THE 1ST ACSEAM MICROSCOPY CONFERENCE (ASSOCIATION OF CHINA SOUTH-EAST ASIA MICROSCOPY)

PROGRAM & ABSTRACT

21 – 22 October 2024

BRIN
BADAN RISET DAN INOVASI NASIONAL

PT Cipta Mikro Material
Beyond Commitment

https://acseam-conference.org/

Contents

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Welcome from the chairman

On behalf of the Indonesian Society for Microscopy (InaSM) as the organizing committee, we would like to welcome all participants to the 1st ACSEAM (Association of China-Southeast Asia Microscopy) Conference to be held at the Gaia Hotel, Bandung, Indonesia on October 21-22, 2024. This conference event is presented as part the China-Southeast Asia initiative in the field of electron microscopy.

This Microscopy Conference aims to bring together electron microscopy users especially from China-Southeast Asia, but not limited to the global electron microscopy users, to share and build research collaborations as well as career opportunities in the field of electron microscopy. This conference event is open to the students, researchers and industries who are interested in the development and applications of electron microscopy. Therefore, the conference will be and give to all participants a good media for information exchange and networking.

We really appreciate all keynote speakers, invited speakers, presenters, sponsors and all active participants to join this event. Your participation will become our memorable activities in the future. We also apologize for the inconvenient situation during conference preparation and implementation.

Finally, we wish you enjoy during the conference in Bandung and see you again at the next ACSEAM Microscopy Conference.

Sincerely yours,

Dr. -Ing. Fadli Rohman
Chairman of the first ACSEAM Microscopy Conference

General Information

Climate
October is the rainy season in Bandung and the surrounding areas, including Serpong and Cibinong. Heavy rain frequently happens (especially this year). The average temperature is 19-29°C. High humidity can reach 88%. Beware of lightning and wind storms. A light jacket is recommended in the evening. A raincoat or umbrella is recommended for you during your trip.

Currency
The currency used is the Indonesian Rupiah. $US, Visa, MasterCard, American Express, and Dinners Club are widely accepted in Hotels, Restaurants or Malls. Banks are open from 08:30 – 15:00 on Monday to Friday and are closed on Saturday and Sunday. Dress Code The dress code for all conference sessions and the social program is smart casual.

Lunch and Coffee
Lunches and Coffee/Tea are included at the Conference at the time indicated in the program. Coffee/Tea takes place at the ballroom of Hotel Gaia Bandung 1st floor next to the registration desk and lunches take place at the buffet area of Hotel Gaia Bandung.

Mobile Phone and Pagers
As a courtesy to speakers and other participants, we request that all mobile phones and pagers be either set in silent mode or switched off before coming into the lecture halls.

No Smoking Policy
All participants should be aware that smoking is banned in public buildings including The Conference Venue. If you need to smoke, please do it only in the designated smoking area.

Liability Disclaimer
ACSEAM 2024 reserves the right to amend any part of the Conference program. ACSEAM 2024 will not accept liability for damages of any nature sustained by participants or accompanying persons, or loss of, or damage to, their personal property as a result of the Conference or related events. All participants should make their own arrangements with respect to personal insurance, along with travel Insurance.

Name Badges
Please wear your name badge to gain access to all Conference sessions and social program.

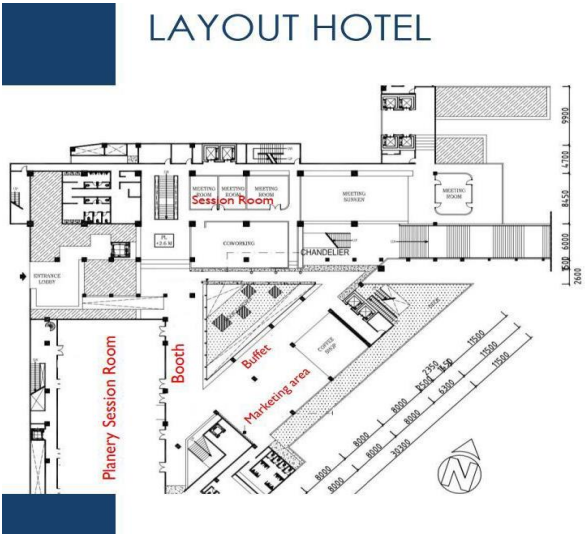
Presenter Information

It is important that all speakers report their preparation to the Room Liability Manager (Chair) of each session at least two hours prior to the commencement of their allocated session. A technician will be available to assist with data projection or other technical requirements. If you require assistance from a technician, please ensure you arrange this during one of the breaks prior to your presentation. Speaker in early morning sessions should report their preparation the day / afternoon prior to their session.

The Venue

Hotel Gaia Bandung

Hotel Gaia Bandung take place in the street of Jl. Dr. Setiabudi No.430, Ledeng, Kec. Cidadap, Kota Bandung, Jawa Barat.



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PRE-CONFERENCE WORKSHOP PROGRAM

Pre-Conference Program (1st Day) For Material Science

Thursday, October 17, 2024

Location	Time	SEM	FIB	TEM
Gd. 720	07:30 - 09:00	Registration		
Gd. 720	09:00 - 09:15	Opening		
Gd. 720	09:15 - 09:45	**Introduction to Electron Microscopy at BRIN**		
Gd. 720	09:45 - 10:00	Coffee Break		
Gd. 720	10:00 - 10:45	**Solving materials analysis challenges through breakthrough in combined SEM-EDS-EBSD**		
Gd. 720	10:45 - 11:30	**Exploring Material Structures from Microscale to Atomic Scale: Advanced Imaging with TEM and Precision Sample Preparation via Dual Beam Techniques**		
Gd. 720	11:30 - 13:00	Lunch Break (ISHOMA)		
Gd. 720	13:00 - 13:30	**Materials characterization using analytical TEM**		
Gd. 442	13:30 - 14:30	Mobilization to building 442 and Coffee Break		
Lab Demo	14:30 - 15:30	Group 1	Group 2	Group 3
Gd. 442	15:30 – 16:00	Closing Remarks (Day 1)		

Pre-Conference Program (2nd Day) For Material Science

Friday, October 18, 2024

Location	Time	SEM	FIB	TEM
Gd. 442	08:30 - 09:30	Group 1	Group 2	Group 3
Gd. 442	09:30 - 10:00	Coffee Break		
Lab Demo	10:00 - 11:00	Group 1	Group 2	Group 3
Gd. 442	11:00 - 13:30	Lunch and Closing Remark		

Pre-Conference Program (1st Day) For Life Science

Thursday, October 17, 2024

Time	Topic	Presenter	Facilitator
08:30 - 09:00	Registration		
09:00 - 09:15	Opening	Dr. Yan Rianto	
09:15 - 09:45	**Introduction to Cryo-EM**	Yudhi Nugraha	
09:45 - 10:00	Coffee Break		
10:00 – 11.00	**Lecture on SPA and CryoTomo**	Dede Heri Y. Y.	
11:00 - 12:00	**Lecture Lamella Milling**	Arbi Dimyati	
12:00 - 13:30	Lunch Break (ISHOMA)	TF Sponsor	
13:30 - 14:30	**Vitrobot Preparation**		CryoEM Team
14:30 - 16:00	**SPA on Krios**		CryoEM Team
16:00 – 16:10	Closing Remarks (Day 1)		

Pre-Conference Program (2nd Day) For Life Science

Friday, October 18, 2024

Time	Topic	Lecturer	Facilitator
08:30 - 09:00	Registration		
09:00 - 11:00	**Lamella Milling Aquilos2**		CryoEM Team
11:00 - 12:00	**CryoTomo on Krios**		CryoEM Team
12:00 - 13:30	Coffee Break		
13:30 - 14:30	**CryoTomo on Krios**		CryoEM Team
14:30 – 16.00	**3D reconstruction**	Lina Herliana	CryoEM Team
16:00 - 16:10	Closing Remarks (Day 2)	Rifki / Silva	

*) During practical session coffee is provided

CONFERENCE PROGRAM

Arrival

Sunday, October 20, 2024

15:00 - 20:00	(Rooftop Garden) Welcome Reception Dr. -Ing. Arbi Dimyati *President of the Indonesian Society of Microscopy* (InaSM)

Conference Program (1st Day)

Monday, October 21, 2024

07:30 - 08:30	Registration	
08:30 - 09:00	(Grand Ballroom Edelweiss) **Opening Speech**	
	10 minutes	Dr. -Ing. Fadli Rohman *Chairman of the first ACSEAM Microscopy Conference*
	10 minutes	Prof. Hing Hiang Lian *President of the Association of China South-East Asia Microscopy (ACSEAM)*
09:00 - 09:30	**Plenary Speech**	
	Prof. Dr. Ze Zhang *Department of Material Science, Zhejiang University*	
09:30 - 10:00	Dr. Tay Khoon Yang *Hi-Tech Instrument* "Multimodal Microscopical Surface – Interior Observation and Characterization"	
10:00 - 10:30	Coffee Break	
10:30 - 11:00	**Parallel Session 1**	
	(Room: Kyo) Invited Speaker: Assoc. Prof. Dr. Noor Najmi Binti Bonnia *Universiti Teknologi MARA, Malaysia* "Optimizing Reaction Time for the Synthesis of Graphene Oxide (GO) from Waste Tyre- A Sustainable Approach"	(Room: Liv) Invited Speaker: Dr. Lim Fei Tieng *Hi-Tech Instrument* "Realizing the Biological and Biomedical Potential of Nanoscale Imaging Using a Pipette Probe (SICM)"
11:00 - 11:15	002-15-MS	001-5-LS
11:15 - 11:30	003-4-MS	008-3-LS

<table>
<tr><td>11:30 - 11:45</td><td>004-6-MS</td><td>020-22-MS</td></tr>
<tr><td>11:45 - 12:00</td><td>005-17-MS</td><td>021-70-MS</td></tr>
<tr><td>12:00 - 13:30</td><td colspan="2">Lunch Break</td></tr>
<tr><td>13:30 - 14:00</td><td colspan="2">(Grand Ballroom Edelweiss)
Plenary Speech</td></tr>
<tr><td></td><td colspan="2">Prof. Boon Huat Bay
Department of Anatomy, National University of Singapore
“Transmission Electron Microscopy: A Valuable Tool for Documenting Fundamental Cellular Processes at the Ultrastructural level”</td></tr>
<tr><td>14:00 - 14:30</td><td colspan="2">Prof. Ahmad Rifqi Md Zain
IMEN, Universitas Kebangsaan Malaysia</td></tr>
<tr><td>14:30 - 15:00</td><td colspan="2">Coffee Break</td></tr>
<tr><td></td><td colspan="2">Parallel Session 2</td></tr>
<tr><td>15:00 - 15:30</td><td>(Room: Kyo)

Invited Speaker:
Dr. Tengku Hasnan Tengku Abd Aziz
IMEN Malaysia
“Enhanced SERS Detection of Creatinine Using Vertically Aligned ZnO Nanorods for Kidney Disease Monitoring”</td><td>(Room: Liv)

Invited Speaker:
Dr. Hanan Kumar Gopalan
Universiti Kuala Lumpur
“Unveiling STZ-Induced Diabetic Type 2 Rats Skeletal Muscle Morphological and Structural Changes Using High-Resolution Electron Microscopy”</td></tr>
<tr><td>15:30 - 15:45</td><td>006-10-MS</td><td rowspan="2">Invited Speaker:
Scott Chang
TFS Cryo-EM
“Application Innovations in Cryo-Electron Microscopy: From Basic to Translational Science”</td></tr>
<tr><td>15:45 - 16:00</td><td>007-8-MS</td></tr>
<tr><td>16:00 - 16:15</td><td>010-31-MS</td><td>016-12-INS</td></tr>
<tr><td>16:15 - 16:30</td><td>012-16-MS</td><td>017-3-INS</td></tr>
</table>

Conference Program (2nd Day)

Tuesday, October 22, 2024

08:00 - 09:00	Registration	
09:00 - 09:30	(Grand Ballroom Edelweiss) Plenary Speech asst. Prof. Dr.Witchukorn Phuthong *Department of Physics, Kasetsart University*	
09:30 - 10:00	Plenary Speech Wang Huimin *TFS Material Science* *"The Role of Electron Microscopy in Advancing Battery Materials for Sustainable Energy Storage"*	
10:00 - 10:30	Coffee Break	
	Parallel Session 3	
10:30 - 11:00	(Room: Kyo) Invited Speaker: Dr. Muhammad Asif bin Ahmad Khushaini *Universitas Kebangsaan Malaysia*	(Room: Liv) Invited Speaker: Scott Chang *TFS Cryo-EM* "Integrating Volume Electron Microscopy with Cell Biology: Advanced Techniques for 3D Imaging and Analysis"
11:00 - 11:15	013-9-MS	Invited Speaker: Dr. Sandi Sufiandi *Cryo-EM Indonesia*
11:15 - 11:30	015-8-MS	
11.30 – 12.00	019-32-MS	018-20-INS
12:00 - 12:10	(Grand Ballroom Edelweiss) Closing Speech Dr. -Ing. Fadli Rohman *Chairman of the first ACSEAM Microscopy Conference*	
12:10 – 13.00	Lunch Break	

CODE FOR PRESENTER The 1st ACSEAM 2024

Monday, October 21, 2024

Parallel Session 1		
Code	**First Author**	**Abstract Title**
Material Science (Room Kyo)		
Invited Speaker	**Noor Najmi binti Bonnia**	**Optimizing Reaction Time for the Synthesis of Graphene Oxide (GO) from Waste Tyre- A Sustainable Approach**
002-15-MS	**Ni Wayan Sugiarti**	**Scanning Electron Microscopy Analysis for Oxidation Characterization on Muntig Siokan Ingot**
003-4-MS	**Azra Umairah Anuar**	**Sustainable Synthesis of Graphene Oxide Nanoparticles from Waste Tires: Tunable Properties via $KMnO_4$ Concentration**
004-6-MS	**Fatin Nur Azmina**	**Evaluating the Efficicancy of Industry versus Green Polyurethane: A Comparative Study on the Physical, Mechanical and Morphological Properties for Enhancing Grouting Application**
005-17-MS	**Djoko Hadi Prajitno**	**Oxidation Behaviour Ternary Zr-Sn-Mo Alloys Doped with Cr at High Temperature**
Life Science (Room Liv)		
Invited Speaker	**Dr. Lim Fei Tieng**	**Integrating Volume Electron Microscopy with Cell Biology: Advanced Techniques for 3D Imaging and Analysis**
001-5-LS	**Wahizatul Afzan Azmi**	**Pathogenicity of Entomopathogenic Fungus (Metarhizium anisopliae) Against Adults of Golden Apple Snails (Pomacea canaliculata)**
008-3-LS	**Latifa Nuraini**	**High-Resolution Analysis of Roof Cross-Section: Insights into Cellular Structure Using Cryo-Focused Ion Beam (Cryo-FIB)**
020-22-MS	**Pritish Mishra**	**Realization of 2-2 Elpasolites using Atomic Resolution STEM and Degradation assisted XRD**
021-70-MS	**Riesma Tasomara**	**Synthesis and Characterisation of Nanophase Sr and Zn Co-substituted Hydroxyapatite by Precipitation Method**
Parallel Session 2		
Material Science (Room Kyo)		
Invited Speaker	**Dr. Tengku Hasnan Tengku Abd Aziz**	**Enhanced SERS Detection of Creatinine Using Vertically Aligned ZnO Nanorods for Kidney Disease Monitoring**

006-10-MS	Akhmad Futukhillah Fataba Alaih	Enhancing the Repeatability of Capacitive Humidity Sensors Using Porous $LaFe_{0.925}Ti_{0.075}O_3$ Perovskite and Ethyl Cellulose Coating
007-8-MS	Muhammad Amin	The Effect of Addition of Polyethylene Terephthalate (PET) and Ethylene Vinyl Acetate (EVA) Plastic Waste on The Physical Properties and Characterization of Porous Mortar Using Activated Fine Sand Material as Aggregate
010-31-MS	Indriyati	Modifying Carbon Dots for Enhanced Photothermal Performance in Solar-driven Water Evaporation
012-16-MS	Nahdori Muhlis	Synthesis of Ce1-xMnxO2 Solid Solution Nanoparticles as a Supercapacitor Electrode Material
Life Science (Room Liv)		
Invited Speaker	Hanan Kumar Gopalan	Unveiling STZ-Induced Type 2 Diabetic Rats Skeletal Muscle Morphological and Structural Changes Using High-Resolution Electron Microscopy
Invited Speaker	Scott Chang	Application Innovations in Cryo-Electron Microscopy: From Basic to Translational Science
016-12-LS	Pascale Ramadhan	Lamella milling of biological cells for Cryo Electron Tomography with Lift-Out Technique using Dual-Beam Cryo-FIB
017-3-INS	Haidar Sitie Rafidah	Ultramicrotomy Methods in Biological Specimen Preparation for Transmission Electron Microscopy Analysis

Tuesday, October 22, 2024

Parallel Session 3		
Code	**First Author**	**Abstract Title**
Material Science (Room Kyo)		
Invited Speaker	Dr. Muhammad Asif bin Ahmad Khushaini	
013-9-MS	Vivi Purwandari	Development and Photocatalytic Performance of Poly (Vinyl Alcohol)- Based Hydrogel with Graphene/PANI and ZnO Hybrid Nanocomposite for Organic Dye Degradation
015-8-MS	Muhandis Shiddiq	Analysis of lead content in cocoa products using nanoparticle-enhanced laser induced breakdown spectroscopy (LIBS)

Parallel Session 3		
Code	**First Author**	**Abstract Title**
019-32-MS	**Fahrisah Nurfadeliah Bahraini**	**FIB-SEM Technique for Digital Rock Physics on a Nanoscale**
Life Science (Room Liv)		
Invited Speaker	**Scott Chang**	**Integrating Volume Electron Microscopy with Cell Biology: Advanced Techniques for 3D Imaging and Analysis**
Invited Speaker	**Sandi Sufiandi**	**Cryo-EM Indonesia**
018-20-INS	**Adinda Fitri Salsabila**	**Automatic Lamella Milling for Cryo in-situ Tomography Saccharomyces cerevisiae using Dual-Beam Cryo-FIB Aquilos2**

ABSTRACT

INVITED SPEAKERS

Optimizing Reaction Time for the Synthesis of Graphene Oxide (GO) from Waste Tyre- A Sustainable Approach

Azra Umairah Anuar[1,a], Noor Najmi Bonnia[1b*], Nur Afiqah Amir Husni[1,c],Nor Suhaila Mohamad Hanapi[1,d], Norashirene Mohamad Jamil[1,e],Nor Dalila Nor Affandi[2,f].

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[2]Textile Research Group, Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.
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Keywords: Graphene, Carbon, Waste Tire, Hummers Method, Nanoparticle.

Abstract. Additionally, the dumping of tires in landfills can harm the local ecosystem, as the waste tires can release toxic chemicals that impact the soil. These pollutants can also alter the ecosystem as they trap water during rain, creating ideal breeding grounds for an increase in mosquitoes and other insects. Abundance of waste tyre become threat to agricultural activities especially food agriculture. This have become a significant environmental concern worldwide. Pyrolysis of waste tyre under high vacuum can be used to produce recovered carbon black (CB) that may have value to be convert as a graphene oxide (GO) for electronic and healthcare settings. GO has its unique properties and versatile functionalization capabilities. Maintaining the optimal synthesis parameters is crucial to producing high-quality GO with high oxidation. This study focuses on the effect of different reaction times during the modified Hummers method on the structural and morphological properties of GO derived from CB of waste tyre. Using reaction times of 60, 120, and 180 minutes, the resulting GO samples were systematically examined through various characterization techniques. FTIR spectroscopy confirmed the increased intensity of O-H bonds vibrations, correlating with longer reaction times. XRD analysis revealed that increasing reaction times resulted in broader and more amorphous peaks, indicative of greater intercalation of oxygen-containing groups. Notably, as the reaction time increase, the oxygen content in the GO also increases, as evidenced by the intensified EDX peaks. Our finding demonstrate that the reaction time significantly influence the degree of oxidation and the distribution of functional groups in GO. This research provides valuable insights into the synthesis of GO from sustainable sources, promoting cost-effective and environmentally friendly approach.

Enhanced SERS Detection of Creatinine Using Vertically Aligned ZnO Nanorods for Kidney Disease Monitoring

Abstract

Early diagnosis of kidney disease requires sensitive and selective detection of biomarkers like creatinine. We propose a novel SERS substrate based on vertically aligned ZnO nanorods, engineered to enhance signal intensity through photon trapping. By controlling the growth temperature during synthesis, we achieved optimal nanorod formation with uniform size and alignment. The resulting structure demonstrated a 30% increase in SERS signal compared to conventional substrates, achieving an enhancement factor of 3×101 for creatinine detection. This indicates the potential of our ZnO nanorod platform for accurate and sensitive monitoring of kidney health, paving the way for improved early diagnosis and personalized healthcare.

Unveiling STZ-Induced Type 2 Diabetic Rats Skeletal Muscle Morphological and Structural Changes Using High-Resolution Electron Microscopy.

[1,2] Hanan Kumar. G, [2]Yanti Rosli, [3]Nur Afrina MH, [3]Tg Rogayah TAR, [4] Wirda IF, [1.] Shazwan Shazdee, [1]JC.Pang, [5]HL HING.

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[2.]Biomedical Science Programme, Centre for Toxicology & Health Risk Studies (CORE), Faculty of Health Science, Universiti Kebangsaan Malaysia
[3.] Electron Microscopy Unit, Institute for Medical Research, Ministry of health 40170 ShahAlam Selangor Darul Ehsan, Malaysia
[4.]Department of Diagnostic Laboratory Service, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia.
[5.] First City University College, NO 1 Persiaran Bukit Utama, Bandar Utama, 47800 PetalingJaya Selangor Darul Ehsan, Malaysia

ABSTRACT

Introduction: Type 2 Diabetes Mellitus (T2DM), characterized by insulin resistance and hyperglycemia, significantly impacts muscle health across various age groups. This condition induces mitochondrial dysfunction, oxidative stress, and the accumulation of advanced glycation end-products (AGEs) in muscle fibers, consequently leading to inflammation, disrupted cellular signalling, muscle atrophy, and fibrosis. To elucidate these structural changes, our study employs advanced Field Emission Scanning Electron Microscopy (FESEM) and Transmission Electron Microscopy (TEM) to examine alterations in the gastrocnemius muscle of Streptozotocin (STZ)-induced T2DM rats. These high-resolution imaging techniques offer pivotal insights into muscle pathology and facilitate the advancement of targeted therapeutic strategies. Method: Our study employed male Sprague-Dawley rats rendered diabetic through a single injection of Streptozotocin (STZ) 65 mg/kg. Following a 30-day period of diabetes maintenance, the rats were euthanized. Gastrocnemius muscle biopsies were subsequently obtained, processed, and subjected to analysis using Haematoxylin and Eosin (H&E), Masson's Trichrome (MT), and histochemical staining techniques. Morphological assessments were conducted utilizing Field Emission Scanning Electron Microscopy (FESEM), while ultrastructural evaluations were performed with Transmission Electron Microscopy (TEM). Results: This study reveals severe pathological effects of hyperglycemia on skeletal muscle in Streptozotocin (STZ)-induced T2DM rats. Significant alterations include extensive myofibers damage and atrophy coupled with pronounced mitochondrial dysfunction. Ultrastructural analysis exposes profound distortions in muscle architecture and substantial deviations from normal morphology. Conclusion: These findings reveal the intricate muscle pathology in Type 2 Diabetes Mellitus (T2DM), providing essential insights for devising targeted interventions to alleviate muscle-related complications and enhance patient outcomes.

Key Words: FESEM – Field Emission Scanning Electron microscopy, TEM- Transmission Electron microscopy, T2DM- Type 2 Diabetic Mellitus

Corresponding Author:
Assoc. Prof. Dr. Yanti Rosli
Biomedical Science Programme
Centre for Toxicology & Health Risk Studies (CORE),
Faculty of Health Science, Universiti Kebangsaan Malaysia

ABSTRACT

MATERIAL SCIENCE (MS)

002-15-MS

SCANNING ELECTRON MICROSCOPY ANALYSIS FOR OXIDATION CHARACTERIZATION ON MUNTIG SIOKAN INGOT

Ni Wayan Sugiarti[1], I Dewa Gede Ary Subagia[2]

Engineering Materials Laboratories, Udayana University, Bukit Jimbaran-Badung Bali 80361, Indonesia

ABSTRACT

A Scanning Electron Microscopy (SEM) analysis has been conducted to characterize the oxide layer on Muntig Siokan ingot, a material prospectively used for traditional keris weapons. The objective of the research is to obtain detailed and accurate information necessary to support the analysis of the corrosion resistance of traditional keris weapon materials caused by chemical oxidation processes. The test samples used were ingots from Muntig Siokan sand after oxidation tests were carried out by reacting K2Cr2O7 and KMnO4 with H2SO4. The elemental composition in the ingot sample is 79.8% Fe, 11.7% C, 7.4% O, and elements such as Si, Cl, K, and Ca as supporting elements. The SEM testing was conducted using JEOL JSM-6510LA equipped with Energy Dispersive X-Ray Spectroscopy (EDS) for chemical composition analysis. Secondary Electron (SE) and Backscattered Electron (BSE) methods with High-Vacuum and Low-Vacuum options were employed to obtain optimal contrast. The analysis results indicate that an oxide layer in the form of Fe2O3 has grown on the sample with a maximum thickness of 45µm. The SEM images clearly show the layer boundary, leaving no room for double interpretation.

Keywords: SEM, EDS, Oxide layer, Muntig Siokan, Keris.

003-4-MS

Sustainable Synthesis of Graphene Oxide Nanoparticles from Waste Tires: Tunable Properties via KMnO4 Concentration

Azra Umairah Anuar[1], Noor Najmi Bonnia[1,2,*], Norashirene Mohamad Jamil[1], and Nor Dalila Nor Affandi[1,2]

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Waste tire is an industrial residue usually disposed of through open burning or ends up in a landfill. However, due to its rich carbon content, it has a good potential as an alternative material to synthesize into nanomaterials. Due to its unique physicochemical properties, graphene oxide nanoparticles (GONPs) was regarded as one of the promising nanomaterials widely used in electronic and healthcare applications. Thus, this study presents a sustainable approach to synthesizing GONPs using recovered carbon black from waste tires via a modified Hummers method with varying concentrations of the oxidizing agent KMnO4 (1g for GO1, 3g for GO2, and 5g for GO3). The impact of KMnO4 concentration on the structural and morphological properties of GONPs was thoroughly examined and characterized by Raman spectroscopy, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), and field emission scanning electron microscope (FESEM). Raman analysis showed D-band peaks at 1360 cm-1, 1358 cm-1, and 1356 cm-1 and G-band peaks at 1619 cm-1, 1586 cm-1, and 1584 cm-1 for GO1, GO2, and GO3, respectively, indicating the successful synthesis of GO. Increasing KMnO4 concentrations enhanced the oxidation degree, as demonstrated by a higher density of oxygen-functional groups on the GONP surface and basal plane. FT-IR analysis revealed that GO3 exhibited a prominent hydroxyl peak, confirming greater oxidation compared to GO1 and GO2. FESEM analysis showed that higher KMnO4 concentrations reduced particle size, with GO3 yielding the smallest (~63.23± 11.0 nm). These findings suggest that GONPs can be sustainably synthesized from waste materials, with tunable properties depending on KMnO4 concentration, offering potential for diverse applications.

004-6-MS

Evaluating the Efficicancy of Industry versus Green Polyurethane: A comparative Study on the Physical, Mechanical and Morphological Properties for Enhancing Grouting Application

Fatin Nur Azmina Mohd Fauzi[1], Noor Najmi Bonnia[1], Razlan Setik[2], Zurianti Abd Rahman[1], Azra Umairah Anuar[1] and Radin Siti Fazrina Nazrah Hizrin[3],

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Polyurethane has become a staple in the construction industry, particularly in grouting applications, due to its excellent adhesive and sealing properties. Industrial polyurethanes derived from petrochemical sources have been widely used. However, growing environmental concerns have spurred the development and use of greener polyurethanes made from renewable sources, incorporating different blowing agents. This article compares industrial polyurethanes and green
polyurethanes using 1,1-dichloro-1-fluoroethane (HCFC 141b) and water as blowing agents, focusing on their physical, mechanical, and morphological properties. The foam reaction times for all types of polyurethane met standard grouting material benchmarks, with cream times ranging from 10 to 20 seconds and rise times exceeding 48 seconds. The castor oil-based water-blown polyurethane exhibited the lowest apparent density but demonstrated significant mechanical strength compared to petroleum-based polyurethane. All polyurethanes showed compression strengths and modulus exceeding the standard values for grouting materials, which are between 30–150 kPa for compression strength and 150–500 kPa for the modulus. FTIR analysis confirmed that all polyurethanes were fully cured, with the expected chemical bonds present. Morphological analysis revealed a uniform cell arrangement across all types, despite differences in cell size, resulting in no gaps between cells and contributing to strong mechanical properties. This study aims to determine which type of polyurethane provides superior performance for the grouting industry, while considering environmental impacts.

005-17-MS

OXIDATION BEHAVIOUR TERNARY Zr-Sn-Mo ALLOYS DOPED WITH Cr AT HIGH TEMPERATURE

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Nuclear power plant has proven to be a reliable, environmentally friendly, and cost-effective source of large-scale electricity and reduce global warming effects. The objectives of this study are to determine and study the effect of Cr on ZrMoSn alloys, to determine microstructure of ternary ZrMoSn alloys and the hardness of ternary Zr-Mo-Sn alloy with different Cr concentration. The study is also to determine the resistance of ternary ZrMoSn alloy to high temperature oxidation environment with different Cr concentration. Synthesis of ternary ZrMoSn zircalloys, were carried out by single arc melting furnace under ultra high purity argon. After melting, several tests were carried out such as characterisation of Zr-Mo-Sn alloy with different Cr concentration by microscop optic, Xray diffraction and SEM-EDS. Micro harness VickersX-Ray Difraction (XRD). The microstructure of the ternary Zr-Mo-Sn alloy with different Cr concentration are consisting of winmanstaten with platelets microstructure. X-ray diffraction of the zircalloys depicted that as cast Zircalloys showed two phases of α and β phase. The micro hardness Vickers testing results show that the addition of Cr to the ZrMoSn ternary is increased the value of its hardness of alloys.EDS examination result show that the composistion of alloy after casting is deviation from the alloy design not signifantly. The addition of Cr in the ZrMoSn alloy improved oxidation resistance at high temperature.

006-10-MS

Enhancing the Repeatability of Capacitive Humidity Sensors Using Porous $LaFe_{0.925}Ti_{0.075}O_3$ Perovskite and Ethyl Cellulose Coating

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Humidity sensors are widely utilized, making their performance enhancement a critical area of research. Significant efforts have been directed towards achieving rapid detection times, minimal hysteresis, and high stability. In our previous study, we successfully developed a capacitive humidity sensor based on porous LaFeO3 perovskite. By incorporating Ti into the perovskite using the sol-gel method, specifically LaFe0.925Ti0.075O3, we achieved a 400% increase in specific surface area through pore formation, resulting in a response parameter of 2094%. This sensor demonstrated an ultra-fast response time of 4.4 seconds and a recovery time of 1.4 seconds, with hysteresis <1% and excellent stability over 28 days at 300 K. However, the sensing material LaFe0.925Ti0.075O3 exhibited poor adhesion to the substrate, leading to detachment issues. Our current research focuses on applying a hygroscopic ethyl cellulose coating as an adhesive agent to enhance the physical durability of the sensing material on the substrate. We also re-evaluated the sensor's performance to assess the significant impact of this coating on the sensor's performance parameters.

007-8-MS

THE EFFECT OF ADDITION OF POLYETHYLENE TEREPHTHALATE (PET) AND ETHYLENE VINYL ACETATE (EVA) PLASTIC WASTE ON THE PHYSICAL PROPERTIES AND CHARACTERIZATION OF POROUS MORTAR USING ACTIVATED FINE SAND MATERIAL AS AGGREGATE

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Abstract. The building and construction industry is a key sector behind the ecological transition as it is one of the main factors responsible for the consumption of natural resources. Thus, in line with the circular economy, the use of waste aggregates in mortars is a possible solution to improve the sustainability of cementitious materials. In this paper, polyethylene terephthalate (PET) from waste bottles was used as aggregate in cement mortar to replace sand aggregates of (0.0%, 2.5%, 5.0%, 7.5%, and 10.0% of the weight of sand) and EVA polymer to replace cement of (0.0%, 0.5%, 1.0%, 1.5%, and 2.0% of the weight of cement) and the sand used was treated with a grain size of 20 mesh retained at 40 mesh and heated at 250oC for 8 hours. Porosity, absorption and density of the proposed innovative mixture were evaluated through physical investigations and characterization of the resulting mortar using XRF, XRD, SEM-EDS. The mixture of dough with PET and EVA polymers at an immersion age of 28 days produced a larger number of pores by 53.01%, an increase in water absorption by 55.37%, and produced a smaller density by 4.54%, when compared to immersion ages of 7, 14, and 21 days, this is due to the volume of recycled plastic aggregate added, the higher the number of pores produced due to the absence of a compact bond between the matrix, cement and recycled plastic with a smooth surface. XRF results show that the mortar is dominated by CaO and SiO2 compounds, the phases formed are calcite (CaCO3) and quartz (SiO2) while SEM results show the formation of C-S-H bonds. The main results of this study indicate the feasibility of reusing PET waste aggregates as a substitute for natural aggregates in mortar is expected to have an effect on the flexural strength of the resulting mortar and the activated sand will produce a fairly large number of pores.

Keywords: PET, EVA. Mortar, cement, polymer

010-31-MS

Modifying Carbon Dots for Enhanced Photothermal Performance in Solar-driven Water Evaporation

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Abstract

As a new class in carbon nanomaterials, carbon dots (CDs) hold great potential for solar driven water evaporation due to their low cost, non-toxicity, high solubility, low thermal conductivity, and tunable optical properties. However, CDs mainly absorb light in the ultraviolet range, with limited absorption in the visible spectrum, which restricts their efficiency in harvesting solar energy. In this study, we modulated the properties of CDs by controlling their structure and surface functionalities through varying the molar ratio of citric acid and urea precursors. Using a microwave irradiation technique -- simple, fast, and highly scalable – we discovered that increasing the nitrogen content expanded the absorption spectrum into the visible region. This was attributed to the introduction of more functional groups on the CDs' surface, which reduced the band gap, as confirmed by both X-ray photoelectron spectroscopy and theoretical calculation. TEM analysis revealed that the CDs have a quasi-spherical shape with particle sizes below 10 nm. HRTEM images showed the presence of both crystalline and amorphous regions, which was further supported by the scanning electron diffraction (SAED) pattern. When used as photothermal materials in a volumetric solar evaporator, the CDs achieved an impressive evaporation efficiency of up to 70% and a volumetric evaporation rate of 1.11 kg m^{-2} h^{-1} under 1 sun illumination, superior to traditional bulk water heating methods. Additionally, the CDs demonstrated excellent durability and stability, maintaining a consistent evaporation rate over 10 days without significant degradation in optical and photothermal properties. This study highlights a promising approach for designing and functionalizing CDs with controllable optical and photothermal characteristics, making them highly effective for solar evaporation system.

Keywords: carbon dots, solar evaporation, photothermal, nanostructure, TEM, HR-TEM.

012-16-MS

Synthesis of $Ce_{1-x}Mn_xO_2$ Solid Solution Nanoparticles as a Supercapacitor Electrode Material

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ABSTRACT

The utilization of rare earth metal-based electrodes as starting materials continues to be developed. However, poor conductivity, low specific surface area, small cycle stability, and low oxygen evolution reaction (OER) overpotential of CeO_2 may limit its application as supercapacitor electrode material. The electrochemical properties of CeO_2 can be easily improved by doping or composite metal ions. The substitution of Mn ions is appropriate because it has various oxidation states (+2, +3, +4, +6, and +7), which provides a strong redox ability between the $Mn^{2+}/Mn^{3+}/Mn^{4+}$ and Ce^{3+}/Ce^{4+} (Ce-O-Mn) ion pairs. Solid solution $Ce_{1-x}Mn_xO_2$ has been successfully synthesized using the polymerizable complex method which will
be studied for its characteristics and performance as a supercapacitor electrode material using a variety of Li_2SO_4, Na_2SO_4, and KOH electrolytes. The results revealed that the substitution of Mn ions was able to increase the specific surface area, pore diameter, and pore volume significantly with type-IV N_2 adsorption-desorption isotherm and H3 hysteresis loop in accordance with IUPAC classification. Surface topography from TEM analysis shows nanosphere particles and the addition of mmol ratio of manganese to CeO_2 has an effect on decreasing d-spacing which corresponds to *hkl* in XRD analysis as well as elemental mappings
showing uniform distribution of Ce, Mn, and O. The diffraction pattern of the synthesis results confirmed CeO_2 with a cubic fluorite crystal system that matches the COD Number 7217885 data and tetragonal Mn3O4 which matches the COD Number 9001302 data. XPS was used to confirm and analyze the valence states of cerium, manganese, and oxygen. The electrochemical performances of CV, GCD, and EIS have been investigated using different electrolyte variations. The highest redox activity occurs in KOH electrolyte with a capacitance value of 219.51 F g^{-1} at 0.5 A g^{-1}, with power density and energy density values of 88.10 Wh kg^{-1} and 810 W kg^{-1}. EIS results show that CeO2 material from each type of electrolyte has a lower Rct value than $Ce_{1-x}Mn_xO_2$, i.e. 1.35 Ω/cm^2 for KOH, 6.79 Ω/cm^2 for Na_2SO_4, and 14.97 Ω/cm^2 for Li_2SO_4.

Keywords: Cerium Oxide, Supercapacitor Electrode, Manganese Oxide, Nanoparticles, Solid solution.

013-9-MS

"Development and Photocatalytic Performance of Poly (Vinyl Alcohol)-Based Hydrogel with Graphene/PANI and ZnO Hybrid Nanocomposite for Organic Dye Degradation"

Vivi Purwandari[1], Marpongahtun[2], Mahyuni Harahap[1], Isnaeni[3], Fatimah[4], M.Z. Akbari[1]

This research aims to develop photocatalytic material based on poly (vinyl alcohol) hydrogel combined with graphene/PANI and ZnO (H-GPZ). Graphene was synthesised from sub-bituminous coal, encapsulated with PANI using In-situ polymerisation technique. ZnO nanoparticles were synthesised from zinc nitrate hexahydrate via hydrothermal method. Hybrid
nanocomposite of Graphene/PANI and ZnO into Poly (vinyl alcohol) filler to form H-GPZ hydrogel with addition of 2% gltaraldehyde as crosslinker agent. This material is expected to have better photocatalytic ability and can be used in the degradation process of organic pollutants, especially dyes such as methylene blue and methylene orange. The results showed that the H-GPZ material has high photocatalytic activity, with a degradation effectiveness of 97% for methylene blue and 85% for methylene orange after repeated use. UV-Vis spectroscopy testing and thermal analysis (TGA) showed good thermal stability of the material, even after repeated use. Morphological analysis of the hybrid composite showed that graphene/PANI and ZnO formed a porous material that was evenly distributed.

015-8-MS

Analysis of lead content in cocoa products using nanoparticle-enhanced laser induced breakdown spectroscopy (LIBS)

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Abstract. Cocoa is consumed by millions of people around the world. The quality control of cocoa is an important matter to ensure safe consumption of cocoa products. The contamination of lead (Pb), which is a toxic heavy metal, in cocoa is a major public health concern. Traditional heavy metal analysis for cocoa products usually requires extensive sample preparations. This poses a problem for cocoa farmers who has limited resources Therefore, a simple and accurate detection of lead content in cocoa is crucial to maintain the quality control of cocoa products. We report an application of laser induced breakdown spectroscopy (LIBS) to analyze lead content in cocoa products. The objective of this research is to build LIBS systems for real-time in-situ lead measurements. The calibration curves of measurements were built using a series of cocoa samples containing different concentrations of lead (Pb). The limits of detection of lead were determined to be around 10 mg/kg. The results indicate that LIBS has potentials to be used for real-time in-situ measurements to detect lead elements in cocoa products.

020-22-MS

Realization of 2-2 Elpasolites using Atomic Resolution STEM and Degradation assisted XRD

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In the previous decade, a lot of research has been done in the area of halide perovskite materials which has led them to be used in all different types of photonic applications. The low dimension crystals of this structure have also shown a lot of promise in quantum photonic devices. We synthesized perovskite Quantum Dots of composition Cs2PbSnI6 for photonic applications in Near Infra-red emission range. The atomic arrangement of B site cations in this composition dictated if the crystal structure formed was a double perovskite (elpasolite) or not. All the elpasolites reported in literature have different oxidation states of the two cations at the B site (+1, +3) for example in Cs2AgBiBr6 , where Ag is +1 and Bi is +3. But in our case, both the B site cations, Pb and Sn, are in +2 state. This increased the chances of having a disordered crystal structure where the B site cations do not follow any order. To verify the crystal structure a few different characterization methods were used, such as X- Ray Diffraction (XRD) or Selected Area Electron Diffraction (SAED) in Transmission Electron Microscope (TEM). But the active perovskite phase, the black phase, was only metastable at room temperature, any action of air, moisture, electron beam and solvent can lead to phase transition to inactive (yellow) phase. Also, the low signal to noise ratio in XRD and EDX led to inconclusive results in nanocrystals as small intensity peaks were not seen. Furthermore, the crystals formed were seen to be cubic in TEM and were always found to land on one of the facets. Since the crystal structure is also cubic, this led to presence of only (100) and (110) reflections and their multiples in both XRD and SAED patterns. The use of solvent also triggered coagulation of nanoparticles and formation of nanowires. Further the use of solvent also led to carbon contamination under electron beam. Due to a combined issue of all the degradation mechanisms, all the measurements were done in air-free conditions. The crystal structures of all possible arrangement of B site cations for both black and yellow phases were simulated using DFT. These structures were then used for Le-Bail refinement and refined with Rietveld refinement. These refined crystal structures were then used for matching with SAED ring pattern of ensemble of quantum dots. XRD was carried out in both air-free and ambient conditions to identify the peaks of interest, which indicated the possibility of ordered structure. Also, atomic resolution STEM images of multiple orientations of the crystals were carried out using high tiltilng holder to confirm the ordered double perovskite crystal structure. The resulting methodology for distinction between ordered and disordered structures can be extended to many more material systems. The possibility of 2-2 elpasolites mentioned in this work would help in understanding the s ructure and properties of wide range of materials under the umbrella of Perovskites.

KEYWORDS: Perovskites, Spectroscopy, Crystallographic structure.

021-70-MS

Synthesis and Characterisation of Nanophase Sr and Zn Co-substituted Hydroxyapatite by Precipitation Method

Nendar Herdianto, Riesma Tasomara, Olivia, Winda Rianti, Yose Fachmi, Nawa Yunia Ekariyani and Dwi Gustiono

Abstract

Hydroxyapatite (HA) is the main material that makes up bones. HA can be made directly using commercial chemicals (calcium and phosphate) or limestone as a source of calcium. Artificial HA does not contain minor chemical elements such as fluorine, iron and zinc which support bone integration and growth. In this research, HA was synthesized which was substituted with zinc and strontium ions (ZnSrHA) using the precipitation method. Then, ZnSrHA was characterized comprehensively using the analytical methods X-Ray Diffraction (XRD), Fourier Transform Infrared (FTIR), Field Emission Scanning Electron Microscopy (FESEM) equipped with Energy Dispersive X-ray (EDX) and High Resolution Transmission Electron Microscopy (HRTEM). The characterizations shows that Zn ions and Sr ions have succeeded in substituting Ca ions in the HA structure.

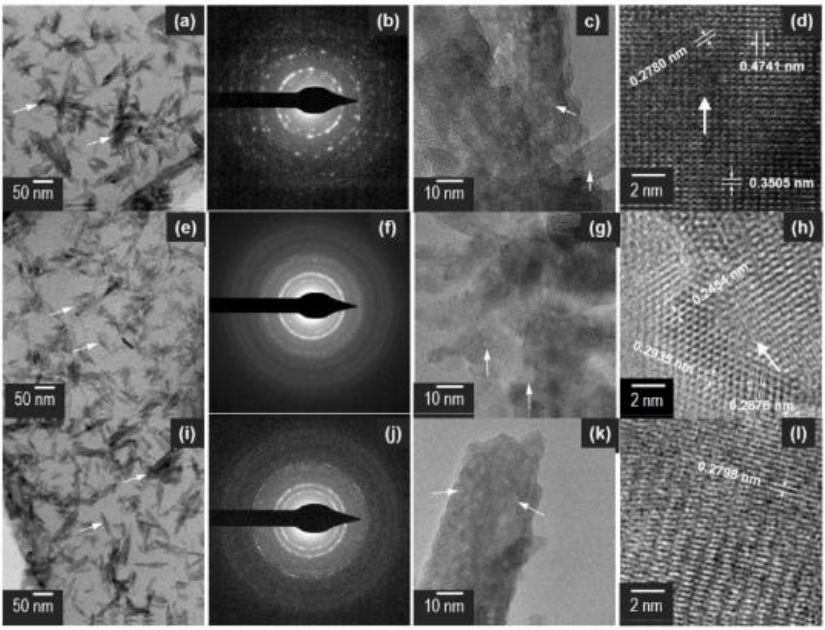

Figure 1. TEM images of the Hydroxyapatite substituted by Zn and Sr ions at the concentration of 0% (a-d), 2.5% (f-h) and 5% (i-l)

ABSTRACT

LIFE SCIENCE (LS)

001-5-LS

PATHOGENICITY OF ENTOMOPATHOGENIC FUNGUS (Metarhizium anisopliae) AGAINST ADULTS OF GOLDEN APPLE SNAILS (Pomacea canaliculata)

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Golden Apple Snails (GAS), Pomacea canaliculata are significant pests in rice fields and other agricultural areas. Their rapid reproduction and voracious feeding habits lead to substantial crop damage, impacting food security and farmer incomes. Traditional control methods, such as chemical molluscicides, pose environmental and health risks, necessitating sustainable alternatives. This study investigates the pathogenicity of the entomopathogenic fungus Metarhizium anisopliae against adult GAS. The effectiveness of a spore conidial suspension and a nano-formulated emulsion of M. anisopliae were compared under laboratory conditions. The study involved conducting pathogenicity tests using different spore concentrations (105, 106, 107, 108 spores/mL) and monitoring GAS mortality and behavioral changes over a 14-days period. Results demonstrated that the nano-formulated emulsion achieved a higher and more rapid mortality rate compared to the spore conidial suspension. By the 14th day, the nano-formulated emulsion had killed 91.11% of the snails, while the spore conidial suspension had a mortality rate of 86.67%. The nano-formulated emulsion also demonstrated improved stability and delivery efficiency, suggesting its potential for field application. These findings indicate that M. anisopliae, especially in its nano-formulated form is a promising biological control agent for managing GAS populations. Further research is recommended to optimize field application and evaluate long-term impacts on non-target species.

008-3-LS

High-Resolution Analysis of Roof Cross-Section: Insights into Cellular Structure Using Cryo-Focused Ion Beam (Cryo-FIB)

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Abstract

This research focuses on the analysis of the roots from Orchidaceae using Cryo-Focused Ion Beam (Cryo-FIB) technology. Result indicated the detailed cellular, including the polygonal pores and cellular compartments across various layers of the roots structure (Figure 1). The Cryo-FIB preparation technique allows for the preservation of the root's morphology, mycorrhizal association, minimizing the damage, and deformation. This research result could be useful for study into the root structural organization, which are important for understanding this orchid flower plant transport mechanism. Further, it will have potential implications for material and agricultural research to study root functionality at the microscopic level.

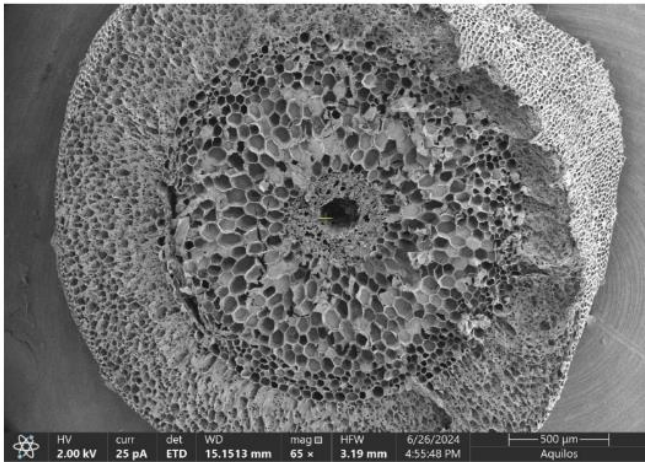

Figure 1. Cryo-FIB image of the root Acriopsis liliifolia

016-12-LS

Lamella milling of biological cells for Cryo Electron Tomography with Lift-Out Technique Using Dual-Beam Cryo-FIB

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ABSTRACT

Lift-Out technique in cryogenic condition is the most innovative method in preparation of TEM lamella for Cryo Electron Tomography (Cryo-ET). In this work Lift-Out technique using Dual-Beam Cryo-FIB Aquilos2 for lamella preparation of cells and tissue with the thickness of less than 200nm is presented. The preparation consists of a high pressure freezing for tissue and plunge freezing in liquid ethane at temperature below -170 °C. Before milling the sample surface was coated with a ca. 5 um thick polymer base material to protect the material surface from the abrasive ion beam and sputtered with Pt to get the surface conductivity. The lamella with ca. 16x10x5 um in size and a so called chunk from grid material with similar size were cut out of the material using focused Ga-ion beam, which is then picked up using the tip of a very sharp tungsten neddle one on the top of another as shown by the picture below. Both were welded on the tip of the three post omni probe TEM grid. The lamella is subjected to polishing at much low ion current to get the final TEM analysis suitable thickness. During the hole process the sample was cooled at -180 °C.

Keywords: Cryo-ET, Cryo-lift out, Dual-Beam Cryo FIB Aquilos2, TEM Lamella.

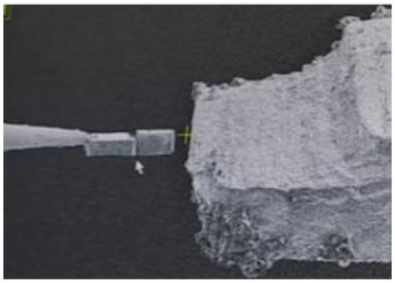

Fig. the lamella on a chunk positioned on top of the three post TEM grid.

017-3-INS

Ultramicrotomy Methods in Biological Specimen Preparation for Transmission Electron Microscopy Analysis

Haidar Sitie Rafidah[1], Bramantyo Wikantyoso[2], Amir Hamzah[1], Ahmad Novi Muslimin[1], Pascale Ramadhan[1], Adinda Fitri Salsabila[1], Anrey Simanjuntak[1], and Arbi Dimyati[3,a)]

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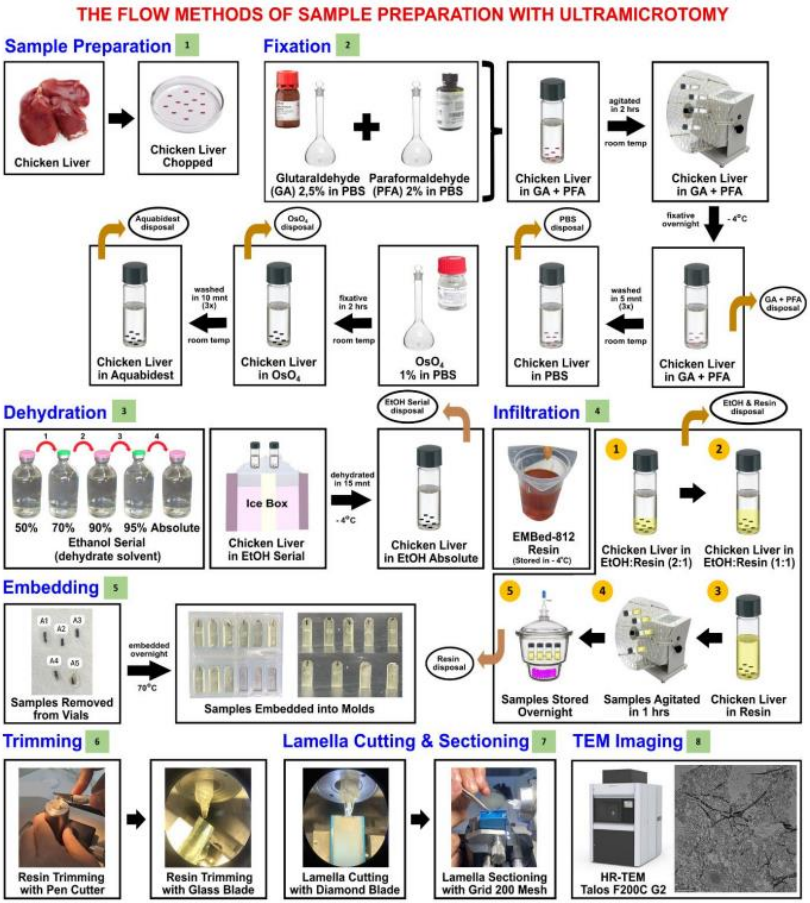
ABSTRACT

Ultramicrotomy is a special preparative method for characterization using transmission electron microscopy (TEM). It was mainly used for cutting an ultrathin sectioning of a biological specimen (lamella). The methods of this technique are fixation, dehydration, embedding, trimming, and lamella sectioning at room temperature. In this work, a biological sample of chicken liver was prepared using ultramicrotomy and the liver tissue was captured in high-resolution transmission electron microscopy (HRTEM) Talos F200C G2. Ultrathin sectioning of chicken liver tissue with ultramicrotomy provided a good feature of HRTEM imaging results. Fixation and dehydration are important in ultramicrotomy methods because the solvents that we used (glutaraldehyde, paraformaldehyde, osmium tetroxide, and ethanol series) can keep the liver tissue in the fixed ambient condition. To get better contrast the lamella was a negative stained using uranyl acetate. Based on the HRTEM results, we can explore the function of the diamond blade for lamella sectioning at room temperature and discover the properties of chicken liver tissue. It was concluded that ultramicrotomy can be used as a preparative ultrathin biological sample method for HRTEM analysis with relatively good results.

Keywords: Ultramicrotomy, High-Resolution Transmission Electron Microscopy, Talos F200C, Diamond Blade, Chicken Liver


THE FLOW METHODS OF SAMPLE PREPARATION WITH ULTRAMICROTOMY
Sample Preparation 1
Chicken Liver
Chicken Liver Chopped
Fixation 2
Glutaraldehyde (GA) 2,5% in PBS
Paraformaldehyde (PFA) 2% in PBS
Chicken Liver in GA + PFA
agitated in 2 hrs
room temp
Chicken Liver in GA + PFA
fixative overnight
- 4°C
GA + PFA disposal
Chicken Liver in GA + PFA
washed in 5 mnt (3x)
room temp
Chicken Liver in PBS
PBS disposal
fixative in 2 hrs
room temp
OsO4 1% in PBS
OsO4 disposal
Chicken Liver in OsO4
washed in 10 mnt (3x)
room temp
Chicken Liver in Aquabidest
Aquabidest disposal
Dehydration 3
50%
70%
90%
95%
Absolute
Ethanol Serial (dehydrate solvent)
Ice Box
Chicken Liver in EtOH Serial
dehydrated in 15 mnt
- 4°C
Chicken Liver in EtOH Absolute
EtOH Serial disposal
Infiltration 4
EMBed-812 Resin
(Stored in - 4°C)
Chicken Liver in EtOH:Resin (2:1)
Chicken Liver in EtOH:Resin (1:1)
EtOH & Resin disposal
Embedding 5
Samples Removed from Vials
embedded overnight
70°C
Samples Embedded into Molds
Resin disposal
Samples Stored Overnight
Samples Agitated in 1 hrs
Chicken Liver in Resin
Trimming 6
Resin Trimming with Pen Cutter
Resin Trimming with Glass Blade
Lamella Cutting & Sectioning 7
Lamella Cutting with Diamond Blade
Lamella Sectioning with Grid 200 Mesh
TEM Imaging 8
HR-TEM Talos F200C G2

018-20-INS

Automatic Lamella Milling for Cryo in-situ Tomography Saccharomyces cerevisiae using Dual-Beam Cryo-FIB Aquilos2

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1 Laboratory of Cryogenic Electron Microscope, Directorate of Laboratory Management, Research Facilities, and Science and Technology Park, National Research and Innovation Agency (BRIN), Indonesia,
2 Research Center for Technology of Nuclear Radiation Analysis, National Research and Innovation Agency (BRIN),
3 Thermo Fisher Scientific, Singapore,
4 Research Institute for Sustainable Humanosphere, Kyoto University, Japan,
5 Research Center for Applied Microbiology, National Research and Innovation Agency (BRIN).

Saccharomyces cerevisiae is the most studied unicellular eukaryote and plays a crucial role in various biotechnological applications. Therefore, understanding the internal structure of S. cerevisiae by means of cryo-electron tomography (cryo-ET) is highly valuable. However, due to its size of more than 1 um, S. cerevisiae cells must be prepared to get a thin lamella which is electron transparent. In this work a new preparation technique called lamella milling of biological sampel such as S. cerevisiae is described. The preparation process begins with the vitrification process using the back-blotting technique, and plunge freezing in a liquid ethane allowing an effective preservation of the cells. The vitrified samples were then milled using a Dual-Beam Cryo-FIB Aquilos2 equipped with an Ga-ion beam mill system to obtain lamellae with the final thickness approximately 200 nm or less. Maps and AutoTEM Cryo software were used during the milling process to produce multiple lamellae simultaneously. During the milling process the sample was keep at temperature -180 °C. The lamellaenwere subsequently observed using an Energy filtered Krios G4 300 kV electron microscope. The Screening results using the Krios G4 300 kV demonstrated that S. cerevisiae lamellae with a thickness of 180-200 nm were suitable for cryo-ET analysis.
Key words: Lamella, Milling, Dual-Beam Cryo-FIB Aquilos2, Cryo-ET, Krios G4.

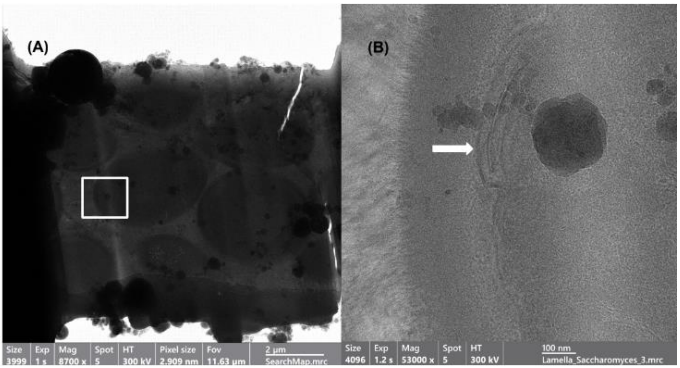

Fig. 1. Two example results of the lamella on Tomo software presets. (A) Low-dose cryo-TEM search map of the lamella. (B) Enlarged section of the same summed tomographic slices (dashed box in A) where the golgi apparatus is visible (white arrow). Scale bar, 100 nm.

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FIB-SEM Technique for Digital Rock Physics on a Nanoscale

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Research related to the analysis of the characterization of hydrocarbon reservoir rocks in Digital Rock Physics (DRP) using 3D reconstruction can now be carried out to nanoscale resolution by using FIB-SEM. FIB-SEM (Focused Ion Beam-Scanning Electron Microscopy) combines the Exceptional performance of SEM, providing very high-resolution surface/morphology images of samples with atomic-scale precision milling using the FIB system. This technique allows for the collection of 2D image slices (sequential image stack) with very high resolution and thickness in the order of nanometers. The research demonstrates 3D reconstruction of raw data FIB-SEM to enable high representativeness of pore rocks characterization on a nanoscale. A micro-plug of a tight reservoir rock was used as a sample with a 2.75 mm diameter and a height of 2 mm. The sample was embedded into a resin and polished to smoothen the surface. The FIB-ESM technique produced a stack of image datasets with an isotropic resolution of 25 nm. The dataset needed to be processed before it could be used in the DRP technique to measure the physical properties of the sample. Several steps are carried out for the post-processing part, i.e., 3D-crop to focus the interest area, alignment data processing, gray value and brightness correction, curtaining effect reduction, and image filtering. Finally, the 3D FIB-SEM image's nanostructure characterization enables us to obtain high-accuracy characteristics and makes it possible to evaluate hydrocarbon reservoirs on a more detailed scale. This sample exhibited a total porosity of 5.435%, with 3.923% connected pores and 0.859% closed pores. The high resolution achieved in this study revealed pore characteristics that are typically undetectable using conventional methods, opening new avenues for investigating tight reservoir rocks. Figure 1 shows a 3D FIB-SEM image of a tight reservoir rock sample after data post-processing. Figure 2 is a visualization of the pore structure of the sample, (red=connected pores, green=isolated pores, yellow=unconnected pores).

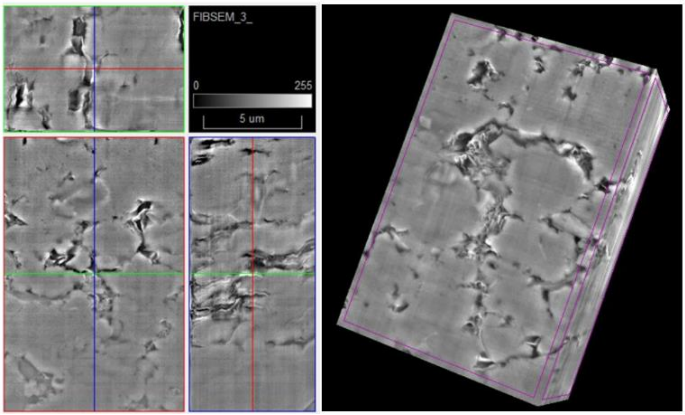

Figure 1. 3D FIB-SEM image of tight reservoir rock after post-processing.

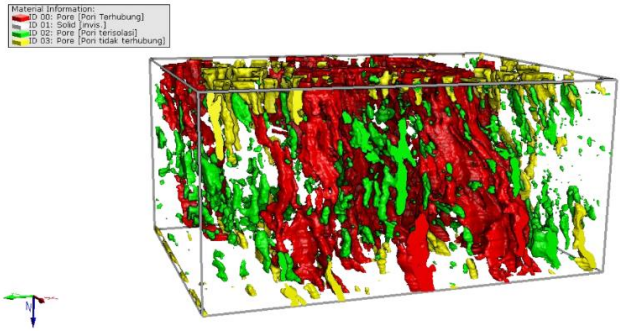

Figure 2. Pore structure from 3D FIB-SEM images of tight reservoir rock.