehensive analysis of surface properties, including morphology, elemental structure, phase composition, surface roughness, and hydrophilicity, was conducted using OM, SEM, and laser microscopy, EDX, XRD, AFM, and contact angle measurements, respectively. The anodized films exhibited enhanced crystallinity, increased surface roughness, and a higher oxygen-to-titanium ratio. As a result, the coatings showed consistent morphology and distribution of elements, with high temperature annealing leading to a transformation from amorphous to crystalline structures, accompanied by elevated surface roughness, and augmented hydrophilicity.

AP - 28

Structural and Functional Enhancement of PVA/Chitosan Hydrogels via Cu-Doped TiO_2 Nanoparticles for Potential Wound Dressing Applications

Kyi Pyar Min Lwin [a, *], Gasidit Panomsuwan[a], Amornrat Lerworasirikul[a], Nattapol Chaimongkol[b], Ingorn Kimkong[b], Prakit Sukyai[c], Chatchawal Wongchoosuk [d], Kiadtisak Saenboonruang[e], and Oratai Jongprateep [a*]

[a]Department of Materials Engineering, Faculty of Engineering, Kasetsart University, 50 Ngam Wong Wan Rd, Ladyao Chatuchak Bangkok 10900

[b]Department of Microbiology, Faculty of Science, Kasetsart University, 50 Ngam Wong Wan Rd, Ladyao Chatuchak Bangkok 10900

[c]Department of Biotechnology, Faculty of Agroindustry, Kasetsart University, 50 Ngam Wong Wan Rd, Ladyao Chatuchak Bangkok 10900

[d]Department of Physics, Faculty of Science, Kasetsart University, 50 Ngam Wong Wan Rd, Ladyao Chatuchak Bangkok 10900

[e]Department of Applied Radiation and Isotope, Faculty of Science, Kasetsart University, 50 Ngam Wong Wan Rd, Ladyao Chatuchak Bangkok 10900

*Author for correspondence; e-mail address: fengotj@ku.ac.th

Keywords: Titanium dioxide nanoparticles, Copper doping, PVA/chitosan hydrogel, Wound dressing.

This study explores the incorporation of undoped and copper-doped titanium dioxide (TiO_2) nanoparticles into poly(vinyl alcohol)/chitosan (PVA/Chitosan) hydrogels, focusing on their structural, optical, and swelling characteristics for potential wound dressing applications. TiO_2 powders, synthesized via solution combustion—a rapid, scalable method—were doped with 3–7 wt% Cu and retained the anatase phase with reduced crystallite size and increased lattice distortion. Optical characterization showed band gap narrowing (from ~3.2 to 2.79 eV) and reduced photoluminescence intensity, indicating enhanced charge separation and photocatalytic potential. These properties imply improved generation of reactive oxygen species (ROS) under visible light, suggesting potential for light-triggered antimicrobial activity, though this was not directly assessed.

FTIR and XRD confirmed strong interfacial interactions between TiO_2 nanoparticles and the PVA/Chitosan matrix, enhancing nanoparticle dispersion, surface hydrophilicity, and swelling capacity. The hydrogel containing 7 wt% Cu–TiO_2 achieved the highest swelling ratio (~170%), supporting its suitability for wound environments that require high fluid uptake and moisture retention.

Overall, this work demonstrates the functional enhancement of PVA/Chitosan hydrogels through the incorporation of combustion-synthesized Cu-doped TiO_2. These findings underscore the potential of the composite for next-generation wound dressings, particularly those benefiting from photo-responsive therapeutic effects. Further biological evaluation is underway.

AP - 43

Influence of Diluent on Rheology, Polymerization, Debinding and Sintering of Alumina Ceramic via Resin Suspensions and LCD 3D Printing

Worachet Supasorn [a, *], **Thanakorn Wasanapiarnpong** [a,b]
[a] *Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand*
[b] *Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University, Bangkok 10330, Thailand*
*6570155323@student.chula.ac.th

Keywords: LCD 3D printing, alumina ceramics, propylene glycol (PPG)

Liquid Crystal Display (LCD) 3D printing is a vat polymerization technique that uses an LCD screen and LED light to cure liquid photopolymer resin layer by layer. Due to its affordability and high resolution, LCD printing is widely used in dentistry for producing dental models and appliances. Achieving an optimal balance between ceramic particle content and suspension viscosity remains a key challenge in ceramic 3D printing. This study presents the fabrication of alumina (Al_2O_3) ceramics with LCD 3D printing, with propylene glycol (PPG) employed as a non-reactive diluent to tailor the rheological properties of the ceramic suspension. Alumina powder with an average particle size of 0.4 μm and a solid loading of 30 vol% was combined with varying PPG concentrations (10, 20, and 30 vol%) to investigate their effects on suspension stability and printability. In addition, the mechanical properties of the sample were analyzed by a Flexural Testing Machine (Instron 5882) and Vickers hardness tester. Resin solution properties were analyzed by Viscometer (Brookfield DV-E) and Cure depth testing. Low-temperature thermal debinding was performed on the printed samples, revealing that higher concentrations of PPG in the formulation effectively reduced interlayer cracking. This suggests that PPG contributes to improved structural integrity during the early stages of thermal processing and sintering.

BP - 08

Development of Permeable Ceramic Brick from Waste Porcelain Insulator and Fly Ash through Anorthite Phase Formation

Apirat Theerapapvisetpong[a, *], Rawipon Yutthadanaikul[a], Sawaros Saithong[a] and Nithiwach Nawaukkaratharnant[a,b]

[a]*Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand*
[b]*Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok, 10330, Thailand*
*apirat.t@chula.ac.th

Keywords: Anorthite crystallization; Permeable ceramic brick; Waste porcelain insulator; Fly ash recycling

This research investigated the development of water-permeable ceramic bricks through the formation of anorthite ($CaAl_2Si_2O_8$) crystalline phase using waste electrical porcelain insulators and fly ash from a paper mill's fluidized bed combustion process. The binder system was designed to promote anorthite crystallization through precise control of $CaO:Al_2O_3:SiO_2$ ratios, using a mixture of fly ash, limestone, and porcelain clay. Heating microscope analysis determined optimal firing conditions, while X-ray diffraction confirmed the predominant formation of anorthite phase in the fired binder. Crushed porcelain insulators served as aggregates, with binder contents ranging from 15-30 wt%. Samples fired at 1230°C for 30 minutes exhibited needle-like anorthite crystals as observed through SEM analysis. The optimal formulation containing 30% binder achieved a compressive strength of 45 MPa, water permeability of 0.08 cm/s, and density of 1.99 g/cm³. The successful formation of anorthite phase contributed to both mechanical strength and pore structure stability, demonstrating an effective approach to recycling industrial wastes into functional construction materials.

BP - 21

Fabrication of concrete roof tiles using mussel shell waste as coarse aggregate by casting technique

Pranee Junlar[1*], Nithiwach Nawaukkaratharnant[2,4]
Kannigar Dateraksa[3], Thanakorn Wasanapiarnpong[4]

[1]Department of science service, Bangkok, 10400, Thailand
[2]Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok, 10330, Thailand
[3]National Metal and Materials Technology Center (MTEC), National Science and Technology Development Agency (NSTDA), Pathum Thani, 12120, Thailand
[4]Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand
[*]E-mail: pranee@dss.go.th

Keywords: Concrete; roof tiles; construction, mussel shell waste

Currently, the seafood industry is growing with increasing demand from consumers, resulting in a large amount of shells waste, especially mussel shell. Improper such waste disposal can result in the emission of malodorous compounds, facilitate vector infestations, and contribute to the dissemination of pathogens. Therefore, employing the shell as a raw material within the construction domain can substantially enhance its rapid removal. This research aims to utilize the mussel shell as coarse aggregate for concrete roof tile fabrication. The ground shell in size of 3-5 cm was mixed with sand and cement with different ratios. Moreover, mixing and forming methods, along with the curing period, were optimized to produce roof tiles with properties that conform to TIS standards. The results indicated that a cement:sand:mussel shell ratio of 1:1:1 (by weight) combined with a solid-to-water weight ratio of 0.38 formed by casting technique was optimal for samples preparation. The samples exhibited a low water absorption (<10%) and a high flexural strength (>10 MPa). In addition, prototype roof tiles with a width of 33, length of 45 cm, and a thickness of 1.5 cm, were produced by casting method. The strength and water absorption of them atter curing for 28 days were 5000 N/mm^2 and 6.53%, respectively. These properties conformed to the standard criteria specified by TIS 535-2556. This study confirms the possibility of using the mussel shell as coarse aggregate for concrete roof tile production at a commercial scale.

BP - 22

Reducing Water Absorption of Cement Mortar by Using Modified Clay Brick Waste

Nuntaporn Kongkajun[a,b], Wannasa Phukutnam[a] , Warittha Sujaritpanich[a] and Parinya Chakartnarodom[c,*]

[a]*Department of Materials and Textile Technology, Faculty of Science and Technology, Thammasat University, Pathumthani, 12121, Thailand*

[b]*Thammasat University Research Unit in Sustainable Materials and Circular Economy, Thammasat University, Pathumthani, 12121, Thailand*

[c]*Department of Materials Engineering, Faculty of Engineering, Kasetsart University, Bangkok, 10900, Thailand*

*fengpryc@ku.ac.th

Keywords: Clay brick waste, Hydrophobic, Stearic acid, Mortar

Cement mortar is inherently hydrophilic due to its porous structure, which allows water penetration and adversely affects its durability and long-term performance. To mitigate this issue, hydrophobic cementitious materials can be developed by incorporating hydrophobic substance during mixing to provide hydrophobic properties throughout the material. This study introduces a wet chemical method using modified clay brick waste (MCBW) as a hydrophobic agent. MCBW were produced by treating clay brick waste (CBW) with stearic acid (SA). The influence of HCBW on mortar properties such as compressive strength, water resistance were evaluated. When 20% of fine aggregate was replaced by MCBW (by weight), the resulting integral hydrophobic mortar exhibited substantial performance improvements. After 28 days of curing, its compressive strength increased by 35% compared to the control. Additionally, the surface contact angle reached up to 155°. The water absorption rate after 3 hours was reduced to just 40% of that of control mix.

BP - 30

Use of Recovered Carbon Black from Spent Tires to Enhance Electrical Properties of Cement Composites

Parinya Chakartnarodom[a], Jirapa Tangsritrakul[b,c], Nathongkan Kesmankit[b] and Nuntaporn Kongkajun[b,c,*]

[a]*Department of Materials Engineering, Faculty of Engineering, Kasetsart University, Bangkok, 10900, Thailand*

[b]*Department of Materials and Textile Technology, Faculty of Science and Technology, Thammasat University, Pathumthani, 12121, Thailand*

[c]*Thammasat University Research Unit in Sustainable Materials and Circular Economy, Thammasat University, Pathumthani, 12121, Thailand*

* n-kongkj@tu.ac.th

Keywords: Spent tires, Carbon black, Cement, Electrical conductivity

Spent tires pose a significant environmental challenge due to their non-biodegradable nature. Pyrolysis is a widely used method for recovering valuable materials from waste tires, including recovered carbon black (rCB). This study explored the feasibility of using rCB, derived from spent tires, as a partial replacement for cement. It also examined the potential of rCB to enhance the electrical conductivity of cement-based composites. The electrical, mechanical, and physical properties of rCB-modified cement composites were evaluated. Results showed that increasing the rCB content led to a gradual decrease in mechanical strength, while significantly improving electrical conductivity. Specifically, replacing 2.5% of the cement by weight with rCB increased the AC conductivity at 20 Hz from the order of 10^{-7} to 10^{-4} S/m after 28 days of curing. This increase in conductivity suggests potential applications in sensing or monitoring changes within cement structures. Despite the improvement in conductivity, the composite maintained a compressive strength of 55 MPa, making it suitable for conventional engineering applications.

BP - 31

A Sustainable Construction Material: Geopolymer Composite from Fly Ash, Bagasse Ash, Sand and Asphalt Emulsion

Pakapond Chowandee[a], **Benya Cherdhitunkorn**[a,*]
[a]*Department of Materials and Textile Technology, Faculty of Science and Technology, Thammasart University, Klong 1, Patumthani, 12120, Thailand*
*benya@tu.ac.th

Keywords: Geopolymer, Coal fly ash, Bagasse ash

This study focuses on the development of geopolymer as a construction material. The main raw materials used in this work were coal fly ash and sugar cane bagasse ash. Sand was also used as a fine aggregate. Additionally, asphalt emulsion, commonly used in road construction and repair, was used as a binder. The mixture of sodium silicate (Na_2SiO_3) and sodium hydroxide (NaOH) with a ratio of 1:1 was used as alkaline solution for geopolymerization reaction. The geopolymer samples with different sand content were formed using casting method, and were then cured at room temperature for 7, 14, and 28 days. The study also investigated the optimal amount of alkaline solution for geopolymer production. Physical and mechanical properties of the geopolymer were determined, including water absorption, density and compressive strength. Microstructure, chemical structure and phase structure were studied using SEM, FTIR and XRD, respectively. The results showed the sample achieved its highest compressive strength of 10.74 MPa after curing for 28 days.

BP - 32

Synthesis of Hydroxyapatite Powders by Chemical Precipitation with Transition Metal Ions Substitution for Solar Reflective Pigments

Thanakorn Wasanapiarnpong[a,b,c]*, Pimpagee Pancharat[a] , Uraiwan Leela-adisorn[a] and Charusporn Mongkolkachit[d]

[a]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Pathumwan, Bangkok 10330, Thailand*

[b]*Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University Research Building, Phayathai Road, Pathumwan, Bangkok 10330, Thailand*

[c]*Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Bangkok, 10330, Thailand*

[d]*National Metal and Materials Technology Center, National Science and Technology Development Agency, Khlong Luang, Pathumthani 12120, Thailand*

*thanakorn.w@chula.ac.th

Keywords: Hydroxyapatite, Solar Reflective Pigment, Transition Metal Substitution, NIR reflectance

Hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) is an inorganic compound composed of hydrated calcium phosphate, which has garnered interest due to its ease of synthesis, environmental friendliness, resistance to weathering, and its light-reflecting properties, particularly in the near-infrared (NIR) wavelength range corresponding to solar heat radiation. This research aims to explore its potential application as a solar-reflective pigment. Hydroxyapatite was synthesized via an aqueous chemical precipitation method using calcium hydroxide and phosphoric acid, with partial substitution of calcium ions (10 mol%) by transition metal ions incorporated into the hydroxyapatite crystal structure. Water soluble sulfate and chloride compounds of chromium, copper, iron, and nickel were used for comparison. The resulting modified hydroxyapatite powders exhibited different colors, including white, purple, blue-green, blue, orange, and light yellow, respectively. The results showed that chloride precursors led to pure hydroxyapatite phase, while sulfate precursors resulted in the presence of gypsum as a secondary phase. The pigments doped with chromium and iron exhibited high NIR reflectance values of up to 83.38% and 82.87%, respectively. Additionally, the synthesized pigments were found to have high fineness with particle sizes below 200 nanometers.

BP - 39

Comparative Study On The Effects Of Alkali Activators And Alumina Additives On Properties Of Industrial Waste-Based Geopolymer Composites

Paing Set Soe[a], Sitthisak Prasanphan[b], Kantima Hamra[b], Nithiwach Nawaukkaratharnant[a,c], Sirithan Jiemsirilers[a,*]

[a]Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand.
[b]National Metal and Materials Technology Center, National Science and Technology Development Agency, 114 Thailand Science Park, Phahonyothin Road, Khlong Nueng, Khlong Luang, Pathumthani 12120, Thailand.
[c]Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok, 10330, Thailand.

*sirithan.j@chula.ac.th

Keywords: Geopolymer, Calcined alumina, Tabular alumina, Alkali activator

Geopolymer is a cementitious substitution material for ordinary Portland cement (OPC) that uses less energy and emits lower CO_2 on production. It can also be made from various solid aluminosilicate waste. This study investigated the comparative effects of alkali activators and alumina-based additives on the physical and mechanical properties of geopolymer composites synthesized from calcined ceramic waste and kaolin processing waste. Two types of activators: sodium hydroxide (NaOH) and potassium hydroxide (KOH), were used to evaluate their influence on geopolymerization process. Consequently, two forms of alumina additives: calcined alumina and tabular alumina, were incorporated at various dosages (5–20 wt%) into an optimum mix of 60:40 ceramic waste to kaolin residue. The results revealed that NaOH–activated geopolymers exhibited higher compressive strength due to the enhanced precursor dissolution while KOH–activated system demonstrated higher density and lower porosity. The addition of calcined alumina or tabular alumina led to a reduction in compressive strength attributed to their low reactivity. Moreover, tabular alumina showed slightly better physical packing than calcined alumina but neither significantly improved the mechanical performance. This study demonstrated a sustainable approach to develop the high-performance construction materials by utilization of ceramic and kaolin processing waste within the circular economy framework which further promotes the 3R principle, natural resource conservation, and low-carbon alternatives to conventional binders.

BP - 40

Utilization of solid waste from fluidized bed process for fabricating press-formed inorganic polymer-based brick

Nithiwach Nawaukkaratharnant[a,b,*], Natthawan Duangkaew[b], Wantanee Buggakupta[b] and Apirat Theerapapvisetpong[b]

[a]*Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok, 10330, Thailand*

[b]*Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand*

*E-mail address: Nithiwach.n@chula.ac.th

Keywords: Inorganic polymers, Fluidized bed process waste, Brick, Compressive strength

Paper mills use a fluidized bed combustion process fueled by sub-bituminous coal, which generates large amounts of waste, including fly ash, bottom ash, and sand. This waste poses environmental problems and increases disposal costs. As a result, recycling these materials into new construction products is gaining interest as a solution. This work presents utilization of fly ash and sand waste from such industry as precursor and aggregate for inorganic polymer-based brick fabrication using pressing process. The binder: 80 wt% fly ash and 20 wt% alkali activators (sodium silicate pellet and sodium hydroxide pellet), was dry milled before mixing with aggregate and water. The ratios of sodium silicate pellet and sodium hydroxide pellet were varied. The mixture was shaped into 25 mm in diameter and 50 mm in height by pressing and then cured in closed container for 7 and 28 days before testing. The results indicated that the sample consisted of sodium silicate and sodium hydroxide in weight ratio of 60:40 as alkali activator provided the highest compressive strength at 28 days. Moreover, the functional group and microstructure of binder part were detected to confirm the reaction.

BP - 42

Fabrication of Porous Fly Ash/Bagasse Ash-based Geopolymer Insulation Brick

Chayanit Sripradit[a,*], Nithiwach Nawaukkaratharnant[a,b], Sitthisak Prasanphan[c] and Sirithan Jiemsirilers[a]

[a]*Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand*
[b]*Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok 10330, Thailand*
[c]*National Metal and Materials Technology Center, 114 Thailand Science Park, Pathum Thani 12120, Thailand*
*E-mail address: sirithan.j@chula.ac.th

Keywords: Porous Geopolymer, Bagasse ash, Fly ash, Agricultural waste

The environmental impact of Portland cement production, particularly its high carbon emissions and energy demand, has intensified the search for sustainable alternatives. Geopolymers synthesized from industrial and agricultural waste, such as fly ash and bagasse ash, offer a low-carbon, thermally stable solution. Notably, porous geopolymers have shown great promise for thermal insulation in energy-efficient building systems. This study presents a novel approach to fabricating porous geopolymer composites using fly ash as the primary aluminosilicate precursor incorporated with bagasse ash (5–20 wt%). Activation was carried out using an alkaline solution composed of 8 M sodium hydroxide (NaOH) and sodium silicate (Na_2SiO_3) in a 2.5:1 weight ratio. To induce and stabilize pore formation, hydrogen peroxide (1 wt%) and sodium lauryl sulfate (2.3 wt%) were employed as the foaming agent and foam stabilizer, respectively. The resulting materials were comprehensively characterized for compressive and flexural strength, thermal conductivity, bulk density, water absorption, microstructure, and phase composition. Among all tested formulations, the composite containing 20 wt% bagasse ash demonstrated the most favorable balance between mechanical strength and thermal insulation. This research offers a practical and sustainable pathway for developing geopolymer-based insulation materials aligned with the principles of circular construction and the goals of Net Zero Energy Buildings.

DP - 29

Effects of Mae-Than Ball clay, Lampang clay, Pottery Stone, and Quartz on Physical and Mechanical Properties for Porcelain Stoneware Products

Phiraya Pukpobsuk[a], Siwat Lawanwadeekul[a] and Soravich Mulinta[a, *]
[a]*Department of Industrial Technology and Innovation Management, Faculty of Industrial Technology, Lampang Rajabhat University, Lampang, 52100, Thailand*
*E-mail address corresponding author: Soravich@g.lpru.ac.th

Keywords: Lampang clay, Pottery Stone, Feldspar, Quartz, Porcelain Stoneware.

This study aimed to study and characterize the properties of the raw materials for porcelain stoneware bodies in Lampang province. The raw materials used in the study came from local sources in Lampang Province, Thailand, including Lampang clay, Lampang pottery stone from Patra Ratana Clays and Minerals (1992) Company Limited, and Mae-Than ball clay from MRD-ECC (Thailand) Co., Ltd, and quartz from Sibelco Minerals (Thailand) Co., Ltd. The characterization of the raw materials was analyzed by a particle analyzer, X-ray fluorescence (XRF), and X-ray diffraction (XRD). To study the mixture ratio of the porcelain stoneware body, the ratio was designed as follows in wt% of 50-90% of Mae-Than ball clay, 5-25% of Lampang clay, 5-25% of Lampang pottery stone, and 10-40% of quartz in fifteen component ratios. The properties of the porcelain stoneware body after firing at 1200°C were studied. Then, the linear shrinkage, water absorption, bulk density, apparent porosity, crazing, and bending strength of the porcelain stoneware body were also tested. The results showed that the Formula 5 (70% of Mae-Than ball clay10% of Lampang clay, 10% of Lampang pottery stone, and 10% of quartz) had a linear shrinkage of 10.77%, water absorption of 2.8%, bulk density of 1.89 g/cm^3, appearance porosity of 7.5%, non-crazing, and mechanical properties of the resistance to bending of 578 kg/cm^2. The porcelain stoneware product followed the requirements of Thai industrial standards (TIS 564-2546).

DP - 56

The Effect of Fluxing Agents on The Synthesis of Malayaite Ceramics Colour Pigment

Lapasrada Paowan, Thaweesak Cheedjan, Niti Yongvanich
Department of Materials Science and Engineering and Industrial Technology, Silpakorn University, Nakhonpathom, 7300, Thailand
Email: Lapasrada2025@gmail.com, niti.yongvanich@gmail.com

Malayaite ($CaSnSiO_5$) is a ceramic pigment known for its unique red-tone color when doped with chromium cations. However, given its precursors' refractory nature, the processing in solid-state reaction requires high firing temperature, leading to increased production costs from high energy consumption. To reduce the processing temperature, adding fluxing compounds into the mixture could facilitate cationic diffusion via liquid-phase reaction. This study compared two types of boron-based fluxing agents: Boric acid and Gerstley borate. Without these fluxes, the malayaite phase could barely form at 1200 °C; X-ray Diffraction (XRD) revealed strong peaks of the precursors. At 5 wt%, flux addition could yield a sharp peak of malayaite but still with the presence of SnO_2 and Ca_2SnO_4 secondary phases. Comparing the relative intensity between the main malayaite and secondary phase peaks, Gerstley borate could be considered a better flux and was used for subsequent characterizations. Elemental analysis revealed the distribution of cations corresponding to the detected phases. The obtained pigment from the Gerstley borate possessed a parameter (redness) at 19.7 which is slightly higher than that from the Boric acid system. All pigments yielded yellowness as detected by positive *b* parameter. The UV-vis absorption peaks were situated in the 500 nm range, indicating appearance of red-tone color. The particle size was in the 1 – 5 micron range. When incorporating into practical glazes, the redness was still maintained but the *b* parameter significantly increased. This could be explained by malayaite's limited stability in glazes with certain raw materials such as zinc oxide.

Keywords: Malayaite, Ceramic pigment, G. Borate, Fluxing

EP - 18

Synthesis of Manganese Dioxide from Spent Zinc–Carbon Batteries with Hydrothermal Process for Application in Zinc-Ion Batteries

Apinya Suwaphapphattharaphon [a], Pakinee Thongrit[b], Auscha Thongsri[a], Rojana Pornprasertsuk[a,c,d,e*]

[a]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand*

[b]*Synchrotron Light Research Institute (Public Organization), 111 University Avenue, Muang District, Nakhon Ratchasima, 30000, Thailand*

[c]*Center of Excellence in Petrochemical and Materials Technology, Chulalongkorn University, Thailand*

[d]*Center of Excellence on Advanced Materials for Energy Storage, Chulalongkorn University, Thailand*

[e]*Department of Materials Science and Bioengineering, Nagaoka University of Technology, Japan*

*E-mail rojana.p@chula.ac.th

Keywords: recycle zinc-carbon, hydrothermal, MnO_2, zinc-ion batteries

The amount of waste from used batteries is steadily increasing, particularly from zinc-carbon batteries, which are still widely used today. Proper management of this type of waste is important to help reduce environmental impact. This study focuses on comparing two recycling methods for spent zinc-carbon batteries: (1) acid leaching with sulfuric acid (H_2SO_4) followed by a hydrothermal process, and (2) one-step hydrothermal treatment of the crushed battery powder without acid leaching. In the first method, the battery powder is leached with sulfuric acid, and hydrogen peroxide (H_2O_2) is added as a reducing agent to convert manganese into manganese sulfate ($MnSO_4$). The resulting solution is then subjected to a hydrothermal process to synthesize manganese dioxide (MnO_2) in the crystalline forms of α-MnO_2, β-MnO_2, and γ-MnO_2. In the second method, the crushed battery powder is treated by a hydrothermal process, MnO_2/C composites such as α-MnO_2/C, β-MnO_2/C, and γ-MnO_2/C. The manganese recovery efficiency and electrochemical performance of the products obtained from both methods are compared. The expected outcomes of this research suggest that both MnO_2 and MnO_2/C are promising materials for sustainable zinc-carbon battery recycling. This approach can help reduce battery waste and provides an alternative method for the efficient and environmentally friendly recovery of materials from spent zinc-carbon batteries.

EP - 26

Efficient Direct Recycling of NMC111 Batteries Using LiI-LiOH Eutectic Salt

Parame Janson [a], Pakinee Thongrit[b], Auscha Thongsri[a], Rojana Pornprasertsuk[a,c,d,e]*

[a]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Thailand*

[b]*Synchrotron Light Research Institute (Public Organization), 111 University Avenue, Muang District, Nakhon Ratchasima, 30000, Thailand*

[c]*Center of Excellence in Petrochemical and Materials Technology, Chulalongkorn University, Thailand*

[d]*Center of Excellence on Advanced Materials for Energy Storage, Chulalongkorn University, Thailand*

[e]*Department of Materials Science and Bioengineering, Nagaoka University of Technology, Japan*

*E-mail rojana.p@chula.ac.th

Keywords: Direct recycling, NMC111, eutectic salt

As the use of lithium-ion batteries (LIBs) in electric vehicles (EVs) and renewable energy storage grows, efficient and sustainable recycling methods are becoming increasingly important. Nickel-manganese-cobalt (NMC) batteries, particularly those with the NMC111 composition (1:1:1 ratio of nickel, manganese, and cobalt), are widely used. However, traditional recycling methods, such as pyrometallurgical and hydrometallurgical processes, face challenges including high energy costs and significant environmental impact, highlighting the need for more sustainable alternatives [2]. This study introduces an innovative approach for directly recycling NMC111 batteries using a eutectic salt mixture of lithium iodide (LiI) and lithium hydroxide (LiOH). The primary goal is to selectively recover valuable metals like nickel, manganese, and cobalt from used NMC111 cathodes while preserving the material's structure. By using LiI and LiOH, which form a eutectic salt, this method enables efficient metal extraction without damaging the cathode's crystal structure, making it an effective alternative to existing recycling techniques. The process involves preparing the LiI-LiOH eutectic mixture, with a focus on varying the molar ratio of LiI:LiOH, such as testing a ratio of at least 0.5 to optimize extraction efficiency. Experimental conditions like temperature and reaction time will be adjusted to maximize metal recovery while maintaining the electrochemical performance of the regenerated cathode. Characterization will focus on morphology, and the recycled material's capacity retention, cycling stability, and rate capability will be assessed to determine its potential reuse in new batteries. This approach offers the potential to significantly reduce battery waste and contribute to environmental sustainability, transforming the recycling process for lithium-ion batteries into a more scalable and sustainable solution for future use.

EP - 33

Influence of Synthesis Method on the Structural and Visible-Light Photocatalytic Activity of $BiVO_4$

Phakapol Lainok[a], Noppakhate Jiraborvornpongsa[b] and Pornapa Sujaridworakun[a,c,d,*]

[a] *Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand*

[b] *Metallurgy and Materials Research Institute Chulalongkorn University, Bangkok, Thailand*

[c] *Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University, Bangkok, 10330, Thailand*

[d] *Photocatalysts for Clean Environment and Energy Research Unit, Faculty of Science Chulalongkorn University, Bangkok 10330, Thailand*

* pornapa.s@chula.ac.th

Keywords: Bismuth Vanadate, Hydrothermal, Solvothermal, Liquid-Solid Reaction, Dye Degradation

Bismuth vanadate ($BiVO_4$) has emerged as a promising visible-light photocatalyst owing to its narrow band gap (2.4 eV), excellent chemical stability, and earth-abundant elemental composition. However, the photocatalytic efficiency of $BiVO_4$ is strongly dependent on its structural and morphological characteristics, which are significantly influenced by synthesis methodology. This study presents a systematic investigation of $BiVO_4$ photocatalysts prepared via three distinct synthesis routes: hydrothermal, solvothermal, and liquid-solid reaction synthesis. The objective was to elucidate structure-activity relationships and identify the optimal synthesis approach for enhanced visible-light photocatalytic performance. Comprehensive characterization was performed using X-ray diffraction (XRD) for crystalline phase identification and structural analysis, scanning electron microscopy (SEM) for morphological evaluation, UV-Vis diffuse reflectance spectroscopy (DRS) for optical property assessment, and Brunauer-Emmett-Teller (BET) surface area analysis for determining specific surface area. Photocatalytic activity was evaluated through Rhodamine B (RhB) degradation under simulated visible light irradiation ($\lambda > 420$ nm) as a model pollutant system. The results demonstrated that the synthetic method significantly affects the photocatalytic efficiency of $BiVO_4$, primarily through variations in surface area, particle dispersion, and light absorption properties. These findings provide crucial insights into the synthesis-structure-performance relationships in $BiVO_4$ photocatalysts and establish a foundation for rational design of efficient visible-light-driven photocatalytic systems for environmental remediation and solar fuel production applications. Future work will focus on improving charge separation efficiency and long-term operational stability under visible-light exposure.

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Fabrication and Performance Evaluation of Highly Porous Clay-Based Ceramics for the Removal of Methylene Blue Dye from Water

Montree Hankoy[a,b], Sudarat Tanjumras[a], Chutipon Tongleak[a], Patharaporn Robroocharoen[a], Mettaya Kitiwan[a,b,*], Prangtip Rittichote Kaewpengkrow[c], Narumon Tangthirasunund[d], Phatcharaphon Tunthawiroon[b,f], Pichanan Teesetsopon[a,b]

[a]Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand
[b]Devices and Systems for Energy and Environment Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand
[c]Department of Chemistry, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand
[d]Department of Biology, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand.
[f]Department of Industrial Engineering, School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand

*E-mail address corresponding author: *mettaya.ki@kmitl.ac.th*

Keywords: Clay, porous, expanded polystyrene, physical properties, methylene blue

This work explores the fabrication of high-porosity clay-based (HPCs) adsorbents using industrial clay waste from Thailand as the primary matrix and expanded polystyrene (EPS) waste as a pore-forming agent. Structural properties are characterized by X-ray diffraction (XRD), while bulk density, porosity, and water absorption are assessed via Archimedes method. Pore morphology was examined using scanning electron microscopy (SEM), while mechanical strength was assessed through compressive tests. The adsorption performance of the HPCs toward methylene blue is systematically investigated to assess their potential in dye removal. The use of low-cost and waste-derived materials suggests that these porous ceramic adsorbents are promising candidates for sustainable wastewater treatment applications in dye-contaminated effluents.

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Preparation of Zeolite 13X from Ceramic Wastes for Carbon Dioxide Capture

Kittiphum Wong [a,*], Nathakon Nakpao [a], and Thanakorn Wasanapiarnpong[a,b]
[a]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Pathumwan, Bangkok 10330, Thailand*
[b]*Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Bangkok, 10330, Thailand*
*w.kittiphum9@gmail.com

Keywords: Zeolite 13X, Ceramic pitcher waste, Carbon dioxide capture, Geopolymer

This research aims to study the synthesis of 13X zeolite from ceramic pitcher waste materials, including vitreous china sanitaryware, porcelain insulators, porcelain tableware, and pottery stone. The main objective was to reuse these waste materials as carbon dioxide (CO_2) absorbents, a major greenhouse gas contributing to global warming. The zeolite was synthesized via a hydrothermal method in which 100 g of finely ground ceramic pitchers and pottery stone were mixed with 120 g of sodium hydroxide (NaOH) powder and calcined at 800 °C at a heating rate of 5 °C/min for 2 hours. The calcined product was then mixed with purified water (RO) at a ratio of 1:4 by weight and incubated at 90 °C for 24 hours to induce zeolite crystallization. The synthesized products were characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), and Brunauer–Emmett–Teller (BET) specific surface area analysis. The sanitaryware-based zeolite exhibited the highest specific surface area of 521.03 m^2/g, with diffraction patterns confirming the formation of Zeolite 13X with good crystallinity and suitable for CO_2 adsorption. The obtained zeolite powders were then formed into 10 mm diameter spherical pellets using a meta-kaolin based geopolymer binder. A zeolite to geopolymer ratio of 50:50 by weight gave the optimum results, with a maximum strength of 10.19 N after forming. the zeolite pellets retain a specific surface area of 398.64 m^2/g and can adsorb 2.37 mmol/g of CO_2, equivalent to 10.43 wt%. This research indicates the potential for converting ceramic waste into Zeolite 13X, which has efficient CO_2 adsorption properties. The proposed process is not only a low-cost and industrially scalable synthesis method but also supports the circular economy concept by converting non-biodegradable waste into value-added materials.

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Mineral Waste-Derived Zeolites as Low-Cost Adsorbents for CO_2 Capture

Panida Wimuktiwan [a], Mana Rodchom [a], Kanit Soongprasit [a], Supawan Vichaphund [a], Punchaluck Sirinwaranon [a], Viboon Sricharoenchaikul [b,c], and Duangduen Atong [a*]

[a] National Metal and Materials Technology Center, National Science and Technology Development Agency, Pathumthani 12120, Thailand
[b] Department of Environmental and Sustainable Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok 10330, Thailand
[c] Energy Research Institute, Chulalongkorn University, Bangkok, Thailand

**E-mail: duangdua@mtec.or.th*

Keywords: Zeolite X, Mineral waste, synthesis, CO2 capture.

The rise in anthropogenic CO_2 emissions from fossil fuel use and industrial activities has intensified the demand for sustainable capture technologies. Zeolite-based materials are among the most attractive solid adsorbents due to their high surface area, tunable pore structure, and excellent thermal stability. Moreover, synthesizing zeolites from industrial by-products offers a low-cost and environmentally friendly alternative. In this study, microporous zeolite X was successfully synthesized from mineral waste, a by-product generated from a local industrial plant in Thailand. The synthesis was performed through an alkali fusion method followed by hydrothermal treatment at 80–100 °C for 12–24 h. The as-synthesized zeolite X exhibited high crystallinity and phase purity, with a Brunauer–Emmett–Teller (BET) specific surface area of 485–672 m^2/g, a total pore volume of 0.24–0.34 cm^3/g, and an average pore diameter of 1.78–2.12 nm. These textural properties are closely comparable to those of commercial zeolite 13X. The CO_2 adsorption performance of the mineral waste-derived zeolite X was evaluated using thermogravimetric analysis (TGA) under atmospheric pressure (1 atm) at temperatures ranging from 25 to 100 °C. The results demonstrated that the adsorption capacity of the synthesized zeolite was as high as that of commercial 13X, confirming its efficiency for CO_2 capture under practical conditions. These findings highlight the potential of mineral waste-derived zeolite X as a sustainable and cost-effective microporous adsorbent for CO_2 capture applications.

EP - 60

Investigation of Potential Interaction and Oxide Dispersion in Cesium Dihydrogen Phosphate –Titanium Dioxide Composites Prepared via various Methods

Sunithi Ratana[a, *], **Apirat Theerapapvisetpong** [a, b] **and Chatr Panithipongwut Kowalski** [a, b]

[a]*Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand*
[b]*Center of Excellence on Advanced Materials for Energy Storage, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand*
E-mail: chatr.p@chula.ac.th

Keywords: Cesium dihydrogen phosphate, Titanium dioxide, synthesis methods

Cesium dihydrogen phosphate has been widely studied as an electrolyte in intermediate-temperature fuel cells because of its high proton conductivity and its potential. Previous research has shown that oxide additives can enhance the stability and performance of cesium dihydrogen phosphate. However, it is still unknown whether interactions with oxides cause structural changes or produce new compounds. Clarifying this issue is important because combining cesium dihydrogen phosphate with oxides may influence both stability and microstructural properties, thereby affecting its potential application as a composite electrolyte. This work aims to investigate whether interactions or new phases form between cesium dihydrogen phosphate and titanium dioxide prepared by three different methods: coprecipitation, mechanical grinding, and a combined method. X-ray diffraction (XRD) was used to identify crystalline phases and to detect any new compounds. Raman spectroscopy and Fourier-transform infrared spectroscopy (FTIR) were employed to identify possible bonding between cesium dihydrogen phosphate and titanium dioxide. Scanning electron microscopy (SEM) with energy-dispersive spectroscopy (EDS) was employed to observe particle morphology and dispersion of titanium dioxide within the composites. Comparison of the three synthesis methods is expected to reveal how preparation methods influence mixing quality, interfacial contact, and the possibility of new phase formation. The findings will help clarify how cesium dihydrogen phosphate and titanium dioxide interact and provide useful guidance for preparing composite electrolyte materials.

FP - 47

Reddish-orange luminescence of new Sm^{3+}-doped borate glass for X-ray imaging

F. Khrongchaiyaphum[a,b], N. Wantana[a,b*], P. Pakawanit[c], C. Phoovasawat[c], and J. Kaewkhao[a,b]

[a]Center of Excellence in Glass Technology and Materials Science (CEGM), Nakhon Pathom Rajabhat University, Nakhon Pathom, 73000, Thailand

[b]Physics Program, Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Nakhon Pathom, 73000, Thailand

[c]Synchrotron Light Research Institute (Public Organization), Synchrotron Research and Applications Division, 111 University Avenue, Muang District, Nakhon Ratchasima, 30000, Thailand

*wnuanthip@webmail.npru.ac.th

Keywords: Borate glasses, X-ray imaging, Photonic

This research investigated the effects of varying Sm_2O_3 concentration on the physical, optical, luminescence, and scintillation properties of newly synthesized Sm^{3+}-doped borate glasses. The study aimed to identify an optimal composition for scintillation and photonic applications. The Sm^{3+} ions in the glass exhibited intense orange luminescence with a peak emission at 600 nm under UV, X-ray, and electron excitation. The highest emission intensity was found in the 0.5 mol% Sm_2O_3-doped glass, with a photoluminescence decay time of milliseconds. X-ray imaging experiments demonstrated that the glass can capture objects with image characteristics comparable to YAG:Ce crystals, albeit with longer exposure times. This developed glass is a promising new material for static X-ray imaging, and orange photonic applications.

GP - 14

Effect of synthesis parameters of zeolite 13X from porcelain insulator waste by alkali fusion method on the carbon dioxide absorption properties

Kittipong Sinwanasarp[1,2], Apirat Theerapapvisetpong[1,2*], Nithiwach Nawaukkaratharnant[2,3]

[1] Center of Excellence on Advanced Materials for Energy Storage, Faculty of Science, Chulalongkorn University, Bangkok, 10330 Thailand
[2] Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand
[3]Metallurgy and Materials Science Research Institute, Chulalongkorn University, Bangkok, 10330, Thailand
[*]E-mail: apirat.t@chula.ac.th

Keywords: Porcelain insulator waste; Zeolite 13X; Alkali fusion method; CO_2 adsorption

The increasing volume of discarded porcelain insulators presents environmental challenges due to their high durability, complex disposal process, and non-biodegradable nature. Traditional disposal methods, such as landfilling, are neither sustainable nor environmentally friendly. Given that porcelain insulators are primarily composed of silica and alumina, key components in zeolite formation, repurposing them into Zeolite 13X aligns with circular economy principles while addressing waste accumulation. In this research, zeolite 13X was synthesized from porcelain insulator waste using the alkaline fusion method without additional silica or alumina sources, and its ability to adsorb carbon dioxide was investigated. The synthesis parameters, including NaOH/porcelain insulator waste mass ratios (0.8-1.2:1.0), calcination temperatures (500-650°C for 2 h), pre-crystallization temperatures (50-70°C for 2 h), and crystallization temperatures (80-90°C for 2-24 h), were focused. The phase composition, morphology, specific surface area, and carbon dioxide adsorption capacity of synthesized powder were characterized. The result indicates that the optimal NaOH/porcelain insulator waste mass ratio and fusion temperature, which can dissolve quartz and mullite of porcelain insulator waste, were 1.2:1 and 650°C, respectively. This study demonstrates that porcelain insulator waste can be successfully utilized as a raw material for zeolite 13X synthesis.

GP - 19

Optimizing Ceramic Engobe Performance through Sustainable Material Integration: Effects on Physical and Mechanical Properties under Single-Firing

Nophawan Dechboon[a, *], Apinya Wilai[a], Prakorn Wilai[a] and Tida Tungyai[a]
[a]*Faculty of Art and Architecture, Rajamangala University of Technology Lanna, Chiang Mai, 50300, Thailand*
*aofdechboon@gmail.com, aof_iccmu@hotmail.com, nophawan@rmutl.ac.th

Keywords: Ceramic; Engobe; Sustainable material; Single-firing

This study aims to optimize the performance of ceramic engobe through the integration of sustainable raw materials and the evaluation of their effects on physical and mechanical properties under single-firing conditions at 1100, 1230, and 1250 °C. Sustainable materials, including lampang kaolin waste (KW), rice husk ash (RA), diatomite (DM), and lignite fly ash (FA), were used as partial substitutes for conventional chemical-based raw materials in engobe formulations applied to stoneware products. The physical properties such as shrinkage, bulk density, water absorption, and surface appearance were analyzed. Mechanical performance was assessed in terms of flexural strength. The experimental results revealed that engobe containing 10–40 wt% of sustainable materials adhered well to the ceramic body when applied by brushing, without delamination after firing. The engobes exhibited comparable physical properties, and water absorption decreased with increasing firing temperature. Specifically, water absorption followed the order DM ≤ FA < RA < KW, and the highest firing temperature resulted in the lowest absorption values. Mechanical properties also improved due to the increased formation of the mullite phase, which led to enhanced flexural strength, following the trend DM > RA > FA > KW. Moreover, higher firing temperatures further contributed to improved mechanical strength. These findings support the feasibility of developing sustainable ceramic engobe formulations for use in ceramic tiles and surface glazing, thereby contributing to the advancement of green manufacturing practices in the ceramic industry.

GP - 35

Microwave-Assisted Green Synthesis of TiO_2 Nanoparticles via *Mangifera indica* Extract

Sudarat Tanjumras[a], Chutipon Tongleak[a], Patharaporn Robroocharoen[a], Montree Hankoy[a,b], Mettaya Kitiwan[a,b,*], Pichanan Teesetsopon[a,b], Prangtip Rittichote Kaewpengkrow[c], Narumon Tangthirasunun[d], Phatcharaphon Tunthawiroon[b,f]

[a]Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand
[b]Devices and Systems for Energy and Environment Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand
[c]Department of Chemistry, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand
[d]Department of Biology, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand.
[f]Department of Industrial Engineering, School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand

*E-mail address corresponding author: *mettaya.ki@kmitl.ac.th*

Keywords: Titanium dioxide, Green synthesis, Plant extract, TEM

Titanium dioxide (TiO_2) nanoparticles have gained significant attention due to their outstanding photocatalytic, antimicrobial, and biomedical properties. In this study, titanium dioxide nanoparticles (TiO_2 NPs) were synthesized through an environmentally friendly green synthesis approach using titanium tetraisopropoxide (TTIP) as a precursor and *Mangifera indica* L. leaf extract as a natural reducing and stabilizing agent, in combination with microwave-assisted processing. The successful formation of TiO_2 NPs was confirmed by X-ray diffraction (XRD), which revealed a nano-crystalline anatase phase. The morphological characteristics and particle size distribution were examined using scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Fourier-transform infrared spectroscopy (FTIR) was employed to identify the functional groups involved in nanoparticle formation. Furthermore, the photocatalytic performance of the synthesized TiO_2 NPs was systematically evaluated, indicating their potential for environmental applications. This study offers a sustainable, non-toxic, and efficient method for the fabrication of TiO_2 NPs, emphasizing the significance of plant-mediated synthesis in advancing green nanotechnology.

GP - 36

Facile Microwave-Assisted Green Synthesis of Zinc Oxide Nanoparticles using Garlic Peel Waste (*Allium sativum L.*) Extract

Chutipon Tongleak[a], Sudarat Tanjumras[a], Patharaporn Robroocharoen[a], Montree Hankoy[a,b], S.Tipawan Khlayboonme[a,b], Pichanan Teesetsopon[a,b], Prangtip Rittichote Kaewpengkrow[c], Narumon Tangthirasunun[d], Mettaya Kitiwan[a,b,*], Phatcharaphon Tunthawiroon[b,d]

[a]*Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*
[b]*Devices and Systems for Energy and Environment Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand*
[c]*Department of Chemistry, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*
[d]*Department of Biology, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*
[d]*Department of Industrial Engineering, School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*

*E-mail address corresponding author: *mettaya.ki@kmitl.ac.th*

Keywords: Zinc oxide, Microwave sintered, Nanoparticles, XRD, SEM

In this study, zinc oxide (ZnO) nanoparticles were synthesized via a green and cost-effective method using zinc acetate ($Zn(CH_3COO)_2$) as a precursor and *Allium sativum* L. (garlic) peel waste extract as a natural reducing and stabilizing agent, under microwave-assisted conditions. X-ray diffraction (XRD) analysis confirmed the successful formation of ZnO nanoparticles with a hexagonal wurtzite structure at 500 °C. The synthesized nanoparticles were further characterized by transmission electron microscopy (TEM), scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and UV–Vis spectroscopy to evaluate their structural, morphological, and optical properties. The antibacterial activity of ZnO nanoparticles was systematically assessed against Escherichia coli and Staphylococcus aureus, demonstrating their potential for biomedical applications. This study highlights a sustainable and value-added approach for nanomaterial synthesis from agricultural waste, supporting the advancement of green nanotechnology for antimicrobial and environmental applications.

GP - 41

Ecofriendly Synthesis and Characterization of Magnesium Oxide Nanoparticles Using *Aloe vera* Extract as a Reducing and Stabilizing Agent

Patharaporn Robroocharoen[a], Sudarat Tanjumras[a], Chutipon Tongleak[a], Montree Hankoy[a,b], Mettaya Kitiwan[a,b,*], Pichanan Teesetsopon[a,b], Prangtip Rittichote Kaewpengkrow[c], Narumon Tangthirasunun[d], Phatcharaphon Tunthawiroon[b,f]

[a]*Department of Physics, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*
[b]*Devices and Systems for Energy and Environment Research Unit, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand*
[c]*Department of Chemistry, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*
[d]*Department of Biology, School of Science, King Mongkut's Institute of Technology Ladkrabang, Bangkok, 10520, Thailand.*
[f]*Department of Industrial Engineering, School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*

*E-mail address corresponding author: *mettaya.ki@kmitl.ac.th*

Keywords: Magnesium Oxide, Nanoparticles, Eco-friendly, *Aloe vera* Extract

Green synthesis has attracted increasing interest from researchers as an eco-friendly approach that reduces the use of hazardous chemicals and solvents while preventing the generation of toxic waste. In this study, magnesium oxide nanoparticles (MgO NPs) were synthesized from magnesium nitrate hexahydrate ($(MgNO_3)_2 \cdot 6H_2O$) using *Aloe vera* extract as a natural reducing and stabilizing agent. X-ray diffraction (XRD) analysis confirmed the successful formation of MgO NPs at 500 °C, with an average crystallite size of approximately 17 nm. Scanning electron microscopy and transmission electron microscopy (SEM and TEM) were employed for morphological characterization, while FTIR and EDS analyses were used to determine the functional groups and elemental composition, respectively. This study demonstrates a simple, sustainable, and environmentally friendly route for producing multifunctional MgO nanoparticles, with promising potential for applications in environmental and biomedical fields.

GP - 52

Green Synthesis and Optimized Annealing Temperature Effects on Zinc Oxide Nanoparticles Using Mango Peel Extract

Supamas Wirunchit[a], Natchayaporn Sakulpeeb[a], Woradech Meedech[a], Sutee Chutipaijit[a], Wantana Koetniyom[b,c*]

[a] *College of Materials Innovation and Technology (CMIT), King Mongkut's Institute of Technology Ladkrabang, Ladkrabang, Bangkok 10520, Thailand*

[b] *Department of Industrial Physics and Medical Instrumentation, Faculty of Applied Science, King Mongkut's University of Technology North Bangkok, Bangkok 10800, Thailand*

[c] *Lasers and Optics Research Center (LANDOS), King Mongkut's University of Technology North Bangkok, Bangkok 10800, Thailand*

*E-mail address corresponding author: wantana.k@sci.kmutnb.ac.th

This study presents the green synthesis of zinc oxide nanoparticles (ZnO-NPs) using mango peel extract (MgE) as a natural reducing and stabilizing agent. Phytochemical extraction was performed with deionized water, ethanol, and methanol for 1–5 hours, with deionized water at 4 hours yielding the highest flavonoid content. Using zinc nitrate as a precursor, 25 mL of MgE successfully facilitated the synthesis of ZnO-NPs (ZnO-25MgE). It was found that annealing temperature at 400°C for 12 hours produced pure ZnO. The obtained nanoparticles were characterized by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR), and field emission scanning electron microscopy (FE-SEM). XRD confirmed the crystalline structure with an average size of 6.67 nm, while FT-IR and FE-SEM analyses revealed Zn–O vibrations, residual organics, and nanoscale morphology. Thermogravimetric analysis (TGA) indicated the appropriate annealing temperature for the removal of organics. For comparison, chemically synthesized ZnO was also characterized, and its antibacterial activity was assessed via disc diffusion against Escherichia coli and Staphylococcus aureus. The results demonstrated notable inhibition, highlighting the potential of biosynthesized ZnO-NPs for antimicrobial applications

Keywords: Green Synthesis, Annealing Temperature, Zinc Oxide Nanoparticles, Mango Peel Extract.

GP - 54

Designing Geopolymer–Zeolite Hybrids: Structural Evolution and Phase Control in Alkali-Activated Metakaolin

Sujitra Onutai[a,*], Yuanbing Zhou[a] and Shuangquan Liao[a]
[a] Key Laboratory of Advanced Materials of Tropical Island Resources of Ministry of Education, School of Materials Science and Engineering, Hainan University, Hainan, 570228, PR China
* Email: onutai.sujitra@hainanu.edu.cn

Keywords: Geopolymer–zeolite composites, Alkali activation, Metakaolin, ATR-FTIR spectroscopy

Geopolymer-zeolite composites represent a sustainable class of materials that merge the mechanical stability of geopolymers with the high surface area and adsorption capacity of zeolites. This study investigates the formation of zeolite during the alkali activation of metakaolin, utilizing both in-situ and ex-situ attenuated total reflectance–Fourier transform infrared spectroscopy (ATR-FTIR), along with support from X-ray diffraction (XRD) and scanning electron microscopy (SEM–EDX). Metakaolin with a fixed Si/Al ratio of 1.01 was activated by sodium hydroxide solutions at Na/Al molar ratios of 1.18, 2.03, and 3.05. Alkali concentration strongly influenced dissolution, gel polymerization, and crystallization. At low alkalinity, zeolite-A and zeolite-X phases coexisted with amorphous geopolymer gels. At intermediate alkalinity, sodalite appeared together with zeolite-A, whereas excessive alkalinity (Na/Al = 3.05) suppressed zeolite-A and X formation, yielding predominantly sodalite. ATR-FTIR revealed systematic shifts of Si–O–Si and Si–O–Al vibrations from 1080 to 940 cm^{-1}, indicating bond cleavage, oligomer formation, and condensation into secondary building units. XRD and SEM confirmed phase transitions and distinct morphologies of cubic zeolite-A, truncated octahedral zeolite-X, and sodalite crystals. These results highlight the templating role of sodium hydroxide in directing zeolite crystallization within geopolymer matrices. The insights enable controlled design of geopolymer–zeolite hybrids with promising applications in sustainable construction, adsorption, and wastewater treatment.

GP - 57

The Synthesis of Malayaite-base pigment from wastes

Teerapong Manakit, Poorinat Thongchai, Piyapon Khunpanya, Niti Yongvanich

Department of Materials Science and Engineering and Industrial Technology, Silpakorn University, Nakhonpathom, 7300, Thailand

Email: teerapongmanakit5@gmail.com, niti.yongvanich@gmail.com

Malayaite-based ceramic pigment is a type of pigment widely used in the ceramics industry, but its production is associated with relatively high costs. Producing this pigment from industrial waste is a method that can help reduce its production cost and serve as an effective approach for managing the waste generated from various industries. This research, therefore, aims to investigate the feasibility of producing Malayaite-based ceramic pigments from industrial waste, serving as a new alternative for cost reduction and sustainability in the ceramic industry. The objective is to study the possibility of using rice husk ash, shells, and chromium from tannery sludge as raw materials for producing Malayaite-based ceramic pigments with the formula $Ca(Sn_{0.9}\ Cr_{0.1})SiO_5$, by adding Gerstley Borate and Boric acid as fluxes to help reduce the firing temperature to 1200°C to produce a stable Malayaite-based ceramic pigment and lower the production cost. Upon analysis with X-ray Diffraction (XRD), it was found that the Malayaite peaks became sharper and more intense with an increasing amount of added flux. This was consistent with the results from the Scanning Electron Microscope (SEM) and Energy-Dispersive X-ray Spectroscopy (EDS), which showed that the pigments had a uniform particle distribution. Furthermore, from the analysis with Ultraviolet-visible Spectroscopy (UV-vis) and the CIE Lab system, it was found that the synthesized pigments had a pale mauve color tone, and increasing the amount of flux resulted in a more intense and vibrant color. The addition of Boric acid 5 wt% yielded the best color tone compared to other samples. When compared to the ceramic pigments used in the industry, it was found to have similar properties and color shades. It can therefore be concluded that Malayaite-based ceramic pigments can be synthesized from industrial waste, which can serve as a cost-effective production alternative and an effective way to manage various industrial wastes.

Keywords: Malayaite, Ceramic pigment, Fluxing

GP - 58

Effects of Alpha-Gypsum Plaster Cement on Casting of Activated Charcoal Prepared from Vetiver Grass Leaves for Odor Absorption Applications

Uraiwan Leela-adisorn[a] Thanakorn Wasanapiarnpong[a,b,c]*, and Noppadon Kitana[d,e]

[a]Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Pathumwan, Bangkok 10330, Thailand

[b]Center of Excellence on Petrochemical and Materials Technology, Chulalongkorn University Research Building, Phayathai Road, Pathumwan, Bangkok 10330, Thailand

[c]Upcycled Materials from Industrial and Agricultural Wastes Research Unit, Department of Materials Science, Faculty of Science, Chulalongkorn University, Phyathai Road, Bangkok, 10330, Thailand

[d]Department of Biology, Faculty of Science, Chulalongkorn University Phayathai Road, Pathumwan, Bangkok 10330, Thailand

[e]Center of Learning Network for the Region – CLNR, Chulalongkorn University Phayathai Road, Pathumwan, Bangkok 10330, Thailand

*uraiwan.l@chula.ac.th

Keywords: Vetiver grass leaves utilization, Activated charcoal, Odor absorption, alpha-plaster cement

Vetiver grass is a highly beneficial plant, particularly known for its capabilities in soil and water conservation on sloped terrains, land rehabilitation, and wastewater treatment. Moreover, it has a wide range of other potential applications. The leaves of vetiver grass serve as a promising biomass material for the production of activated carbon and odor absorber charcoal products. With proper cultivation and management, its high annual yield per area also supports its potential for economically viable industrial-scale production. This research focuses on synthesis of high-surface-area activated charcoal from vetiver grass leaves and forming activated charcoal into prototype odor absorber products. Fresh leaves were harvested from experimental plots, oven-dried, cut into approximately 1 cm lengths, and impregnated with phosphoric acid solution at a ratio of 2.0 parts acid and 3.0 parts distilled water based on dry weight of the vetiver leaves, just enough to fully submerge the material. The mixture was incubated for 24 hours, then dried and pyrolyzed in a tube furnace under a nitrogen atmosphere at 600 ºC for 1 hour. The resulting product was washed with distilled water until neutral pH was achieved, yielding activated charcoal with a relatively high specific surface area of 982.62 m^2/g. This activated charcoal was then mixed with alpha-plaster at a ratio of 20 g activated charcoal to 80 g plaster, and 100 g of water was added. The mixture was stirred thoroughly for 1 minute and cast into molds to prepare test specimens. Once set, the samples were demolded and oven-dried at 60 ºC for 24 hours. The results showed that the final composite had a compressive strength of 5.67 MPa, flexural strength of 0.89 MPa, high porosity of 49.52%, and a relatively high specific surface area of 197.82 m^2/g. It is suitable for use as an odor absorber, which generally requires a standard specific surface area higher than 150 m^2/g.