National Battery Research Institute

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ICB REV

Program Book

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22-24 June 2021

WELCOME FROM CHAIRS

Dear all participants,

Welcome to International Conference on Battery for Renewable Energy and Electric Vehicles (ICB-REV) 2021. This conference becomes one of the most important event to discuss the current issue of the sustainable clean energy in the world. The ICB-REV 2021 will bring together the experts on battery technology from all over the world, the researchers from university and institution, practitioners from industry, and other stakeholders that related to this issue.

The conference is organized by the National Battery Research Institute (NBRI) in collaboration with the Queen Mary University of London, Material Research Society Indonesia (MRS-INA), and International Union of Material Research Societies (IUMRS). This conference is a part of the implementation of the Global Challenges Research Fund (GCRF) 2020-2021.

The main interest of ICB-REV 2021 is focused on advanced battery technology from raw materials to cell fabrication, energy storage for renewable energy, and electric vehicles battery and charging station. This conference invites 30 distinguished scientists including honorable nobel prize winner on lithium-ion battery 2019. It is expected that ICB-REV 2021 can deliver the output and outcome that will be beneficial for all parties. Therefore, the target of sustainable development goals especially on clean energy and climate change will be achieved.

Due to the present situation of COVID-19, the format of presentation will be conducted online. We sincerely hope that you will enjoy the ICB-REV 2021 and have a pleasant experience.

Prof. Dr. rer. nat. Evvy Kartini
Chair and Founder of National Battery Research Institute (NBRI)

Prof. Alan J Drew
Vice Chair and Co-Founder of National Battery Research Institute (NBRI)

GENERAL INFORMATION

National Battery Research Institute (NBRI) is a platform that brings together scientists, academicians, industry partners, the government and all stakeholders that focus on battery technology for both Electric Vehicles and Renewable Energies. The NBRI was supported by the UK Government's Global Challenge Research Fund (GCRF) 2020-2021. Since it began its activities in January 2020, NBRI has performed various activities such as Focus Group Discussion (FGD), NBRI Lectures, Millenials Talks, and Joint Webinars with diverse institutions, universities, industries, communities, national and international scope. One of the prestige program is International Conference on Battery for Renewable Energy and Electric Vehicles (ICB-REV) 2021.

The purpose of the conference is to gather all the experts on battery technology from all over the world to present their recent works and share their knowledge to all participants. This event is also expected to open international networking in the fields of energy storage and renewable energy. This should be accomplished by the presence of invited world-class speakers and international participants for the scientific program to bring the impact of this battery technology. This event will invite the honorable Nobel prize winner on lithium-ion battery 2019. Furthermore, the industries are welcome to promote their products.

TIME AND VENUE

Time: 22-24 June 2021
Venue: Indonesia (Conducting Online)

THEME

The theme for the **International Conference on Battery for Renewable Energy and Electric Vehicles (ICB-REV) 2021** is ***"Innovation in advanced battery technology for e-mobility and sustainable clean energy."***

MAIN TOPICS OF SYMPOSIA

1. Advanced battery technology from raw materials to cell fabrication.
2. Energy storage for renewable energy (solar, wind, biomass, etc)
3. Battery electric vehicles, battery swap, and charging station.
4. Other related topics (policy, regulation, standardization, industry, etc)

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TENTATIVE AGENDA OF ICB-REV 2021

Sessions	Time	(Day-1) Tuesday, June 22nd		Time	(Day-2) Wednesday, June 23rd			Time	(Day-3) Thursday, June 24th	
Morning Session (GMT+7)	08.00-08.10	Opening by Master of Ceremony		08.20-08.30	Opening by Master of Ceremony			08.20-08.30	Opening by Master of Ceremony	
	08.10-08.20	Prof. Dr. rer. nat. Evvy Kartini (*Founder of NBRI and President of MRS-INA*)		08.30-09.10	Prof. Jun Liu (*Director of the Innovation centre for Battery 500 Consortium*)			08.30-09.10	Prof. Dr. Ir. Anhar Riza Antariksawan (Head of BATAN, Indonesia)	
	08.20-08.30	Prof. B.V.R. Chowdari (*Director of Regional IUMRS*)		09.10-09.50	Ir. Agus Tjahajana (*President Commissioner of IBC*)			09.10-10.00	Yi Ke, Ph.D. (*Energy Storage Program Manager – New Energy Nexus Global*)	
	08.30-09.10	Dr. Laksana Tri Handoko (*Chairman of National Research and Innovation Agency, Republic of Indonesia*)		09.50-10.30	Prof. Dr. rer. nat. Evvy Kartini (*Founder of National Battery Research Institute and President of MRS-INA*)			10.00-10.45	Prof. Ying Shirley Meng (*Research Award of International Battery Material Association 2019*)	
	09.10-09.50	Prof. Tim White (*President of MRS-Singapore*)		10.30-10.35	Room Transition			10.45-10.50	Room Transition	
	09.50-10.00	Prof. John B. Goodenough (*Nobel Prize Winner in Chemistry 2019*)		10.35-11.05	Parallel Session			10.50-11.20	Parallel Sessions	
	10.00-10.05	Room Transition								
	10.05-10.35	Parallel Sessions			**Battery** Prof. Stefan Adams (*NUS, Singapore*)	**Renewable Energy** Diyanto Imam (*Program Director of New Energy Nexus, ID*)			**Battery** Dr. Alexey Glushenkov (*ANU, Australia*)	**Renewable Energy** M. Firmansyah, S.E. (*CEO at INFIEN ENERGI*)
		Battery Prof. Takashi Kamiyama (*Spallation Neutron Source, China*)	**Renewable Energy** Prof. Dr. M. Zaki Mubarok (*ITB*)							
	10.35-12.00	Oral Session		11.05-12.00	Oral Session			11.20-12.00	Oral Session	
	12.00-13.00	Break Session								
Afternoon Session (GMT+7)	13.00-13.15	Prof. Colin Gareth Bailey (*President and Principal of QMUL*)		13.00-13.40	Prof. Rodrigo Martins (*President of IUMRS and European Academy of Science (EurASc)*)			13.00-14.00	Prof. Laurence Hardwick (*Director of the Stephenson Institute for Renewable Energy, University of Liverpool*)	
	13.15-14.00	Prof. Alan J Drew (*Co-founder of NBRI*)								
	14.00-15.00	Prof.Dr.Eng. Eniya Listiani Dewi, M.Eng (*Deputy for Information, Energy, and Materials Technology of BPPT*)		13.40-14.20	Dr. Ir. Taufik Bawazier, M.Si. (*General Director of ILMATE The Ministry of Industry, Indonesia*)			14.00-14.50	Dr. Ana Jorge Sobrido, Ph.D. (*UKRI Future Leaders Fellow, QMUL*)	
	15.00-15.05	Room Transition		14.20-14.25	Room Transition			14.50-14.55	Room Transition	
	15.05-15.35	Parallel Sessions		14.25-14.55	Parallel Sessions			14.55-15.25	Parallel Sessions	
		Battery Prof. Dr. Vanessa Peterson (*ANSTO, Australia*)	**Electric Vehicles** Prof. Dr. Santi Maensiri (*President of MRS-Thailand*)		**Battery** Dr. Haznan Abimanyu (*LIPI*)	**Battery (2)**	**Electric Vehicles** Prof. M. Nizam (*Coordinator of National Research Priority*)		**Battery**	**Electric Vehicles** Dr. M. Mustafa Sarinanto (*BPPT, Indonesia*)
	15.35-16.30	Oral Session		14.55-16.30	Oral Session			15.25-16.30	Oral Session	
								16.30-17.00	**Closing Remarks**	

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DAY 1

ICB REV

Topic

Battery, Renewable Energy, and Electric Vehicles

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Day-1 (Tuesday, June 22nd 2021)

Session	Time	Code	Estimation	Speaker	Topic	Affiliation
Morning Session (GMT+7)	08.00-08.10	**Opening by Master of Ceremony**				
	08.10-08.20	OP	10’	Prof. Dr. rer. nat. Evvy Kartini		Founder of NBRI and President of MRS-INA
	08.20-08.30	OP	10’	Prof. B.V.R. Chowdari		Director of Regional IUMRS
	08.30-09.10	PL	40’	Dr. Laksana Tri Handoko		Chairman of National Research and Innovation Agency, Republic of Indonesia
	09.10-09.50	PL	40’	Prof. Tim White	Battery Research at NTU for a Sustainable Future	President of MRS-Singapore
	09.50-10.00	PL	10”	Prof. John B. Goodenough	The Role of Lithium Battery Technology	Nobel Prize Winner in Chemistry 2019
	10.00-10.05	**Room Transition**				
	10.05-12.00	**Battery**				
		KN	30’	Prof. Takashi Kamiyama	Neutron Probe for Battery Development	Spallation Neutron Source, China
		INV	25’	Lukman Noerochim, Alvalo Toto Wibowo, Widyastuti Widyastuti and Achmad Subhan	Direct Double Coating of Carbon and Nitrogen on Fluorine-Doped Li4Ti5O12 as An Anode for Lithium-Ion Battery	ITS, ITS, ITS, LIPI
		INV	25’	Sudaryanto, Evvy Kartini, Muhammad Fakhrudin, Moch Setyadji, and Kurnia Trinopiawan	Utilization of Rare-Earth Elements for Performance Improvement of Lithium Battery Materials	BATAN
		OR	15’	Asih Kurniasari, Ariono Verdianto, Iyan Subiyanto and Chairul Hudaya	The Effects of Nitrogen Gas Flow Rate on Physical Characteristic of Corncob Activated Carbon as Active Electrode Material of Lithium-Ion Capacitors	B2TKE BPPT, KIST School-Korea University of Science and Technology, Korea Institute of Energy Research, Universitas Indonesia-Universitas Teknologi Sumbawa
		OR	15’	Rizka Ayu Puspita, Evvy Kartini, Muhammad Fakhrudin, Widi Astuti and Slamet Sumardi	The Study of (Ni, Mn, Co)SO4 as Raw Materials for NMC Precursor by X-Ray Fluorescence (XRF)	NBRI, BATAN-NBRI, BATAN, LIPI, LIPI
		Renewable Energy				
		KN	30’	Prof. Dr. M. Zaki Mubarok	Separation of Nickel and Cobalt by Selective Oxidative Precipitation Using Ozone Gas for Preparation of Cathode Materials Used in NMC Lithium Ion Battery	Institute of Technology Bandung
		INV	25’	Zainal Arifin and Linda Fitri	Implementation of Battery Energy Storage System at Cirata PV Solar Floating for Reducing the Electricity Cost Production on JAMALI Grid	PT PLN (Persero), Insitut Teknologi PLN
		OR	15’	Cipta Panghegar Supriadi, Adit Triwiguno, Muhammad Firmansyah and Evvy Kartini	Techno Economic Analysis of Public Solar Street Light with Integrated Monitoring System For Parking Area	INFINITI ENERGI INDONESIA, INFINITI ENERGI INDONESIA, INFINITI ENERGI INDONESIA
		OR	15’	Ganesh Eega, Sai Ram Pavuluri, Eswar Sai Kiran Reddy Gangireddy, Pavan Kumar R and Mohit Kumar Goel	Automatic solar tracking for Energy Management	Lovely Professional University, India

	12.00-13.00	**Break Session**				
Afternoon Session (GMT+7)	13.00-13.15	OP	15’	Prof. Colin Gareth Bailey		President and Principal of QMUL
	13.15-14.00	PL	50’	Prof. Alan J Drew		Co-founder of NBRI
	14.00-15.00	PL	60’	Prof.Dr.Eng. Eniya Listiani Dewi, M.Eng	Energy Storage for Green Economy	Deputy for Information, Energy, and Materials Technology, Agency for the Assessment and Application of Technology (BPPT)
	15.00-15.05	**Room Transition**				
	15.05-16.30	**Battery**				
		KN	30’	Prof. Dr. Vanessa Peterson	Advanced Neutron Characterization of Rechargebale Battery Systems	Australian Nuclear Science and Technology Organisation (ANSTO), Australia
		INV	25’	Teguh Yulius Surya Panca Putra, Takashi Saito, Yustinus Purwamargapratala, Sudaryanto Sudaryanto, Evvy Kartini, Bambang Sugeng, Rina Kamila, Muhammad Fakhrudin, Nur Ika Puji Ayu, Masato Hagihala and Takashi Kamiyama	Synthesis and Structural Study of Li4Ti5O12/SnO2 Composite as Anode Materials for Lithium Ion Batteries	BATAN, KEK, BATAN, BATAN, BATAN, BATAN, BATAN, BATAN, KEK, KEK, KEK
		OR	15’	Muhammad Nizam Fanani, Evvy Kartini, Muhammad Fakhrudin, Rizka Ayu Puspita, Agus Sudjatno	The Effect of Stirring Time on Synthesis of NMC-622 Cathode Active Material with Oxalate Coprecipitation	STTN-BATAN, BATAN-NBRI, BATAN, NBRI, BATAN
		OR	15’	Fajrul Mawaddah, Evvy Kartini, Rizka Ayu Puspita, M Fakhrudin and Agus Sudjatno	The Effect of Milling Time and Rotation Speed on Li-NMC Cathode Performance	STTN-BATAN, BATAN-NBRI, NBRI, BATAN, BATAN
		Electric Vehicles				
		KN	30’	Prof. Dr. Santi Maensiri		President of MRS-Thailand
		INV	25’	Susanto Sigit Rahardi and Evvy Kartini	Battery Swap Indonesia National Standard Concept	B4T, NBRI
		OR	15’	Muhammad Alfawza Biljannah and Evvy Kartini	Design of Battery Pack for Electric Bike	Diponegoro University, NBRI-BATAN
		OR	15’	Abi Nur Hakim, Ubaidillah and Muhammad Nizam	Multipe Coil Design on Eddy Current Brake Type Half Circle Slotted	UNS
		OR	15’	Shinta Widyaningrum, Evvy Kartini and Martin Taylor	Reducing Carbon Monoxide (CO) Air Pollution with Electric Vehicles to Overcome Climate Change	NBRI, NBRI, Swinburne University of Technology

OP= Opening Remarks
PL= Plenary Session
KN= Keynote Session
INV= Invited Speaker
OR= Oral Contributor

OPENING REMARKS

Prof. Dr. rer. nat. Evvy Kartini

Evvy Kartini is an expert on the neutron scattering and respected internationally. Her international reputation in the field of neutron scattering and solid state ionics, has been well established. She began her research on Superionic glasses early 1990, at Hahn Meitner Institute, Berlin, Germany and supervised by scientists Prof. Dr. Ferenc Mezei. In 1994-1995, during her PhD work, she joint McMaster University, under supervision of Prof. Dr. Malcolm F. Collins. The existence of Boson peaks in $ZnCl_2$ and CKN, glasses were an interesting phenomena, therefore she conducted experiment inelastic neutron scattering at Nuclear Research Reactor, Chalk River Laboratory, Canada. In 1995-1996, she returned to Germany, and finished her PhD at the Technical University (TU), Berlin, Germany. She has been performing international collaborations with prominent International scientists from Bragg Institute, Australia Nuclear Science and Technology Organization (ANSTO), Australia; Japan Proton Accelerator Research Complex (J-Parc), Japan; High Energy Accelerator Research Complex (KEK), Japan; Ibaraki University, Japan; Tohoku University, Japan etc; McMaster University, Canada; and former Hahn Meitner Institute, Berlin, Germany. She has been represented as a leader (President) of the Indonesian Neutron Scattering Society (INSS) since 2013. Since 2012, Evvy Kartini has been appointed as one of referee members of the National Accreditation Journal of the Indonesian Institute of Science. She has been evaluating and reviewing various national journals and contributing on their quality improvements.

Topic: *The Development of NMC 811 Cathode for Lithium Ion Battery Based on The Local Mineral Resources*

Prof. Dr. B. V. R. Chowdary

Prof. B.V.R. Chowdari obtained Ph.D degree from the Indian Institute of Technology (IIT) Kanpur, Doctor of Science (Honoris Causa) from the K.L. University, India and the Doctor of Literature (Honoris Causa) from the Mangalore University, India. His 50-year research career enabled him to work at IIT Kanpur, India; Nagoya University, Japan; University of Stuttgart, Germany; University of Pennsylvania, USA; University of Zurich, Switzerland; and Shanghai Institute of Ceramics, China, in different capacities at different times. As a part of his academic career, he worked at the Indian Institute of Technology (IIT), Madras; the National University of Singapore (NUS) and the Nanyang Technological University (NTU), Singapore, in different capacities at different times with the ultimate one being the Professorship at both NUS and NTU. Currently he is the Director, NTU – India Connect, a special initiative of NTU, Singapore, to connect NTU with the Indian Universities and Institutes of Higher Learning in India through variety of actions. He has served as the President of the "International Union of Materials Research Societies (IUMRS)" and the "Asian Society for Solid State Ionics", and Chairman of the 15th Asian Physics Olympiad (APhO 2014). Currently he is the President of the Materials Research Society of Singapore and Chairman of the International Conference on Materials for Advanced Technologies (ICMAT) series which is going to the 10th edition. He has also initiated series of conferences named "IUMRS – International Conference of Young Researchers on Advanced Materials (ICYRAM)" and "Trilateral Conference on Nanoscience – Energy, Water and Healthcare".

Prof. Colin Gareth Bailey

Prof. Bailey is a President and Principal of Queen Mary University of London. He is a researcher in structural engineering, who became the President and Principal of Queen Mary University of London in September 2017. Prior to that, Bailey was Deputy President and Deputy Vice-Chancellor at the University of Manchester. He is a Fellow of the Royal Academy of Engineering, the Institution of Civil Engineers, the Institution of Structural Engineers and a member of the Institution of Fire Engineers.

Dr. Laksana Tri Handoko

Dr. Laksana Tri Handoko is an Indonesian scientist and public official specializing in theoritical and particle physics. He formerly served as the deputy head of science and technology for the Indonesian Institute of Sciences from 2014 to 2018. And he became Chairman of the institute start from 2018. He appointed as the second (but first independent) holder of Head of National Research and Innovation Agency.

PLENARY LECTURES

Prof. Tim White

Tim White is the President's Chair in Materials Science & Engineering and Associate Vice President (Infrastructure & Programmes) in the President's Office at the Nanyang Technological University, Singapore. He has over 40 years research experience at national laboratories and universities in Australia and Singapore in materials science and engineering, minerals processing, nuclear waste treatment and environmental management. These appointments included group leader at The Australian Atomic Energy Commission and Multiplex Professor of Environmental Technology. He is presently Vice President of the Materials Research Society of Singapore (since 2016), He is presently President of the Materials Research Society of Singapore (since 2020). He is also a pioneer of massive open online courses (MOOCs) and for several years delivered one of the few such courses in the world that awards full academic credit. His current teaching is in partnership with Ludwig-Maximilians-Universität München for the joint-development and deployment of the Adaptive Learning and Teaching System ATLAS on-line platform to serve the needs the Skills Future learners, as well as catering for graduate students.

ABSTRACT

Battery Research at NTU for a Sustainable Future

Tim White

Associate VP Research (Infrastructure & Programs), Nanyang Technological University, Singapore

President of Materials Research Society, Singapore

Coordinated energy research at NTU began in 2005 with the creation of the NanoCluster that created opportunities for harmonized efforts across Colleges and Schools in nanomaterials synthesis, organic molecular electronics, catalysis and nano-devices. From these beginnings, the Energy Research Institute@ NTU (ERI@N) was established in 2011 to focus on the translation of research to practical policy and technological outcomes. This presentation will provide an overview of the positioning of battery research at NTU in the context of national priorities, highlight the foci and competencies that underpin innovation, present case studies of industry partnerships, and describe the manner in which faculty and students contribute to the education and manpower development.

Prof. John B. Goodenough

Prof. John B. Goodenough is an American physicist who won the 2019 Nobel Prize for Chemistry for his work on developing lithium-ion batteries. Goodenough became a professor at the University of Texas at Austin in 1986 in the departments of mechanical engineering and electrical and computer engineering. He has been honoured with the National Medal of Science (2011), the Charles Stark Draper Prize (2014), and the Copley Medal (2019). He wrote Magnetism and the Chemical Bond (1963), Solid Oxide Fuel Cell Technology: Priciple, Perfomance and Operations (2009, with Kevin Huang), and an autobiography, Witness to Grace (2008).

Prof. Alan J Drew

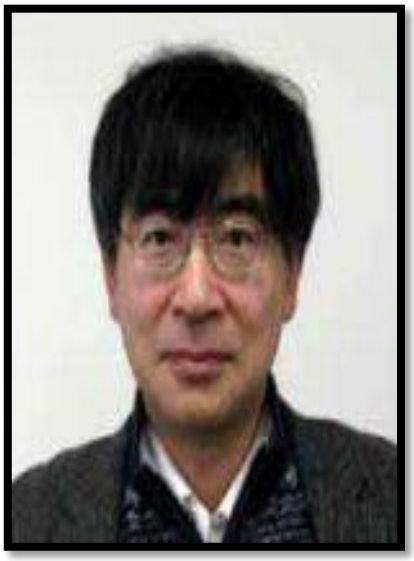
Head of the Condensed Matter Research Centre in Queen Mary University of London (Acting Head Oct 2016 – Feb 2017; Head March 2017 – present) Responsible for the overall management of about sixty researchers, comprising 12 academic staff with their PhD students and postdoctoral researchers. He has been a member of the MRI Senior Management Team since November 2016, and in September 2018 I was asked to take on the Interim Directorship to bring about improvements to MRI performance, with a specific focus on increasing grant income, industrial engagement and interdisciplinarity. The responsibilities are to provide strategic leadership for the research activities of around 200 researchers, including more than 60 academic staff, in 5 Schools across 2 Faculties. Work so far has been focused on “getting the house in order”, but the coming months should be about defining an overall vision and strategy.

Prof. Dr. Eng. Eniya Listiani Dewi, M.Eng

Prof. Eniya Listiani Dewi is Professor Electrochemical Process at Agency for the Assessment and Application of Technology (BPPT). She is also deputy of Information, Energy, and Materials Technology at BPPT. Prof. Eniya had finished Bachelor of Engineering at Applied Chemistry of Waseda University at 1998, then completed Doctor of Engineering on the advanced research institute for science and engineering, engineering faculty, department of applied chemistry, Waseda University, Tokyo, Japan at 2003, as DC1 JSPS special researcher. Her interest are on electron transfer phenomenon on the nanocatalyst, hydrocarbon polymer materials, PEM-fuel cell, zinc-air fuel cell batteries as well as hydrogen production from biomass and PEM-electrolyser. Her activity were awarded from many institutions, such as Mizuno Award, Koukenkai Award, Asia Excellent Award, Best Scientist Award, Engineering Award, Medco-Energy Research Award, Patent Innovation Award, The Habibie Award, etc.

Topic: Energy Storage for Green Economy

KEYNOTE LECTURES



Prof. Dr. Takashi Kamiyama

Takashi Kamiyama is a Professor from the High Energy Accelerator Organization, KEK (2005-present), Graduate University for Advanced Studies, Sokendai (2005-present) and Hokkaido University (2006-present). He is the leader of Neutron Science Section of Materials and Life Science Division in J-PARC (2007-2014) and Dean of School of High Energy Accelerator Science (Graduate University for Advanced Studies), Sokendai (2014-present). He is a Steering Committee Member – The Crystallographic Society of Japan (2003–2008, 2010-present), Chief Editor of Journal – The Crystallographic Society of Japan (2008-2010), Member of Neutron Scattering Committee – International Union of Crystallography (2005-2011), Steering Committee Member – The Japanese Society for Neutron Science (2003-2007, 2009-2012), , Secretary of Crystallography Committee – Science Council of Japan (2003-2006), Council Member – Asia Crystallography Association (AsCA) (2011-present), Chair of one Committee – JSPS University-Industry Cooperative Research Committees (2010-2012). His research interest is in Structure-Function Relationship in Advanced Materials such as Li-ion Batteries, Fuel-cell Materials, Hydrogen-absorbing Materials, Multiferroic Materials, Strongly Correlated Electron Systems, and Superconductors, etc. Crystallography, Powder Diffraction, Rietveld Analysis, Software development, Neutron Scattering, Development of Neutron Diffractometers in Pulsed Neutron Facilities.

ABSTRACT

Takashi KAMIYAMA[1,2]*

[1]J-PARC and Institute of Materials Structure Science of High Energy Accelerator Research Organization (KEK), 203-1, Tokai-mura, Ibaraki 319-1106, JAPAN

[2]China Spallation Neutron Source (CSNS), Institute of High Energy Physics (IHEP), Chinese Academy of Sciences (CAS), 1 Zhongziyuan Road, Dalang, Dongguan, Guangdong 523803, China

E-mail : *takashi.kamiyama@kek.jp

With the rapid spread and sophistication of smartphones, various devices beeing digitized, and equipped with sensors, and as a result, we can see the shape of a future society in which people are connected into the Internet. Electric vehicles, robots will be main players. Science and technology on various functional materials will be more highlighted to support such society. Here, I will talk about research on energy materials and devices using neutron beam. Neutron beam can be used as a probe through scattering, transmission and resonances. The scattering method can obtain atomic-scale structure information as well as dynamics information with meV to eV. Transmission imaging ordinally gives sub millimeter structure

information. The resonances are sensitive method to detect atomic compositions. Neutron scattering and transmission are more sensitive probe to detect light elements than Xray since neutron atomic scattering/absorption factors do not depend on atomic numbers. So, neutron gives more adequate information in structural variation of some functional materials with light elements. Opportunity to use neutron is increasing in Asia-Pacific region since new facilities have started in China (CSNS) and Japan (J-PARC) in addition to existing facilities, OPAL (Australia) HANARO (Korea), etc. I report here on progress and prospect battery research using neutron.

Keywords: Battery Neutron Materials

Prof. Dr. M. Zaki Mubarok

Prof. Dr. mont. M. Zaki Mubarok, ST., MT. Is a head of Hydro-Electrometallurgy Laboratory of ITB. He pursued Doctoral degree from Department of Nonferrous Metallurgy, University of Leoben, Austria 2005. He also published many research papers and various award. In 2020, he received high-impact research article awards from National Research and Innovation Agency.

ABSTRACT

Separation of Nickel and Cobalt by Selective Oxidative Precipitation Using Ozone Gas for Preparation of Cathode Materials Used in NMC Lithium Ion Battery

The cathode precursor material for lithium NMC batteries is commonly synthesized from nickel sulfate, cobalt sulfate, manganese sulfate which are converted to carbonates and then mixed with lithium carbonate in a stirred tank reactor. For producing pure nickel sulfate and cobalt sulfate from the extraction of nickel ore, pregnant leach solution is usually purified through a series of iron and aluminum removal and separation of nickel and cobalt through solvent extraction. The solvent extraction process is commonly done to the solution produced by re-leaching of mixed sulfide precipitate (MSP) or mixed hydroxide precipitate (MHP). This article discusses an alternative method of purification of nickel and cobalt separation from the solution produced by MHP leaching by means of selective precipitation method using ozone gas. The principle of this method is to oxidize cobalt and manganese to their trivalent forms which are then precipitated by adjusting the pH while maintaining the nickel in the dissolved form. The results of the selective precipitation experiment showed that a nickel-rich solution with a concentration of 43.8 g/l nickel containing only 0.001 and less than 0.0001 g/l dissolved cobalt and manganese, respectively can be produced from the feed solution containing 48.1, 1.8 and 0.3 g/l nickel, cobalt, and manganese, respectively. The ratio of nickel concentration to cobalt concentration in the resulted solution is about 42,000 which is higher than the typical solution produced by solvent extraction process. The advanced development is carried out to reduce the size of the ozone bubble to nanoscale for enhancing the solubility and stability of the ozone molecule in the solution. This novel approach is developed to look for more versatile route in producing nickel sulfate and cobalt sulfate for utilized in lithium NCM battery.

Prof. Dr. Vanessa Peterson

Prof. Vannesa is a Senior Principal Research and Neutron Scattering Instrument Scientist at ANSTO. Leader, Energy Materials Research Project Neutron Instrument Scientist at ANSTO, Powder Diffraction (Wombat and Echidna instruments) Honorary Professorial Fellow, Institute for Superconducting and Electronic Materials, University of Wollongong. Australian Neutron Beam Users Group neutron award for "Outstanding research in neutron science and leadership promoting the Australian neutron scattering community (> 10 years post PhD) (2019). Expertise in understanding materials function by relating atomic-scale structure and dynamics to material properties.

ABSTRACT

Advanced Neutron Characterization of Rechargeable Battery Systems

The performance of functional materials central to rechargeable batteries is determined largely by material structure and dynamic-function relations. These materials undergo change in structure across a broad length scale spanning atomic to macroscopic level, as well as compositional change during use. Robust characterization methods that quantitatively and accurately capture these changes are essential to the strategic design of new materials with superior function, and consequently, to improving battery performance. Neutrons have attributes that make them exceptionally well suited for the characterization of battery materials, allowing the mechanisms of operation to be probed across all relevant length scales. Today, advances in neutron instrumentation and methods means that neutron characterization can capture these material changes in detail, often within whole batteries and while they are occurring under real-life operating conditions. This presentation will feature examples of neutron methods used to understand rechargeable battery function, including neutron powder diffraction, neutron imaging, small and ultra small angle neutron scattering, and quasielastic neutron scattering, with a focus on instrumentation available at the Australian Centre for Neutron Scattering (ACNS) for this research.

Keywords: *Battery, Neutron, Diffraction, Scattering, Imaging*

Prof. Dr. Santi Maensiri

Prof. Dr. Santi Maensiri is the Director of SUT Center of Excellence in Advanced Functional Materials (SUT-AFM) and Vice-Rector for Academic Affairs and Internationalization, Suranaree University of Technology, Nakhon Ratchasima, Thailand. He is the author of over225 papers with citations over 3400 times and h-index of 31 in ISI journals. His research of interest is in the fields of materials physics and nanostructured materials, which focus mainly on the fabrication, properties, and applications of materials. The materials of interest include: 1) functional nanostructured materials, 2) diluted magnetic semiconductors and magnetic nanoparticles, 3) giant dielectric ceramics and nanocomposites, and 4) electrospun nanofibers of ceramics, polymers, and nanocomposites for electronic device, environmental, and energy applications. Prof. Maensiri received his BSc. Degree (Physics) from Khon Kaen University, Thailand, M.Sc. degree (Ceramic Processing) from Leeds University, and D.Phil. degree (Materials) from Oxford University, U.K. He received many research awards including Thai Young Scientist Award 2007 (Physics), TWAS Prize 2009 for Young Scientists in Thailand in Physics, TRF-CHE-SCOPUS Researcher Award 2010 (Physical Sciences), Thailand Research Fund (TRF) Senior Research Scholar 2013, and Thailand National Outstanding Researcher Awards 2013 (NRCT).Prof. Maensiri is the President of Materials Research Society of Thailand (MRS-Thailand).

ORAL CONTRIBUTORS

Direct Double Coating of Carbon and Nitrogen on Fluorine-Doped Li4Ti5O12 as An Anode for Lithium-Ion Battery

Lukman Noerochim[1*], Alvalo Toto Wibowo[2], Widyastuti[3], Achmad Subhan[4], and Bambang Prihandoko[5]

[1,2,3]*Department of Materials and Metallurgical Engineering, Sepuluh Nopember Institute of Technology, Surabaya 60111, Indonesia*

[4,5]*Research Center of Physics, Indonesian Institute of Science, Serpong, Indonesia*

*E-mail: *lukman@mat-eng.its.ac.id*

ABSTRACT

Li4Ti5O12 is a strong candidate to replace carbon for the next generation anode of lithium-ion battery. In this work, fluorine-doped Li4Ti5O12 was successfully synthesized with direct double coating of carbon and nitrogen using a solid-state method and followed by pyrolysis process of polyaniline. The XRD results show that the adding of fluorine is successfully doped to the spinel-type structure of Li4Ti5O12 without any impurities are detected. The carbon and nitrogen coating are homogenously distributed on the surface of Li4Ti5O12 particles as shown in the SEM image. The fluorine-doped Li4Ti5O12 shows a superior electrochemical performance with the highest specific discharge capacity of 142.52 mAh g-1 and 98.51% retention capacity achieved at 5 C. It is attributed to the synergy between appropriate amount of carbon and nitrogen coating that induced the high mobility of electron, and larger crystallite size due to insertion of fluorine to spinel-type structure of Li4Ti5O12 enhancing lithium-ion transfer during insertion/extraction process.

Keywords: *direct double coating, fluorine-doped Li4Ti5O12, solid-state method, lithium-ion battery*

Utilization of Rare-Earth Elements for Performance Improvement of Lithium Battery Materials

Sudaryanto[1*], Evvy Kartini1, Muhammad Fakhrudin[1], Moch. Setyadji1, Kurnia Trinopiawan[1]

[1]Center for Science and Advanced Material Technology - National Nuclear Energy Agency of Indonesia, Puspiptek, Setu, South Tangerang, Banten 15314

*E-mail : *dryanto@batan.go.id*

ABSTRACT

Lithium-ion batteries (LIB) are batteries with excellent performance when compared to other batteries. However, research to improve the performance of lithium batteries according to the demands of the application is still being carried out. The main problem with battery performance is the decrease in capacity or voltage over time. Battery performance depends on various factors such as application conditions, manufacturing method, design, materials used and others. One of the problems with batteries is the dissolution of transition metals in the cathode material into the electrolyte. To overcome this, it is necessary to do stabilization by doping or coating methods. Several studies show an impact on improving the performance and stability of LIB when doped with rare-earth elements (REE). The doping greatly affects the intercalation of Li+ ions which causes improvement of battery performance such as cycle capability and C-rate. The REE have different atomic sizes from each other but have the same ionic oxidation number, 3+. However, research using REE doping still needs to be carried out because of its unique nature and of course there are still many characteristics of rare earth metals that are not yet known.

Keywords: *Li-Ion Batteries, Rare-Earth Elements, Battery Materials, Battery Performances*

The Effects of Nitrogen Gas Flow Rate on Physical Characteristic of Corncob Activated Carbon as Active Electrode Material of Lithium-Ion Capacitors

Asih Kurniasari[1], Ariono Verdianto[2], Iyan Subiyanto[3], Chairul Hudaya[4,5*]

[1]Center for Energy Conversion Technology, B2TKE BPPT, Puspiptek Serpong, Tangerang Selatan 15314, Indonesia

[2]Division of Energy and Environment Technology, KIST School, Korea University of Science and Technology, Seoul 02792, Republic of Korea

[3]Energy Materials Laboratory, Korea Institute of Energy Research, Daejeon City 34129, Republic of Korea

[4]Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia, Depok 16424, Indonesia

[5]Sumbawa University of Technology, Sumbawa 84371, Indonesia

**Corresponding author's e-mail: c.hudaya@eng.ui.ac.id*

ABSTRACT

The lithium-ion capacitor (LIC) is an energy storage system that complements the lack of power and energy density in lithium-ion batteries and super-capacitors. In this study, the biomass-derived activated carbon from corncob (CACN) is prepared by adopting both physical and chemical activation process under different flow rate of nitrogen gas (N2). Activation of CACN is done using KOH and pyrolysis at 700°C with N2 flow rate of 200, 300, and 400 standard centi-meter cubic per minute (sccm). Scanning electron microscopy (SEM) images reveal the surface morphology that appears to be having highly pore structure. The highest specific surface area (SSA) is achieved when the process is carried out under 300sccm (CACN300) which is further confirmed through the Brunauer-Emmett-Teller (BET) results of 1936 m2g-1. X-ray diffraction (XRD) and Raman spectroscopy results show the crystal structure of the CACN were amorphous and CACN300 has the best crystallite physical property. Advance electrochemical testing provides information about the coin-cell characteristic that turn-out to be like capacitor and battery behaviour from the quasi-rectangular cyclic-voltammogram (CV) graph. The great coulomb stability is owned by LICN300 with the highest energy and power density, 10.79Wh kg-1 and 526.39W kg-1, by charge-discharge (CD) test. Based on our investigation, this simply optimization of carbon activation is enabling us to achieve the optimum physical characteristic and electrochemical performance of activated carbon and LIC respectively.

Keywords: *nitrogen gas flow rate, activated carbon, corncob, lithium ion capacitor, physical properties, electrochemical performance*

The Study of (Ni, Mn, Co)SO4 as Raw Materials for NMC Precursor by X-Ray Fluorescence (XRF)

Rizka Ayu Puspita[1*], Evvy Kartini1[2], Muhammad Fakhrudin[2], Widi Astuti[3], Slamet Sumardi[3]**

[1]*National Battery Research Institute, Edu Center Building Lt 2 Unit 22260 BSD City, South Tangerang 15331, Indonesia*

[2]*Center for Science and Advanced Material Technology - National Nuclear Energy Agency of Indonesia, Puspiptek, Setu, South Tangerang, Banten 15314*

[3]*Research Unit for Mineral Technology – Indonesian Institute of Science, Jl. Ir. Sutami, Serdang, Tj. Bintang* District, South Lampung Regency, *Lampung 35361*

*E-mail : *rizka.ayu@n-bri.org*
***evvy.kartini@n-bri.org*

ABSTRACT

Recent research progress on lithium-ion battery application leads to the development of electric vehicle. NMC with high nickel rich has futuristic option as cathode material for battery in electric vehicle due to its excellent characteristic. NMC active material is produced from calcinated NMC precursor mixed with lithium source. NMC precursor synthesis methods are challenging to obtain the desire its properties that depends on its raw materials quality. Those raw materials in solid form are NiSO4, MnSO4, CoSO4 (metal sulfate). So that, it is important to perform some material characterizations from the beginning of the process. In this research, X-Ray Fluorescence (XRF) PANalytical Epsilon 3XLE was utilized to analyze the containing element for the raw materials that are used to produce NMC precursor. The XRF summary result is described as follows: nickel content in NiSO4 is about 78%, manganese content in MnSO4 is about 77.7%, and cobalt content in CoSO4 is about 80.7%. The result was used as preliminary characterization, further characterization must be conducted using related characterization technique.

Keywords: *NiSO4, MnSO4, CoSO4, NMC Precursor, X-Ray Fluorescence*

Implementation Of Battery Energy Storage System At Cirata Pv Solar Floating For Reducing The Electricity Cost Production On Jamali Grid

Zainal Arifin [1*], , Linda Fitri [2]

[1] PT PLN (Persero), Jakarta Selatan 12610 Indonesia

[2] Institut Teknologi PLN, Jakarta Barat, 11750 Indonesia

**zainal.arifin22@pln.co.id*

Email : linda1810017@itpln.ac.id; happsyah@gmail.com

ABSTRACT

Along with the exponential growth of renewable energy penetration to the grid, the role of battery energy storage to create gird more flexible has been significantly increasing. There are two main functions of battery storage on grid; load shifting and load smoothing. The utilization of battery storage does not only create some technical beneficial such as reliability and flexibility but also a financial cost saving. This study investigates the implementation of lithium-ion battery storage system at PV floating farm for reducing the electricity cost production on the grid system. The financial feasibility is conducted through a spread sheet financial modelling based on life cycle cost and levelized cost of electricity. The impact of PV floating with BESS to the grid is tested by a power system tool ETAP. This study found that the implementation of BESS at PV floating farm is potentially reducing the electricity cost production based on both full store and partial store scenarios. The difference of financial cost saving between both scenarios is not significant. Other finding is the implementation of BESS with PV floating does not affect significantly the grid system stability. The result of study is useful for energy developer and buyer or off taker to define the right cost of power purchasing agreement for battery energy storage system application. It also supports the utility firms that want to utilize the storage technology for achieving more flexible, reliable and resilient of their grid. Further research is recommended to study a capacity optimization of battery storage to the PV farm, to investigate more unit analysis, to asses' various capacity of battery and to analyse it at different grid system

Keywords: *Battery Energy Storage System (BESS), Load Shifting, Load Smoothing, Levelized Cost of Electricity, Cost Reduction.*

Techno Economic Analysis of Public Solar Street Light with Integrated Monitoring System For Parking Area

Cipta Panghegar Supriadi[*1], Adit Triwiguno[1], Muhammad Firmansyah[1], Evvy Kartini2

[1]*Infiniti Energi Indonesia, South Tangerang, Indonesia, Edu Center Building 2nd Floor Unit 22260 Kav Commercial International School Lot 2 No, South Tangerang, Indonesia.*

[2]*National Battery Research Institute, Edu Center Building 2nd Floor Unit 22260 Kav Commercial International School Lot 2 No, South Tangerang, Indonesia*

*E-mail : *cipta.panghegar@gmail.com*

ABSTRACT

Indonesia has a great potential on solar energy since it is located across the equator. Therefore, it is beneficial to implement photovoltaic system in the area. One of the photovoltaic application is solar street light system. The techno – economic analyses of public solar street light has been conducted including the potential for CO2 reduction and cost reduction analysis. The solar street was designed for parking area wih moderate traffic. It has been design to give 6 lux illumination and 12 hour service time. The additional system has been integrated to monitor daily power consumption and to ease the maintenance procedure. The energy input has been calculated by referring to solar energy data in North Jakarta. A 370 watt peak solar panel with 24V and 50Ah battery configuration are implemented for the public solar street light system. The system is designed to serve for 3 days of autonomy.

Keywords: *Battery, Renewable Energy, Solar Street Light, CO2 Reduction.*

Automatic Solar Tracking For Energy Management

Ganesh Eega[1], Pavuluri Sai Ram[1], R Pavan Kumar[1], Gangireddy Eswar Sai Kiran Reddy[1], Mohit Kaumar Goel[1]

[1]School of Electronics and Communication Engineering, Phagwara, India

Email : ganesheega43@gmail.com, pavulurisairam99@gmail.com, pavankumar143111@gmail.com, eswarsaigangireddy@gmail.com, mohit.16907@ipu.co.in

ABSTRACT

In the article we discussed about design and implementation of automatic solar tracking with changes the direction of solar panel with respective to the sun. In present day society the increasing of usage of electricity, the most effective solution is use the renewable resources such as solar energy. In the solar energy production Automatic solar tracker produce more energy than other stationary solar panel. The primary function is it taken the energy from the convert to electrical energy most efficient than other systems. The sensors in the system always monitor motion of the sunlight changes the direction solar panel without any human interference. The motors in the system changes the direction of panel by control the motors using the control system. In this project we discussed solar tracking with less complex and more efficiency generate system using minimum cost than any other solar tracker.

Keywords : *Solar panel, Arduino UNO, DC Motors, LDR Sensors, L293D Motor Driver*

Synthesis and Structural Study of Li4Ti5O12/SnO2 Composite as Anode Materials for Lithium Ion Batteries

T.Y.S. Panca Putra[1*], T. Saito[3], Y. Purwamargapratala[1], Sudaryanto[1], E. Kartini, B. Sugeng[1], R. Kamila[1], M. Fakhrudin[1], N.I.P. Ayu[2], M. Hagihala[3], and T. Kamiyama[3]

[1]Center for Science and Technology of Advanced Materials, National Nuclear Energy Agency of Indonesia, PSTBM BATAN, Gedung 40 Kawasan Puspiptek Serpong, Tangerang Selatan, Banten 15314, Indonesia*

[2]High Energy Accelerator Research Organization (KEK), 1-1 Oho, Tsukuba, Ibaraki 305-0801, Japan

*E-mail : *teguhpanca@batan.go.id*

ABSTRACT

Synthesis and structural study of Li4Ti5O12/SnO2 composites by time-of-flight neutron diffraction (TOF-ND) have been done. The composites were synthesized by mechanical milling (MM) of Li4Ti5O12 and Sn mixtures for various MM times and Sn content. Structural analysis by Rietveld refinement of TOF-ND data showed lattice parameters *a* of LTO are 8.34643(1) Å, 8.34647(1) Å and 8.34645(1) Å for composites synthesized by MM for 0, 2 and 4 hours, respectively, and 8.34654(1) for LTO/SnO2 composites synthesized with 5wt.% of Sn and MM for 2 hours. MEM analyses of the LTO phase using structure factors from TOF-ND analysis shows that the electron density distribution among the composites is similar and suggested that there is no Sn incorporated into the LTO structure. The result shows no significant difference in structural parameters among the composites.

Keywords: *Li4Ti5O12/SnO2 composites, Anode, Li-ion battery, Structure, Time-of-Flight Neutron Diffraction*

The Effect of Stirring Time on Synthesis of NMC-622 Cathode Active Material with Oxalate Coprecipitation Method

M. Nizam Fanani[1]*, Evvy Kartini[2,3], Rizka Ayu Puspita[2], M. Fakhrudin[3], Agus Sudjatno[3]

*[1]Department of Nuclear Technochemistry, Polytechnic Institute of Nuclear Technology, Babarsari, Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia**

[2]National Battery Research Institute, Gedung Edu Center Lt 2 Unit 22260 BSD City, Tangerang Selatan 15331

[3]National Nuclear Energy Agency of Indonesia, Puspiptek, Setu, Tangerang Selatan 15314, Indonesia

*E-mail: *mnizamfanani@gmail.com*
evvy.kartini@n-bri.org

ABSTRACT

Renewable energy technology has a weakness that is intermittent which can be overcome by energy storage systems. Li-ion battery is one of the secondary batteries currently being developed which has promising performance to solve this problem. One of the most important components of a lithium battery is the cathode. In this study, LiNi0,6Mn0,2Co0,2O2 (NMC-622) cathode was synthesized using the oxalate coprecipitation method. The control parameters in this method greatly affect the particle composition and morphology of the resulting material. Metal oxalate samples prepared at different stirring times (40~100 minutes) were characterized using X-Ray Diffraction (XRD) to see the crystal structure and the composition formed. XRD results of NMC-622 synthesized by a stirring time of 80 minutes showed the best results based on the intensity ratio of peak (003) to peak (104) obtained, which was 1,462.

Keywords: NMC, Cathode, Oxalate coprecipitation, Stirring time, XRD

The Effect of Milling Time and Rotation Speed on Li-NMC Cathode Performance

Fajrul Mawaddah[1*], Evvy Kartini[2,3], Rizka Ayu Puspita[2], M. Fakhrudin[3], Agus Sudjatno[3]

*[1]Department of Nuclear Technochemistry, Polytechnic Institute of Nuclear Technology, Jl. Babarsari, Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia**

[2]National Battery Research Institute, BSD Taman Tekno blok L2/29, Kec. Setu, Kota Tangerang Selatan, Indonesia

[3]National Nuclear Energy Agency of Indonesia, Jl. Kw. Puspiptek, Muncul, Kec. Setu, Kota Tangerang Selatan, Indonesia

*E-mail : *fama9908@gmail.com*

evvy.kartini@n-bri.org

ABSTRACT

Technological developments of electrical energy storage on this era are batteries. Many electronic devices using battery for energy storage, so the batteries in the future will be a strategic and economical source of energy storage. Li-ion battery consists of anode, cathode and separator. The cathode is fully functional in the process of transferring lithium ions, during the charging and discharging processes. Li-ion batteries work according to the intercalation phenomenon, which lithium ions move from the cathode through the electrolyte to the anode during the charging process. Otherwise, lithium ions also move from the anode to the cathode during discharging process. The particle size plays an important role in the electrochemical performance of the cathode for Li-ion batteries. Milling is a way to reduce particle size and improve electrochemical performance. Milling is a method that use the collision energy between grinding balls and the walls of the container (jar milling). These characteristic X-rays are analytical signals used in electron microscopy for chemical analysis. The X-ray spectrum emitted by the specimen provides information which able to identify the types of elements present in the sample and the composition of each element. The results showed that a longer milling time and a higher rotation speed, will produce smaller particle size which increased the electrochemical performance of the battery cathode.

Keywords: *NMC carbonate, cathode, milling time, rotation speed, SEM*.

Battery Swap Indonesia National Standard Concept

Susanto Sigit Rahardi[1*], Evvy Kartini[2]

[1] Center for Material and Technical Product (B4T) Sangkuriang Street No.14, Bandung City,Indonesia*

[2]Badan Tenaga Nuklir Nasional Gedung 43, Kawasan Puspiptek Serpong

E-mail: susantosr@kemenperin.go.id

ABSTRACT

Battery swap technology has a potential opportunity in Indonesian market, especially for two-wheeler electric vehicles and utilization of portable energy storage. However, by the substantial amount of return of investment and embedded risks in this business, it is necessary to established standardization for assuring quality and level of services, for technology providers, service providers, producers, consumers, infrastructure and environment. In 2020, two Standar Nasional Indonesia (SNI) for two-wheeler battery swap have been published. The first standard is SNI 8927:2020 safety requirements for removable and swappable battery system of electric vehicle L category. The second standard is 8928:2020 its technical specification for removable and swappable battery system, particularly about dimension of pack, nominal voltage and communication system. In this exposure, we present the two SNI concept in the scope of safety requirements and its specification.

Keywords: *Battery* Swap, *Electric Vehicle, Standar Nasional Indonesia*

Design of Battery Pack for Electric Bike

Muhammad Alfawza Biljannah[1], Evvy Kartini[2]

[1]*Department of Electrical Engineering, Faculty of Engineering, Diponegoro University,*

Jl. Prof. Sudharto, SH, Kampus UNDIP Tembalang, Semarang 50275, Indonesia

[2]*National Battery Research Institute, Gedung Edu Center Lt 2 Unit 22260, BSD City, Tangerang Selatan 15331, Indonesia*

E-mail: fawza.biljannah@gmail.com, evvy.kartini@n-bri.org

ABSTRACT

In the last decade, Electric Vehicles (EV) have begun to be produced massively, one of which is bikes. Many bikes are produced due to the increasing market demand for bikes, especially during this pandemic. Peoples choose bikes because they are cheap vehicles, and also do not require any driving license. But in reality, the price of electric bikes is considered quite expensive, so many people prefer to convert ordinary bike into electric bike. One of the most important aspects in making an electric bike is the battery, which is the source of electrical energy in electric bike. This study aims to explain the steps in designing a battery pack for an electric bike from a Lithium-ion Battery NMC21700 with a voltage of 3.6V and a capacity of 5000mAh with dimensions of Ø21.25 × 70.8 mm. The expected result of the battery pack will produce the power of 720Wh.

Keywords: *Electric Vehicle, Electric Bike, Lithium-ion Battery, Battery Packaging*

MULTIPLE COIL DESIGN ON EDDY CURRENT BRAKE TYPE HALF CIRCLE SLOTTED

Abi Nur Hakim[1], **Ubaidillah**[2], **Muhammad Nizam**[3]

[1,2]*Mechanical Engineering Department, Universitas Sebelas Maret*

[3]*Electrical Engineering Department, Universitas Sebelas Maret, Indonesia*

Surakarta, Indonesia

Corresponding: ubaidillah_ft@staff.uns.ac.id

ABSTRACT

This study aims to analyze the relationship between the magnitude of the braking torque value and the magnetic field generated by the influence of the magnetic core area on the ECB braking system. This study uses the Finite Element Method (FEM) in the ECB modeling process with a wide variation of the core area facing the conductor with two-sided and one-sided slots, namely 225, 375, 525, and 675 mm2 at variations in rotational speed of 150, 300, 450, 600, and 750 rpm. The results of the research show that the wide variation of cores with an area of 675 mm2 produces the highest braking torque value on each conductor with two-sided or one-sided half circle slots. The resulting braking torque values are 93.52 Nm and 93.83 Nm at a rotating speed of 450 rpm. From the results of this study, it can be concluded that the variation of the core area facing the conductor affects the value of the braking torque produced by the ECB, the more the surface area of the core facing the conductor, the greater the resulting braking torque.

Keywords : *Eddy Current Brake, Half-circle Slotted, Finite Element Method (FEM), Electromagnet*

Reducing Carbon Monoxide (CO) Air Pollution with Electric Vehicles to Overcome Climate Change

Shinta Widyaningrum[1*], Evvy Kartini[2], Martin Taylor[3]

[1,2]National Battery Research Institute Edu Center Building 2nd Floor Unit 22260 Kav Commercial International School Lot. 2 No.8 BSD- City - Indonesia

[3]Swinburne University of Technology John St, Hawthorn VIC 3122, Australia

*E-mail : shinta.w@n-bri.org**

ABSTRACT

Climate change has a broad impact over a long period of time. This has resulted in increased air temperature, seawater volume, weather events, shifting wildlife populations and habitats. Climate change causes weather patterns to be less predictable. One of the contributing factors to climate change is air pollution. Air pollution that comes from vehicles contributes significantly. In 2015 the Paris Agreement was formed which aims to overcome the problem of climate change which was adopted by 196 Parties. One of the efforts is to convert conventional fossil-based vehicles into electric vehicles (EVs). Vehicles emit direct emissions which are generated immediately during engine combustion and released through the exhaust. Emissions released by conventional vehicles produce CO, NOx , HC and PM. When NOx is released from the exhaust into the atmosphere, this is one of the causes of smog and acid rain. EVs compensate for high production phase emissions with low tailpipe emissions when similar EVs and ICE cars are compared. The study was conducted with literature studies and in-depth analysis with qualitative methods. The data shown aims to provide information about the importance of transforming vehicles from conventional vehicles to electric vehicles to reduce the impact of climate change.

Keywords : *Electric Vehicles, Carbon Monoxide, Air Pollution, Climate Change*

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Program Book

Day-2 (Wednesday, June 23rd 2021)

Session	Time	Code	Estimation	Speaker	Topic	Affiliation
Morning Session (GMT+7)	08.20-08.30	Opening by Master of Ceremony				
	08.30-09.10	PL	40’	Prof. Jun Liu	Future Energy Systems and Energy Storage	Director of the Innovation centre for Battery 500 Consortium
	09.10-09.50	PL	40’	Ir. Agus Tjahajana		President Commissioner of MIND ID
	09.50-10.30	PL	40’	Prof. Dr. rer. nat. Evvy Kartini	The development of NMC 811 cathode for lithium ion battery based on the local mineral resources	Founder of National Battery Research Institute and President of MRS-INA
	10.30-10.35	Room Transition				
	10.35-12.00	Battery				
		KN	30’	Prof. Stefan Adams	Opportunities and Challenges in All-Solid-State Lithium Batteries	NUS, Singapore
		INV	25’	Evvy Kartini, Agus Sudjatno, Muhammad Fakhrudin, Mohammad Zaki Mubarok, Rizka Ayu Puspita	The Study of Mixed Hydroxide Precipitate (MHP) from Local Mineral Resources in Indonesia	BATAN-NBRI, BATAN, BATAN, ITB, NBRI
		OR	15’	Sutarsis	Effect of the Oxygen Functional Group on the High-Voltage Performance and Self-Discharge of Carbon Supercapacitors Electrodes	ITS
		OR	15’	Rialdy Fahmi and Evvy Kartini	Synthesis and Characterization of NMC111 Cathode by Co-precipitation Method	Padjajaran University, National Battery Research Institute
		OR	15’	Brillian Aqif Naufal, U Ubaidillah, Aditya Prabowo and Muhammad Nizam	Mechanical Load Test Battery Developed By Universitas Sebelas Maret (UNS) with Experimental Approaches	UNS
		Renewable Energy				
		KN	30’	Diyanto Imam	The Prospect of Renewable Energy Start-up to become Game Changer for Sustainable Clean Energy	Program Director of New Energy Nexus, ID
		INV	25’	Sri Sarjana and Efendhi Prih Raharjo	Renewable Power Plant Development Model	Poliktenik Transportasi Darat Indonesia-STTD
		OR	15’	Mochamad Subhan Alkyana and Evvy Kartini	Strengthening Energy Diplomacy to achieve “Affordable, Reliable, Sustainable, and Modern Energy for all” (SDGs 7) by 2030	NBRI
		OR	15’	Aris Budi Sulistyo and I Gusti Bagus Wijaya Kusuma	Increasing performance of solar cell by using red wavelength	Poliktenik Transportasi Darat Bali and University of Udayana
	12.00-13.00	Break Session				
Afternoon Session (GMT+7)	13.00-13.40	PL	40’	Prof. Rodrigo Martins	Functional Materials for a Better Prosperity for All	President of IUMRS and European Academy of Science (EurASc)
	13.40-14.20	PL	40’	Dr. Ir. Taufik Bawazier, M.Si		General Director of ILMATE The Ministry of Industry, Indonesia

	14.20-14.25	**Room Transition**				
	14.25-16.30	Battery (1)				
		KN	30’	Dr. Haznan Abimanyu	Nanostructure Materials in Li-ion Battery for Electric Vehicles	Director of Research Centre for Electrical Power and Mechatronics Indonesia Institute of Science
		INV	25’	Muhammad Fakhrudin, Evvy Kartini and Heri Jodi	CeO2-Coated NMC 811 as the Cathode Material for Li-Ion Batteries	BATAN
		INV	25’	Sih Wuri Andayani, Alfiz Muhamad Qizwini, Muhammad Aryansyah, Jesslyn, Najmuddin Yahya	Cathode Active Material of Lithium Battery from Nickel Matte: Indonesian Case Study	Centre for Material and Technical Product, Centre for Material and Technical Product, Centre for Material and Technical Product, Chemistry Department ITB, Centre for Material and Technical Product
		OR	15’	Yustinus Purwamargapratala, Evvy Kartini, Agus Sujatno, Teguh Yulius Surya Panca Putra and Heri Jodi	Activated Carbon from Rice Husk With Various Activators For Lithium Ion Battery Cathode Material Additive	BATAN, NBRI, BATAN, BATAN, BATAN
		OR	15’	Moh. Wahyu Syafi'ul Mubarok, Muhammad Fakhrudin and Evvy Kartini	Synthesis and Structural Study of CeO2-Doped NMC 811 as the Cathode Material	NBRI, BATAN, BATAN-NBRI
		OR	15’	Slamet Sumardi, Widi Astuti, Fika Rofiek Mufakhir, Muhammad Fakhrudin and Evvy Kartini	Effect of Alkali Types during Iron Precipitation on the Manganese Sulfate Crystallization from Indonesian Manganese Ore	LIPI, LIPI, LIPI, BATAN, BATAN
		Battery (2)				
		INV	25’	Anne Zulfia Syahrial, Jarot Raharjo, Benediktus Madika	Synthesis of Lithium Lanthanum Titanate using Local Lanthanum Oxide as a Lanthanum Source for Lithium-ion Battery Anode Material Application	UI, BPPT, UI
		INV	25’	Widi Astuti, Slamet Sumardi, Fika Rofiek Mufakhir, Muhammad Fakhrudin and Evvy Kartini	Synthesis of Manganese Carbonate from Indonesian Manganese Ore as NMC Cathode Precursor	LIPI, LIPI, LIPI, BATAN, BATAN
		OR	15’	Kurnia Setiawan Widana, Ilsa Rosianna, Dhatu Kamajati, Frederikus Dian Indrastomo, Yarianto Sugeng Budi Susilo and Agus Sumaryanto	Characterization of Unconventional Rare Earth Elements Resources from Bangka Monazite and Tin Slag	BATAN
		OR	15’	Fanny Fahriatunnisa Muliawanti and Evvy Kartini	Graphene derived from rice husk	Padjajaran University, National Battery Research Institute
		OR	15’	Kurnia Trinopiawan, Evvy Kartini, Yarianto Sugeng Budi Susilo, Kurnia Setiawan Widana, Sudaryanto Sudaryanto and Mochamad Setyadji	Development of a process for production of Rare Earth Hydroxide from Monazite	BATAN
		Electric Vehicles				
		KN	30’	Prof. M. Nizam		Coordinator of National Research Priority

						on Energy Storage
		INV	25’	Adit Triwiguno, Muhammad Firmansyah, and Evvy Kartini	Market Study on the Mineral Resources for NMC Lithium-ion Battery Cathode in Indonesia	Infiniti Energi Indonesia, NBRI
		OR	15’	Henny Sudibyo, Vita Susanti and Merry Devi	Overview of the Level of Domestic Components in the Opportunities of the Indonesian Electric Vehicle Industry	LIPI
		OR	15’	Prasetyo Aji, Dionysius Aldion Renata, Rully Kusumajaya, Rachmawan Atmaji Perdana and Made Gunawan	Test Performance of Charging Station of Management System	BPPT
		OR	15’	I Made Gatot Karohika and I Nyoman Gde Antara	Optimization of Airless Tire Design for Electric Vehicles	Universitas Udayana
		OR	15’	Egi Jonathan, Shafira, Evvy Kartini	Market of Electric Vehicles in Indonesia	NBRI

PL= Plenary Session
KN= Keynote Session
INV= Invited Speaker
OR= Oral Contributor

PLENARY LECTURES

Prof. Jun Liu

Dr. Jun Liu is a Washington Foundation Innovation Chair and Campbell Chair Professor at the University of Washington (UW) and a Battelle Fellow at the Pacific Northwest National Laboratory (PNNL). He also serves as the Director for Innovation Center for the Battery500 Consortium and President of the International Coalition for Energy Storage. In the past, he has played key leadership roles in major research organizations and national programs, including the Thrust Leader for the Integrated Center for Nanotechnologies (CINT), Cross-Cut Science Lead for the Joint Center of Energy Storage Research (JCESR), the Division Director for Energy Materials and Processing at PNNL. Dr. Liu received the PNNL Life-Time Science and Technology Achievement Award, Battery Division Technology Award from The Electrochemical Society (ECS), two R&D100 Awards and the DOE EERE Exceptional Achievement Award. He is an elected member of Washington Academy of Science, a Materials Research Society (MRS) Fellow, an Electrochemical Society (ECS) Fellow, and an American Association for the Advancement of Science (AAAS) Fellow. He has been ranked as a highly cited researcher in the world since 2014. He was named a Distinguished Inventor of Battelle in 2007, and was two times selected as PNNL's Inventor of the Year.

ABSTRACT

Future Energy Systems and Energy Storage

Jun Liu

University of Washington, Seattle. Pacific northwest National Laboratory, Richland

Energy storage is playing a critical role for modern communication, electric vehicles and energy storage. The drive towards renewable energy and zero carbon will produce a distributed energy system, which depends on reliable and cost-effective energy storage to operate. This seminar will analyze key approaches for developing next generation energy storage materials and technologies, as well as challenges in these approaches. The seminar will also discuss scientific barriers for using Li metal for developing high energy batteries with a specific energy much higher than 300 Wh kg^{-1}. The seminar will summarize the current understanding of the scientific and technological challenges, discuss recent progress and propose potential directions based on design, fabrication and testing. The fundamental relationship between the electrodes and other cell components is explored at the cell level in order to effectively address these grand challenges in high energy cells.

Dr. Ir. Agus Tjahajana Wirakusumah

Dr. Ir. Agus Tjahajana Wirakusumah is a President Commissioner of IBC. Dr. Agus graduated from Institut Teknologi Bandung (ITB) majoring Mechanical Engineering in 1979. He also received Bachelor of Economic from Universitas Indonesia (1988). Dr. Agus pursued his master degree on Industrial System Engineering University of Florida, United States (1991). Along his career in private sector, Dr. Agus often becomes the commissioner in many companies. Like General Manager at PT Rekadaya Sarana (1981-1982), Commissioner at PT Semen Baturaja (1995-2002), President Commissioner at PT Semen Baturaja (2002-2006), President Commissioner at PT Boma Bisma Indra (2008-2011), to President Commissioner at PT Rekayasa Industri (2011-2014). In public sector, he also has several core position. Dr. Agus is a former General Director of International Industrial Cooperation Ministry of Industry (2010-2015).

Prof. Dr. Ir. Anhar Riza Antariksawan

Prof. Anhar Riza Antariksawan is a Head of National Nuclear Energy Agency (BATAN). He obtained bachelor degree of Nuclear Engineering from Gadjah Mada University in 1986. Then, he pursued his master and doctoral degrees from Energy Physics in Institute of National Polytechnique de Grenoble, France in 1989 and 1993.

Prof. Rodrigo Martins

Rodrigo Martins is full professor in Materials Science Department of Faculty of Science and Technology of New University of Lisbon, a Fellow of the Portuguese Engineering Academy since 2009 and a member of the European Academy of science since 2016. He was decorated with the gold medal of merit and distinction by the Almada Municipality for his R&D achievements. Currently he is the President of the European Academy of Sciences (EurASc) and Chair of The Global Leadership and Service Award Committee of the International Union of Materials Research Societies (IUMRS). Rodrigo Martins has been involved in the pioneer European research on amorphous silicon semiconductors and pioneer with is group worldwide activity related to passive and active oxides, the so called transparent electronics and it is one of the inventors of the so-called paper electronics, where paper is exploit not only as a substrate but also as a functional component in active devices. Martins published over 700 papers and during the last 10 years got more than 14 International and national prizes and distinctions for his work (e.g: Lisbon Energy Live Expo, Innovation prize, 2012 (Solar tiles); European Patent Office Innovation nomination 2016 (paper electronics); Exame Informática Innovation prize 2016 (paper solar cells).

ABSTRACT

FUNCTIONAL MATERIALS FOR A BETTER PROSPERITY FOR ALL

Rodrigo Martins

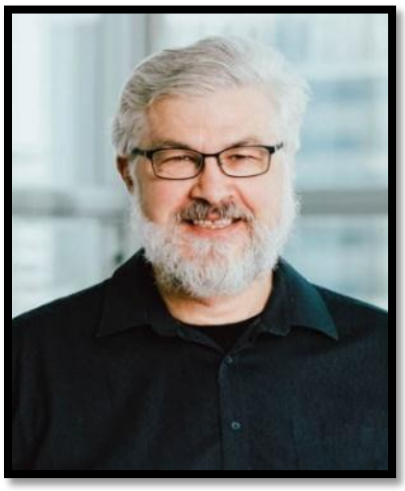
Full Professor at FCT-NOVA ; President of European Academy of Sciences EurASc

The aim of this presentation is to show how today advanced materials are a key component to accelerator and activate the challenges of the 4th technological and industrial revolution, as they are the basis for the development of key sectors of our lives. As a result, they address important societal ‘grand challenges’, such as mobility, healthcare, energy, and climate change. In this context, advanced materials are vital for the future comfort and prosperity, as they will enhance the competitiveness of all, by turning able to deploy the next generation of high performing, cost-effective and environmentally sustainable products and technical solutions in the areas of energy, health, transportation and information and communication technologies.

Dr. Ir. Taufik Bawazier, M. Si.

The man who was born in Gresik 1969 was appointed as Director General of Metal, Machinery, Transportation Equipment, and Electronics Industry since May 2020. Taufiek Bawazier previously served as Head of the Industrial Research and Development Agency since January 2020, was Director of Downstream Chemical Industry and Pharmacy since November 2018, Director of Downstream Chemical Industry since September 2017 and has started since Secretary of the Directorate General of Chemical Industry in June 2016. Taufiek Bawazier completed his education and earned a Bachelor of Engineering from the Sepuluh Nopember Institute of Technology. Then he continued his education at the Master Program in Economics, University of Indonesia. After he obtained his Doctorate in Political Science from the University of Indonesia (2011). He is presently the General Director of Metal, Machinery, Transportation Equipment, and Electronics Industry of the Indonesian Ministry of Industry

KEYNOTE LECTURES



Prof. Dr. Stefan Adams

Prof. Adams is an Associate Professor at Department of Materials Science and Engineering, National University of Singapore since 2011. His work is to combine in situ characterization by electrochemical, neutron, and x-ray diffraction methods with computational approaches to promote the understanding of charge and mass transport in solids and the underlying structure-property correlations. His studies also encompass a wide range of materials for sustainable energy applications such as fast ion conducting solids and mixed conducting cathode materials for lithium batteries with higher power or energy density, and ceramic fuel cells operating at moderate temperatures, nanocomposites for chemical and electrochemical energy storage.

ABSTRACT

Opportunities and Challenges in All-Solid-State Lithium Batteries

Stefan Adams
National University of Singapore, Department of Materials Science and Engineering

Lithium-ion batteries are one of the most transformative energy storage technologies. However, the state-of-the-art lithium-ion batteries can hardly satisfy the rising demand for combining even higher gravimetric and volumetric energy density with improved operational safety. New, safe and reliable solid-electrolyte chemistries can potentially overcome these limitations. In recent years more and more solid electrolytes have been realised and over the past months now several companies claim major progress in translating these materials technologies into high performance all-solid-state Li-metal batteries (ASSLBs). Here advantages and disadvantages of the most relevant oxide, sulphide and halide-based classes of ceramic electrolytes will be discussed with respect to their suitability to enable the realisation of ASSLB with energy and power density, safety, long cycle life, and ease of processing into ceramic or ceramic:polymer composite electrolytes. Beyond individual materials properties, the most pressing issue is to engineer the performance and stability of electrolyte:electrode interfaces both on the lithium anode side and on the side of the (mostly oxide-based) cathodes. Therefore perspectives, guidelines, and selected strategies to engineer these interfaces will be analysed.

Diyanto Imam

Diyanto Imam is a Program Director, PT New Energy Nexus Indonesia, Jakarta, Indonesia. He is an impact-focused professional who delivers creative business solutions with significant and extensive experience in hardware-based startups and impact startups and impact enterprise development in Indonesia. He pursued his bachelor degree on Management at Queensland University of Technology (QUT) 1998 and master's degree on International Business at Swinburne University of Technology in 2000.

ABSTRACT

Energy Storage Startups in Indonesia

Energy storage is a relatively new sector in Indonesia. However, in the last couple of years a number of startups have come on scene with ideas for real-world applications. Despite some opportunities, startups face challenges in implementing their ideas and business models, among others. Close collaborations between startups, services providers, government, research institutes and industry are needed in order to support the development of the sector in Indonesia.

Prof. M. Nizam

Prof. Nizam is a coordiantor of the National Research Priority of Indonesia on lithium battery and fast charging station. He is presently working as a senior lecture in Universitas Sebelas Maret in Surakarta. He achieved his bachelor and master's degree from Universitas Gadjah Mada majoring in Electrical Engineering while the PhD of electrical, electronic, and systems engineering was obtained from Universiti Kebangsaan Malaysia in 2008. Prof. Nizam put his research interest on power systems, renewable energy, energy management, energy storage system, and power quality.

Dr. Haznan Abimanyu, PhD.

Dr. Haznan Abimanyu is a Director of Research Centre for Electrical Power and Mechatronics at Indonesian Institute of Sciences (LIPI). Dr. Haznan started his research career in 1997 at the Research Centre for Chemistry Indonesian Institute of Science. He pursued his PhD in University of Science and Technology, South Korea. His research scope related to energy, catalyst, atsiri, and oleochemistry.

ORAL CONTRIBUTORS

The Study of Mixed Hydroxide Precipitate (MHP) from Local Mineral Resources in Indonesia

Evvy Kartini[1,3*], Agus Sudjatno[1], Muhammad Fakhrudin[1], Mohammad Zaki Mubarok[2], Rizka Ayu Puspita[3]**

[1]*Center for Science and Advanced Material Technology, National Nuclear Energy Agency of Indonesia, Puspiptek, Setu, South Tangerang 15314, Indonesia*

[2]*Department of Metallurgical Engineering, Faculty of Mining and Petroleum Engineering, Institute Technology of Bandung, Jl. Ganesha, 10, Bandung 40132, Indonesia*

[3]*National Battery Research Institute, Edu Center Building Lt 2 Unit 22260 BSD City, South Tangerang 15331, Indonesia*

*E-mail : *evvy.kartini@n-bri.org*

***sujatno.agus@gmail.com*

ABSTRACT

Indonesia has the largest nickel source in the world. It is estimated, there are about 21 million metric tons of nickel reserves in Indonesia. Laterite nickel ore is the most abundant nickel source especially in tropical regions. Laterite nickel with low nickel content ore is mainly found as deposits below the ground surface. Hydrometallurgical process is a popular method to recover nickel trough pressure/high pressure acid leaching by utilized sulphuric acid as leaching agent. Mixed hydroxide precipitate (MHP) is intermediate product of this process. In this research, we investigate MHP product from PT. Smelter Nickel Indonesia. The nickel laterite ore was mined from Sulawesi. The MHP quality content is important for further process of nickel recovery. The XRF result shows that the MHP has nickel content up to 81.85% while cobalt content 1.30%. There are some impurities that need to be consider for further processes. The SEM and XRD data also provided in this research.

Keywords: *Mixed Hydroxide Precipitate, Nickel Laterite, Indonesia Local Mineral*

Effect of the Oxygen Functional Group on the High-Voltage Performance and Self-Discharge of Carbon Supercapacitors Electrodes

Sutarsis [1,2*], Jeng-Kuei Chang[3]

[1]*Institut Teknologi Sepuluh Nopember, Kampus ITS Keputih, Surabaya, East Java, Indonesia 60111*

[2]*Graduate Institute of Material Science and Engineering, National Central University, 300 Zhongda rd, Zhongli, Taoyuan 320, R.O.C*

[3]*Department of Material Science and Engineering, National Chiao Tung University, 1001university rd, East district, Hsinchu 300, R.O.C*

*Email: *sutarsis@mat-eng.its.ac.id*

ABSTRACT

In this works, impact of various oxygen functional groups content on the high voltage performance and self-discharge of activated carbon electrode was investigated by mean galvanostatic charge-discharge in 1 M TEABF4/PC electrolyte. Three activated carbon with different in amount of oxygen functional groups as coded; SFG-1, SFG-2, and SFG-3 for 2.4 wt %, 1.6 wt %, and 1.4 wt %, respectively, were prepared by heat treatment at different temperature. From the charge-discharge measurement at 2.85 V show that SFG-1 sample exhibit the highest capacitance at low current density but low capacity retention and low cycle stability. In other hand, SFG-3 sample show superior performance on the cycle stability, capacitance retention, and efficiency with slightly decreased capacitance at low current density. Furthermore, self-discharge test was conducted after the samples charged at 2.5 V for 12 h.

Keywords: *Supercapacitors, Carbon, Functional Group, High Voltage Performance, Self-Discharge, Leakage Current*

Synthesis and Characterization of NMC111 Cathode by Co-precipitation Method

Rialdy Fahmi[1,2*], Evvy Kartini[2,3], Muhammad Fakhruddin[3], Rizka Ayu Puspita[2]**

*[1]Department of Physics, Faculty of Mathematics and Natural Sciences, Padjadjaran University, Jln. Raya Bandung-Sumedang Km. 21 Jatinangor, Kab. Sumedang 45363, Indonesia**

[2]National Battery Research Institute, Serpong, South Tangerang 15310, Indonesia

[3]National Nuclear Energy Agency (BATAN), Puspiptek Area Serpong, Tangerang Selatan 15314, Indonesia

*E-mail: *rialdy18001@mail.unpad.ac.id*

***evvy.kartini@n-bri.org*

ABSTRACT

A combination of nickel, manganese, and cobalt is one of the most successful li-ion cathode formulas developed to date. Lithium-Nickel-Manganese-Cobalt-Oxide (LiNiMnCoO2) — NMC, become a dominant focus for cathode material development. NMC cathodes are great importance for the development of lithium ion batteries with high specific energy and energy density also reducing environmental impact. In this work, we will synthesis of Ni1/3Co1/3Mn1/3(OH)2 precursor from co-precipitated spherical metal hydroxide and characterization of LiNi1/3Co1/3Mn1/3O2 powders cathode material for secondary lithium batteries by X-ray diffraction (XRD) and scanning electron microscopy (SEM). For the synthesis of NCM active materials, the use of coprecipitate precursor, which possesses homogenous elemental distribution and specific particle morphology for high tap density, is one of the most efficient routes. The preparation of metal hydroxide was significantly dependent on synthetic conditions, such as pH, amount of chelating agent, stirring speed, etc. In this experiment, the value that is observed and varied is the precipitation reaction time (40, 80, 120 minutes).

Keywords: *NMC111, Cathode Material, Co-precipitation, Li-ion Batteries.*

Mechanical Load Test Battery Developed By Universitas Sebelas Maret (UNS) with Experimental Approaches

Brillian Aqif Naufal1, Ubaidillah[1*], Aditya Rio Prabowo[2], Muhammad Nizam[3]

[1]*Department of Mechanical Engineering, Universitas Sebelas Maret, Surakarta 57126,*

Indonesia

E-mail : brian.aqif@gmail.com

ABSTRACT

Battery as one of the electrical energy storage media technologies with various advantages in the use of batteries with high energy density, durability, and environmental friendliness. There are two types of batteries according to their creation, namely primary batteries and secondary batteries. In developing battery technology, Universitas Sebelas Maret (UNS) Indonesia has developed several types of secondary batteries with 18650 battery specifications, including Lithium Iron Phosphate (LFP), and Nickel Manganese Cobalt Oxide (NMC) with a capacity of 1800 mAH, and 2500 mAH . However, there has been no comparative study of safety performance on the types of batteries developed by UNS. Therefore, it is necessary to conduct a comparative study of safety performance on UNS batteries. Mechanical testing methods were carried out to see the safety performance of battery, including the charpy impact test, lateral test, axial test, and three-point bending test. This study aims to identify the performance of battery types with different levels of precision in their application. The meta-analysis method is used to analyze the performance comparison between battery types in each test. Parameters from the experimental results and subsequent studies were carried out to predict the failure behavior of the battery under mechanical load. The results of this study can provide a reference for the design of battery safety under the behavior of mechanical loads on the battery

Keywords: *Battery, lithium ion battery, mechanical loads, axial crush, lateral cracking*

Renewable Power Plant Development Model

Sri Sarjana[1*], Efendhi Prih Raharjo[2]

[1,2]Politeknik Transportasi Darat Indonesia – STTD, Bekasi, Indonesia

*E-mail : *srisarjana@gmail.com*

ABSTRACT

Renewable energy is needed to meet the needs of electrical energy in order to create energy independence on national scale. The mix method was developed in this study which aims to examine the performance of renewable energy which is influenced by several aspects including supply chain, partnership strategy, dynamic capability, and regulation. The unit of analysis developed is renewable power plant with data sources coming from government, business actors, PLN management, environmental institutions, and experts in the energy sector. Analytical hierarchy process and structural equation modeling were used to test the hypothesis. The results of the study state that regulations, partnership strategies and supply chain performance are solution and important priorities in building the performance of renewable power plants in Indonesia. Renewable power generation is recommended as one of the national policies that must be issued by government to support the fulfillment of alternative energy needs.

Keywords: *Renewable Energy, Supply Chain Performance, Partnership Strategy, Dynamic Capability*

Strengthening Energy Diplomacy to achieve "Affordable, Reliable, Sustainable, and Modern Energy for all" (SDGs 7) by 2030

Mochamad Subhan Alkyana[1*], Evvy Kartini[2]

[1,2]National Battery Research Institute Edu Center Building 2nd Floor Unit 2260 Kav Commercial International School Lot. 2 No. 8BSD City – Indonesia

E-mail : subhan.alkiana@n-bri.org, evvy.kartini@n-bri.org

ABSTRACT

Energy is something that is essential, especially in modern society which cannot be separated from energy needs and the rise of electrification in various ways. However, the high demand for this energy is not proportional to the energy sources that we have. Many countries energy supply relies on fossil-based systems which contribute to climate change and will run out over time. This is what ultimately initiates the Global Energy Transition from fossil-based to renewable energy. The concern on energy is also part of Sustainable Development Goals 7 whose objective is to ensure universal access to affordable, reliable and modern energy services and increase substantially the share of renewable energy in the global energy mix. The issue of energy is so strategic that it is closely related to the economic, social and political sectors. This makes energy one of the agenda and projections of a country's foreign policy. Energy diplomacy is a growing diplomatic field which aims to enhance access to energy resources in order to provide energy security. This study will conduct with literature studies and in-depth analysis with qualitative methods. The data shown aims to provide information about energy diplomacy as one of the efforts to achieve SDG's 7.

Keywords: *Energy Diplomacy, Renewable Energy, Sustainable Development Goals*

Increasing performance of solar cell by using red wavelength

Aris Budi Sulistyo, I Gusti Bagus Wijaya Kusuma*

[1]Automotive Mechanics Technology, Polytechnic of Land Transportation, Jl. Cempaka Putih, Kerambitan - Tabanan, Bali, Indonesia, 82161

[2]*Master Degree Program of Mechanical Engineering,* Faculty of Engineering, *University of Udayana, Jl. PB Sudirman, Denpasar, Bali, Indonesia, 80114*

*E-mail: *wijaya.kusuma88@gmail.com*

ABSTRACT

In 2016, the United Nations Framework Convention on Climate Change established the Paris Agreement where the agreement discusses GHG emission mitigation, adaptation, and finance. Globally, Indonesia contributed 0.554 GT CO2 equivalent to 1.49% of total GHG emissions. As a party to the Paris Agreement, the Government of Indonesia is committed to reducing emissions by 29% by 2030. In order to participate in developing renewable energy and building a renewable energy study, several tests were carried out on solar panels that will support Solar Power Plants. Polycrystalline solar panels are panels with efficiencies ranging from 12% -14%. The output power of solar panels is influenced by the intensity and wavelength of light radiation, but previous studies have shown that in high sunlight, the output power of solar panels actually decreases. Further research has been conducted in order to better understand the relationship between the wavelength of light and the output power of the solar panel. To increase the output power, the sunlight is directed in such a way that only certain wavelengths hit the panel. From the research has been tested, it shown that red wavelength gave the best performance of solar panel performance. Subsequently, this research aims to increase the efficiency of polycrystalline solar panels to reach values above 22%.

Keywords: *Solar Panel, Solar Cells, Wavelength, Renewable Energy*

CeO2-Coated NMC 811 as the Cathode Material for Li-Ion Batteries

Muhammad Fakhrudin[1*], Evvy Kartini[1], Heri Jodi[1]

[1]National Nuclear Energy Agency Center for Science and Technology of Advanced Material Building no.43, PUSPIPTEK region, South Tangerang, 15314, Indonesia

*E-mail : *m.fakhrudin@batan.go.id*

ABSTRACT

LiNi0.8Mn0.1Co0.1O2 (NMC811) is one of the most promising cathode materials for Li-ion Batteries due to its high energy density. However, its use in electric vehicles is still experiencing problems due to its poor cycle performance and rate capability. High voltage operation is also limited due to the dissolution of transition metals due to corrosion from the electrolyte. In this study, Cerium Oxide was used to coat NMC 811 by using simple evaporation and precipitation method followed by heat treatment. XRD analysis showed that there is no significant change in crystal Structure in NMC 811 material but the appearance of small CeO2 peaks in patterns. EIS analysis show that coated NMC811 has improved ionic conductivity. Compared to pristine material, CeO2 coated NMC811 also exhibits better rate and cyclic performance.

Keywords: *CeO2, NMC 811, Coating, Cathode, Li-Ion Batteries*

Cathode Active Material of Lithium Battery from Nickel Matte: Indonesian Case Study

Sih Wuri Andayani[1*], Alfiz Muhamad Qizwini[1], Muhammad Arsyansyah[1], Jesslyn[2], Najmuddin Yahya[1]

[1]*Centre for material and technical product, Ministry of Industry, Bandung*

[2]*Department of Metallurgical Engineering, Faculty of Mining and Petroleum Engineering, Institute Technology of Bandung, West Java, Indonesia*

*E-mail: * wurisih@yahoo.com*

ABSTRACT

Indonesia is the largest nickel producers in the world in form of nickel laterite ore. It is smelted as ferro nickel and nickel matte. Nickel matte, with around 77% Ni, 1% Co and 0.3% Fe, could be used as nickel source in cathode active material synthesing, NMC by using nickel sulphate route. This study dealing with synthesizes cathode active material from nickel matte. The nickel matte was converted into nickel sulfate in certain condition and catalyst and then reacting with comercials Mangan Sulphate (MnSO4) and Cobalt Sulphate (CoSO4) (technical grade) resulting NMC. The type of active material was focused on NMC 111. Then, it was doppant using lithium carbonate in varied composition, 1.35% weights to 0.4 % weights. The product of Li - NMC 111 was characterized by using AAS for ratio composition and XRD for crystalography. Based on the diffractogram, as low as LiCO3 composition will give more purity crystal and better performance in the lithium ion battery. Based on its performance, initial charging test, the lithium ion battery has working voltage in the range of 3.0 VDC and 4.2 VDC, with capacity of 0.4 mAH with stability for 30 hours of charge – discharge cycle.

Keywords: *Cathode active material, LiNMC, lithium ion battery, nickel matte*

Activated Carbon from Rice Husk with Various Activators for Lithium Ion Battery Cathode Material Additive

Yustinus Purwamargapratala[1*], Evvy Kartini[2], Agus Sujatno[1], Teguh Yulius Surya Panca Putra[1], Heri Jodi[1]**

[1]Center for Science and Advanced Material Technology - National Nuclear Energy Agency of Indonesia, Puspiptek, Setu, South Tangerang, Banten 15314

[2]National Battery Research Institute, Edu Center Building Lt 2 Unit 22260 BSD City, South Tangerang 15331, Indonesia

*E-mail : *pratala@batan.go.id*

***evvy.kartini@n-bri.org*

ABSTRACT

Activated carbon is needed as an additive in the cathode and anode materials of the battery. Rice husk is a carbon source that allows it to be synthesized into activated carbon using an activator. Measurements using a simultaneous thermal analyzer (STA) showed that changes in the thermal pattern of rice husks occurred at temperatures of 400 oC and 700 oC. Dry and clean rice husks were carbonated at 400 oC for 2 hours, activated with HCl, H3PO4, NaOH, or ZnCl2, then calcined at 700 C for 2 hours. The results of crystal structure analysis using X-ray diffraction (XRD) showed that carbon was formed and the results of morphological observations using a scanning electron microscope (SEM) showed the formation of activated carbon with an average pore diameter of 15 m. The results of measurements using the impedance capacitance resistance meter showed the highest value 6.4834 x 10-4 S.Cm-1 was found in the use of 0.1 M NaOH activator, which is the most effective activator compared to other activators.

Keywords: *activated carbon, rice husk, activator, additive*

Synthesis and Structural Study of CeO2-Doped NMC 811 as the Cathode Material

Moh. Wahyu Syafi'ul Mubarok[1*], Muhammad Fakhrudin[2], Evvy Kartini1,[2,*]

[1]*National Battery Research Institute, 2nd Floor EduCenter Building Unit 22260 BSD, South Tangerang 15314, Indonesia*

[2]*The Center for Science and Advanced Material Technology - National Nuclear Energy Agency of Indonesia, Jl. Kw. Puspiptek, South Tangerang, Banten 15314, Indonesia*

*E-mail: *wahyu.syafiul@n-bri.org, evvy.kartini@n-bri.org*

ABSTRACT

Lithium ion battery is essential for electric vehicles development. One of the most promising cathode materials for Li-ion battery is LiNi0.8Mn0.1Co0.1O2 (NMC 811) due to its high energy density. However, it has a bad rate capability and obvious capacity degradation at high potential cycle, which indeed limits its extensively practical application. One of the potential solution to overcome that problem is by doping. It will modify the structure of cathode materials and improve the electrochemical performances. The impressive material candidate for this case is REE (rare earth element). Besides, Indonesia has one of the biggest deposits for rare earth element. Among all rare earth elements, Cerium has been much widely used in many fields as addition and catalyst. In this research, NMC 811 is doped by Cerium Oxide (CeO2) using co-precipitation method for 5 hours followed by heat treatment. The product was characterized by XRD (X-Ray Diffraction) and SEM-EDS (Scanning Electron Microscope-Energy Dispersive X-ray Spectroscopy), in order to understand its structural behaviour. It is expected that, Cerium reduced the cobalt composition by 0.02, 0.03, and 0.04 mol, that increasing the rate capability.

Keywords: *CeO2, NMC 811, doping, li-ion battery, cathode*

Effect of Alkali Types during Iron Precipitation on the Manganese Sulfate Crystallization from Indonesian Manganese Ore

Slamet Sumardi[1*], Widi Astuti[1], Fika Rofiek Mufakhir[1], Muhammad Fakhrudin[2], Evvy Kartini[2]

[1]Research Unit for Mineral Technology, Indonesian Institute of Sciences, Jl Ir Sutami km 15 Tanjung Bintang, South Lampung 35361, Indonesia

[2] Science and Technology of Advanced Material, National Nuclear Energy Agency of Indonesia, Kawasan PUSPIPTEK Serpong Gedung 43, Setu, Tangerang Selatan 15310, Telp. (021) 7560-922 Fax. 7560-926

*E-mail : *slametsumardi99@gmail.com*

ABSTRACT

NMC is a lithium-ion battery that combines three primary metals, namely Nickel, Manganese, and Cobalt. Manganese metal is used in the form of manganese sulfate (MnSO4). This research has studied the effect of adding alkali in the precipitation of impurities from the solution of manganese ore leaching on the crystals of MnSO4 as raw material for the manufacture of NMC. Some manganese ores are leached using oxalic acid as a reducing agent in a sulfuric acid atmosphere. This leaching process was conducted using sulfuric acid with a concentration of 6%, leaching temperature 80oC, for 6 hours, oxalic acid used 30 g/liter, with a ratio of ore to the sulfuric acid solution was 52.63 gr/l. Then, the impurities (mainly iron) precipitation from pregnant leached solution was carried out with pH adjustment using various alkalis. The alkalis used in this study were NaOH, NH4OH, KOH, Ca(OH)2, and CaCO3. The MnSO4 products were characterized using XRF and XRD. The results showed that the use of Ca(OH)2 or CaCO3 in the precipitation of iron and other impurities from the pregnant leached solution could provide better MnSO4 crystals than the use of NaOH, NH4OH, and KOH.

Keywords: *NMC battery, MnSO4, precipitation, leaching*

Synthesis of Lithium Lanthanum Titanate Using Local Lanthanum Oxalate as a Lanthanum Source for Lithium-Ion Battery Anode Material Application

Anne Zulfia Syahrial[1*], Jarot Raharjo[2], Benediktus Madika[1***]**

[1]*Department of Metallurgical and Materials Engineering, University of Indonesia, Depok, Indonesia*

[2]*Centre of Technology for Materials, Agency for the Assessment and Application of Technology, Indonesia*

*E-mail: *anne@metal.ui.ac.id*

*** jarot.raharjo@bppt.go.id*

**** benediktusmadika10@gmail.com*

ABSTRACT

The ever-increasing energy demand, which comprises 80% of fossil fuels-based energy, has contributed to two-thirds of C02 emissions globally. Therefore, research on eco-friendly renewable energy is continually intensified. Lithium-Ion Battery-based energy storage has been one of the most promising technologies that may enable the energy transition due to its energy storage feature suitability for electric vehicle applications. This paper presents a novel material, Lithium Lanthanum Titanate (Li0.5La0.5TiO3), that has been synthesized from local Lanthanum Oxalate (95.296 at. % Lanthanum), commercial Lithium Carbonate, and commercial Titanium Oxide through a simple and low-cost solid-state reaction process followed by two-step calcination. The Li0.5La0.5TiO3 was heat-treated at three different second step calcination temperatures of 1050°C (LLTO1),1150°C (LLTO2), and 1250°C (LLTO3) yielding 97.987, 98.141, and 92.328 wt. % of the Li0.5La0.5TiO3, respectively. It was observed that each of the Li0.5La0.5TiO3 exhibited a non-porous structure with a larger number of vacant sites between its particles which could participate in the Lithium-ion storage and transport during charging/discharging of Lithium-Ion Battery. Therefore, the Li0.5La0.5TiO3 synthesized through this method is promising to be utilized as anode materials for Lithium-Ion battery applications.

Keywords: *Anode Material, Two-Step Calcination, Lithium-Ion Battery, Lithium Lanthanum Titanate, Solid-State Reaction*

Synthesis of Manganese Carbonate from Indonesian Manganese Ore as NMC Cathode Precursor

[1]*Widi Astuti,* [1]*Slamet Sumardi,* [1]*Fika Rofiek Mufakhir,* [2]*Muhammad Fakhrudin,* [2]*Evvy Kartini*

[1]*Research Unit for Mineral Technology, Indonesian Institute of Sciences, Jl Ir Sutami km 15 Tanjung Bintang, South Lampung 35361, Indonesia*

[2] *Science and Technology of Advanced Material, National Nuclear Energy Agency of Indonesia, Kawasan PUSPIPTEK Serpong Gedung 43, Setu, Tangerang Selatan 15310, Telp. (021) 7560-922 Fax. 7560-926*

Email: widi.mineral@gmail.com; slametsumardi99@gmail.com, fika.cupiw@gmail.com, evvy.kartini@gmail.com, m.fakhrudin@batan.go.id

Abstract

The Li-NMC cathode battery production usually applies carbonate precipitation processes. Manganese compound used is in the form of manganese sulfate (MnSO4) and precipitate using carbonate to produce manganese carbonate. This research has studied the synthesis of manganese carbonate from Indonesian manganese ore as raw material for the manufacture of NMC cathode precursor. Some manganese ores are leached using oxalic acid as a reducing agent in a sulfuric acid atmosphere. This leaching process was conducted using sulfuric acid with a concentration of 6%, leaching temperature 80oC, for 6 hours, oxalic acid used 30 g/liter, with a ratio of ore to the sulfuric acid solution was 52.63 gr/l. Then, the impurities (mainly iron) precipitation from pregnant leached solution was carried out with pH adjustment using various alkalis. The alkalis used in this study were NaOH, Na2CO3, and NH4OH. Manganese carbonate products were characterized using XRF and XRD. The results showed that manganese carbonate with high purity (>95%) can be synthesized from Indonesian manganese ore using leaching and precipitation method.

Keyword*: Li-NMC cathode precursor, Manganese Carbonate, MnSO4, Indonesian Manganese Ore, Leaching, Precipitation.*

Characterization of Unconventional Rare Earth Elements Resources from Bangka Monazite and Tin Slag

Kurnia Setiawan Widana[1], Ilsa Rosianna[1], Dhatu Kamajati[1], F.D. Indrastomo[1], Yarianto Sugeng Budi Susilo[1], Agus Sumaryanto[1], Umar Syarip[1]

*1Center for Nuclear Minerals Technology-National Nuclear Energy Agency (Jl. Lebak Bulus Raya No. 9, Pasar Jumat, Jakarta Selatan, 12440, Indonesia)**

*E-mail : *kurnias@batan.go.id*

ABSTRACT

Rare earth elements (REO) is one of the materials that can be applied as a battery, but the price that rose sharply in 2011 puts the risk of supplying it in the supply chain of this material, so currently, other materials based on Li and Ni elements are the main choice. Unconventional mineral resources are one of the resources obtained from the side process of mineral processing such as in tin mining, which is the residue from processing that produces lead-related minerals (MIT), one of which is monazite and tin slag (slag). Both contain quite high rare earth metals depending on the level of beneficiation and processing. Bangka's monazite and tin slag concentrate contain a total of about 60% and 7% of rare-earth elements (TREO), respectively about 1,000 ppm and 500 ppm uranium and 6% and 5,000 ppm thorium. Based on unconventional resource data collection conducted in Bangka, the tonnage of monazite and tin slag is 9,500 tons and 650,000 tons, respectively. So the total tonnage of rare earth metals, uranium, and thorium that has been recorded from Bangka monazite and tin slag is 52,700 tons, 330 tons U and 3,700 tons Th.

Keywords: *Rare Earth, Monazite, Slag*

Synthesis Graphene Derived from Rice Husk

Fanny Fahriatunnisa Muliawanti[1,2*], Evvy Kartini[2,3], Muhammad Fakhruddin[3], Rizka Ayu Puspita[2]**

*[1]Department of Physics, Faculty of Mathematics and Natural Sciences, Padjadjaran University, Jln. Raya Bandung-Sumedang Km. 21 Jatinangor, Kab. Sumedang 45363, Indonesia**

[2]National Battery Research Institute, Serpong, South Tangerang 15310, Indonesia

[3]National Nuclear Energy Agency (BATAN), Puspiptek Area Serpong, Tangerang Selatan 15314, Indonesia

*E-mail: *fannyfahriatunnisa05@gmail.com*

***evvy.kartini@n-bri.org*

ABSTRACT

Synthesis graphene using enviromantally friendly biomass resource such as rice husk was successfully. Graphene was synthesis using rice husk ash (RHA) and potassium hydroxide (KOH) at 900oC for 2h with 1:5 ratio. Utilize RHA as a source carbon for synthesis of graphene and used to prevent oxidation during annealed process at high temperature. XRD confirmed a presence of graphitic structure . Novelty of this synthesis graphene using enviromentally friendly biomass resource can be one of technique to reduce the use of toxic chemical and natural precursor.

Keywords: *Graphene, rice husk, potassium hydroxide, XRD*

Development of a process for production of Rare Earth Hydroxide from Monazite

Kurnia Trinopiawan[1*], Evvy Kartini[2], Yarianto Sugeng Budi Susilo[1], Kurnia Setiawan Widana[1],Sudaryanto[2], Mochamad Setyadji[3]

[1]*Center for Nuclear Minerals Technology, BATAN, Jl. Lebak Bulus Raya No.9 Pasar Jum'at, Jakarta, Indonesia 12440*

[2]*Center for Science and Technology Advanced Materials, BATAN, Kawasan Puspiptek Serpong, Tangerang Selatan, Indonesia 15314*

[3]*Center for Science and Accelerator Technology, BATAN, Jl. Babarsari kotak pos 6101 ykbb, Yogyakarta,55281*

*E-mail : *kurnia.t@batan.go.id*

ABSTRACT

Several studies have shown an increase in the performance and stability of Li-ion batteries by utilizing rare earth elements (REE) as dopants in battery materials. REE in Indonesia can be found in the monazite mineral, which is a by-product of tin mining activities. The Center for Nuclear Minerals Technology – BATAN developed the REE production technology from monazite with process stages including milling, alkaline leaching, REE dissolution, and multistage precipitation. This process produces REE hydroxide concentrate as the main product, where testing on a laboratory scale obtained REE hydroxide purity of 82.5% and radioactive impurities (uranium and thorium) of less than 100 ppm. The dominant REE compositions in REE hydroxide concentrate are cerium, lanthanum, and neodymium with concentration of 35.04%, 24.69%, and 14.88%, respectively. Initial testing in a pilot plant with a processing capacity of 50 kg monazite/batch of 8 batches provides data on the purity of REE hydroxide products reaching 80% with U and Th content which is still high. The optimization of the process carried out by controlling the concentrations of U and Th in the precipitation stage succeeded in reducing the concentrations of U and Th to below 100 ppm. This shows that the developed technology could obtain products with fairly high purity and free of radioactivity (based on BAPETEN Regulation No. 16 of 2013 concerning Radiation Safety in Storage of Technologically Enhanced Naturally Occurring Radioactive Materials).

Keywords: *rare earth elements, monazite, production*

Overview of the Level of Domestic Components in the Opportunities of the Indonesian Electric Vehicle Industry

Henny Sudibyo[1*], Merry Indahsari Devi[1], Vita Susanti[1] ,

[1]*Research Centre for Electrical Power and Mechatronics- Indonesian Institute of Sciences, Jl Sangkuriang, Bandung 40135, Indonesia*

[2]*Research Center for Policy and Management of Science, Technology and Innovation*

*E-mail : *sudibyohenny@gmail.com*

ABSTRACT

Indonesia has used electric vehicles for future transportation, the government has passed a law to help and facilitate the implementation of future electric vehicles. These regulations are contained in Presidential Regulation No. 55 of 2019 concerning the Acceleration of the battery-based electric motor vehicle program and Permenperind No. 27/2020 Concerning Specifications, development roadmaps and provisions for calculating the component level of domestic (TKDN) electric vehicles for battery-based electric motorized vehicles. This paper describes the opportunities for Indonesian electric vehicles in the future as well as the main and supporting components of electric vehicles that can gr adually produce domestically, thereby increasing the TKDN value. Analysis of the main and supporting components of electric vehicles can be seen from the development of research and industries engaged in Indonesian electric vehicles as well as government policies and implementations that have been real to support the production of national electric vehicles. The main components in an electric vehicle are batteries (35%), frame or body (7%), drive train and PCU (13%), electric instruments (3%) and supporting components. the stage towards the industry, the government has collaborated with private manufacturers to produce national batteries. The TKDN value is expected to increase as consumers and government policies provide incentives to the electric vehicle industry

Keywords: *local content, electric vehicles, main components, supporting components*

Test Performance of Charging Station Management System

Prasetyo Aji[1*], Dionysius Aldion Renata[1], Rully Kusumajaya[2], Rachmawan Atmaji Perdana[2], Made Gunawan[2]

[1] *National Laboratory for Energy Conversion Technology (B2TKE), Agency for the Assessment and* Application of Technology (BPPT), Puspiptek 620-625 Building, *Banten 15314, Indonesia*

[2] *Information and Communication Technology Center (PTIK), Agency for the Assessment and* Application of Technology (BPPT), *Puspiptek 3th Technology Building, Banten 15314, Indonesia*

E-mail : prasetyo.aji@bppt.go.id

ABSTRACT

The Sonik Charging Station Management System (CSMS) application is a web-based application that functions to remotely manage and monitor various charging stations (CS) registered in the application. This test is part of the application development stage and the results of this test will be used as input for the development team to improve the Sonik CSMS application so that when used officially, it can show adequate performance. The tests carried out include security (static or dynamic), performance (load test), and compliance with the SRS (System Requirement Specification) document. For the security aspect, the static security test results show that the CSMS application has no security problems. But the results of dynamic security testing, this application still has security problems at all security levels. To determine the ability of the CSMS application in managing several CS, a load test has been carried out where this application is burdened with 400 dummy CS. Dummy CS is a CS that is simulated using the JMeter tool and performs transactions imitating transactions on real CS. Judging from the compatibility between the features in the Sonik CSMS application and the features written in the SRS document, several features have not been realized. However, it is stated in the SRS document that features that do not yet exist will be realized in the next version of the CSMS application.

Keywords: *Charging Station Management System, Security, Performance, Compliance*

Optimization of Airless Tire Design for Electric Vehicles

I Made Gatot Karohika[1, 2*,] I Nyoman Gde Antara[1]

[1]Department of Mechanical Engineering, Faculty of Engineering, Universitas Udayana, Jl. Raya Kampus UNUD, Bukit Jimbaran, Kuta Selatan, Badung-Bali-803611, Indonesia

[2]Pusat Penelitian Teknologi dan Material, Universitas Udayana

*E-mail: *gatot.karohika@unud.ac.id*

ABSTRACT

The performance of electric vehicles is strongly supported by the development of their components. One of the components that affect the performance of an electric vehicle is the tire wheel. So far, the vehicle uses pneumatic tires which need to always control the tire pressure and if the tire is flat, it will affect the stability of the vehicle which indirectly affects battery performance. This research will offer airless tires as a replacement for pneumatic tires for electric vehicles. An airless tire with honeycomb-shaped spokes with various dimensions will be simulated using ANSYS software with the objective function is the tension and deflection that occurs in the tire. The optimization method uses the Taguchi method. From the optimization results, we will obtain a spokes honeycomb dimension that provides optimal airless tire performance.

Keywords: *Airless Tire, Electric Vehicle, optimization, Taguchi, Spokes.*

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Day-3 (Thursday, June 24th 2021)

Session	Time	Code	Estimation	Speaker	Topic	Affiliation
Morning Session (GMT+7)	08.20-08.30	Opening by Master of Ceremony				
	08.30-09.10	PL	40’	Prof. Anhar Riza Antariksawan		Head of BATAN
	09.10-10.00	PL	50’	Yi Ke, Ph.D.	The Opportunities for Startups and Large Corporate Collaborations and our Experience on the EV and Battery Challenge and LG Chem Battery Challenge.	Energy Storage Program Manager – New Energy Nexus Global
	10.00-10.45	PL	45’	Prof. Ying Shirley Meng	From Atom to System-Building Better Batteries for Energy Transition	Research Award of International Battery Material Association 2019
	10.45-10.50	Room Transition				
	10.50-12.00	Battery				
		KN	30’	Dr. Alexey Glushenkov	Potassium-ion and Dual-ion Battery Chemistries	ANU, Australia
		INV	25’	Agus Sugiyono and Ira Fitriana	The Role of Battery Energy Storage System in Supporting the Net Zero Emission Target in Indonesia’s Electricity System	BPPT
		OR	15’	Achmad Subhan and Abdulloh Rifai	Li-ion Diffusion Behavior and Electrochemical Performance of Li4Ti5O12 and Na2Li2Ti6O14	LIPI
		Renewable Energy				
		KN	30’	M. Firmansyah, S.E.	The Effect of Renewable Energy Policy Implementation on Energy Usage	CEO at INFIEN ENERGI
		OR	15’	Mohammad Ridho Nugraha and Evvy Kartini	Analysis of Stand-Alone Street Light Installation in Tekno Area by Monitoring System Powered with Polycrystalline PV Panel and LiFePO4 Prismatic Battery	NBRI
		OR	15’	I Gusti Bagus Wijaya Kusuma and Aris Budi Sulistyo	Increasing energy storage capacity by using liquid hydrogen	University of Udayana and Politeknik Transportasi Darat Bali
	12.00-13.00	Break Session				
Afternoon Session (GMT+7)	13.00-14.00	PL	60’	Prof. Laurence Hardwick	In situ vibrational spectroscopy of electrode interfaces	Director of the Stephenson Institute for Renewable Energy, University of Liverpool
	14.00-14.50	PL	50’	Dr. Ana Jorge Sobrido, Ph.D.	Sustainable Freestanding Electrodes for Energy Storage	UKRI Future Leaders Fellow, QMUL
	14.50-14.55	Room Transition				
	14.55-16.30	Battery				
		INV	25’	Evangelin Hutamaningtyas, Hande Alptekin, Jorge Pavel Victoria, Ana Belen Jorge Sobrido, Magdalena Titirici, Alan J Drew	Tin-Hard Carbon Composite Anode Materials for Sodium-ion Batteries	QMUL, Imperial College London, QMUL, QMUL, Imperial College London, QMUL
		OR	15’	Safira Sabilla Rosyad and Mohammad Zaki Mubarok	Effect of pulse current on morphology and crystal structure of electrolytic manganese dioxide	ITB

		OR	15’	Heri Jodi, Anne Zulfia, Muhammad Fakhrudin, Evi Yulianti and Evvy Kartini	The Conductivity Enhancement of 1.5Li2O-P2O5 Solid Electrolytes by Montmorillonite Addition	BATAN, UI, BATAN, BATAN, BATAN
		OR	15’	Deswita Deswita, Yulia Indriani and Indra Gunawan	Synthesis and Characterizations of LiMn2O4 Sheet over Al Foil as Cathode Material for Li Ion Baterry	BATAN, UNS, BATAN
		Electric Vehicles				
		KN	30’	Dr. M. Mustafa Sarinanto	BPPT’s Role for Coming Age of Battery Electric Vehicle in Indonesia	BPPT, Indonesia
		INV	25’	Putu Gardian, Ardhi Wardhana and Rio Pramudita	The Impact of Growing Electric Vehicle Battery Production to Nickel Supply Chain in Indonesia Using System Dynamics Approach	Low Carbon Development Initiatives Indonesia, Institut Teknologi Bandung, PT Akuo Energy Indonesia
		OR	15’	Setiawan Nur Ikhsan and Evvy Kartini	Power Consumption Analysis of A Brushless DC Motor 48V 500W Electric Bike on An Assembled Lithium-ion Battery Pack	Diponegoro University, NBRI-BATAN
		OR	15’	Dzaky Pratama, U Ubaidillah, Aditya Prabowo and M Nizam	An Axial and Lateral Battery Crushing using Non-Linear Finite Element (NLFE) approach.	UNS
	16.30-17.00	**Closing Remarks**				

PL= Plenary Session
KN= Keynote Session
INV= Invited Speaker
OR= Oral Contributor

PLENARY LECTURES

Yi Ke, Ph.D

Yi Ke, Ph.D. is a material science Ph.D. and strategic consultant in energy. She lead the energy storage program at New Energy Nexus (previously known as California Clean Energy Fund). They aim to support diverse entrepreneurs to drive innovation in the energy storage and battery sector with funds, accelerators, and networks. Projects under their energy storage program include CalCharge, EV and Battery Challenge (with LG Chem, Hyundai Motor, and Kia Motor), LG Chem Battery Challenge, Bay Area Battery Summit. While working at Rocky Mountain Institute, She provided strategy consulting service to government and utilities, on topics from long-term energy system planning to short-term power market designto create clean, prosperous, and secure low-carbon energy future for all. Her works were used as a reference to the US-China Joint Presidential Statement on Climate Change in 2015 by the White House and China's 13th Five Year Plan by NDRC.

Prof. Ying Shirley Meng

Prof. Ying Shirley Meng is a materials scientist and professor of the department of Nanoengineering and the Materials Science Program at University of California, San Diego. She currently holds the Zable Endowed Chair Professor in Energy Technologies. She is also the founding Director of Sustainable Power and Energy Center. She achieved several prestigious awards including International Battery Association IBA Research Award in 2019 and Chancellor's Associates Faculty Research Excellence Award 2019.

ABSTRACT

FROM ATOM TO SYSTEM - BUILDING BETTER BATTERIES FOR ENERGY TRANSITION

High energy long life rechargeable battery is considered as key enabling technology for deep de-carbonization. Energy storage in the electrochemical form is attractive because of its high efficiency and fast response time. Besides the technological importance, electrochemical devices also provide a unique platform for fundamental and applied materials research since ion movement is often accompanied by inherent complex phenomena related to phase changes, electronic structure changes and defect generation. In this seminar, I will discuss a few new perspectives for energy storage materials including new fast ion conductors, new intercalation compounds and their interfacial engineering. With recent advances in characterization tools and computational methods, we are able to explore ionic mobility, charge transfer and phase transformations in electrode materials in-operando, and map out the structure-properties relations in functional materials for next generation energy storage and conversion. Moreover, I will discuss a few future priority research directions for electrochemical energy storage.

Prof. Laurence Hardwick

Prof. Laurence Hardwick is Professor of Electrochemistry and Director of the Stephenson Institute for Renewable Energy within the Department of Chemistry at the University of Liverpool. He received his Mchem in Chemistry in 2003 from the University of Southampton and PhD in Chemistry from ETH-Zurich in 2006. Before joining Liverpool in 2011, he spent his postdoctoral time working at the Lawrence Berkeley National Laboratory and at the University of St Andrews Investigating Li-ion battery electrode degradation mechanism, lithium diffusion pathways through carbon and the chemical and electrochemical process in Li-air cells. His recent work has focused on the development of advanced in situ electrochemical surface enhanced infrared and Raman methodologies that examine electrochemical reaction mechanisms on variety of electrodes interfaces which assist in our understanding on the function of metal-air and li-ion batteries.

ABSTRACT

In situ vibrational spectroscopy of electrode interfaces

Laurence J. Hardwick

Stephenson Institute for Renewable Energy, Department of Chemistry,

University of Liverpool, L69 7ZF, United Kingdom,

E-mail: hardwick@liverpool.ac.uk

Research within our group focuses on the understanding and control of the interfaces within energy devices. For example, side reactions and passivation layers at the electrode/electrolyte interface affect the performance and safety of batteries. In this presentation I will highlight how surface enhanced Raman techniques (such as Shell-isolated Nanoparticles for Enhanced Raman Spectroscopy or SHINERS for short) can be used to investigate oxygen reduction reaction mechanisms in metal-oxygen cells and introduce how complementary techniques, such as surface enhanced infrared spectroscopy, assist in understanding the particular chemical environment at the electrode/electrolyte interface. Talk will also explore *in situ* Raman methods looking at intercalation mechanisms and controlling the reactivity of lithium metal surfaces.

Dr. Ana Jorge Sobrido, Ph.D.

Dr. Ana Jorge Sobrido, Ph.D. is a senior lecturer in Sustainable Energy Materials UKRI Future Leaders Fellow Programme Director for Sustainable Energy Engineering of Queen Mary University of London. After finishing her degree in chemistry (2004), she moved to Barcelona to conduct a PhD in Materials Science at he Autonomous University of Barcelona and the Institute of Materials Science, being awarded a Prize for an outstanding PhD thesis (2009). In 2019, Dr. Ana became a Lecturer in Energy Materials at QMUL. Dr. Ana's group studies the design of high-performing sustainable electroactive materials using easy-to-scale processing techniques for application in energy storage and conversion. She is a member of the UK Redox Flow Battery Committee, STFC Battery Steering Committee and Director of the London Energy Materials & Devices Hub.

ABSTRACT

Sustainable Freestanding Electrodes for Energy Storage

The current global energy demand is mainly met by the production of electricity from fossil fuels, with typical power outputs of over 1GW, but this is far from being sustainable. Consequently, the concentration of carbon dioxide in the atmosphere has almost doubled, reaching a value of 401 ppm in 2015. The use of renewable energy is an inevitable choice to achieve sustainable development. However, its inherent intermittent nature makes its use and delivery through the grid extremely challenging and stresses the need for efficient ways to store energy. Among the electrochemical energy storage alternatives, redox-flow batteries (RFBs), in which the energy conversions are based on the reversible electrochemical reactions of redox couples dissolved in electrolyte, are well-suited for large-scale energy storage because of their unique combination of flexible design, long life, high reliability, environmental friendliness and low maintenance. RFBs commonly employ non-optimised carbon felts or papers as the electrodes, meaning the activity towards the redox reactions are often poor, which in turn leads to low operating power densities. Additionally, the complex flow characteristics of the electrodes are not well understood, and it is hard to find ideal electrode materials that can have a proper balance of the desired properties. Metal-air batteries are also a promising energy storage technology with a great potential in the automotive field. However, the sluggish kinetics of the oxygen evolution and reduction reactions taking place at the air- cathode require the use of expensive noble metal electrocatalysts, which has hindered their development. In this talk, I will present our alternative materials which rely in biomass waste to produce high performing functional electrodes for redox flow and metal-air batteries. The materials have been processed using electrospinning, a very versatile scalable technique that enables the production of self-supporting energy materials with tailored properties.

KEYNOTE LECTURES

Dr. Alexey M. Glushenkov

Alexey M. Glushenkov is an Associate Professor at the Australian National University (ANU). He is a part of the Research School of Chemistry and a Research Lead in Battery Materials in ANU Battery Storage and Grid Integration Program, a joint initiative with the School of Engineering. Associate Professor Glushenkov received his Master of Physics degree from Novosibirsk State University in Russia in 2003 and his PhD degree (physics, electronic materials engineering) from the Australian National University in 2009. He had research appointments at Boreskov Institute of Catalysis (Russia), Australian National University, Deakin University, Melbourne Centre of Nanofabrication, the University of Melbourne (all - Australia) as well as Drexel University (the US). Associate Professor Glushenkov's research interests are centred on electrochemical energy storage in metal-ion batteries, electrochemical supercapacitors and hybrid metal-ion capacitors as well as materials that enable these energy storage cells. Previously, he was a winner of 2014 Vice-chancellor's Award for Research Excellence at Deakin University (early career researcher) and was a 2017 Emerging Investigator of Journal of Materials Chemistry A.

ABSTRACT

Potassium-ion and dual-ion battery chemistries

Alexey M. Glushenkov
Research School of Chemistry, The Australian National University, Canberra 2601, ACT, Australia

Although lithium-ion batteries become more and more dominant at present in various applications, including stationary energy storage, electric mobility, and portable electronics, there are sustainability concerns around the abundance of some of the chemical elements involved (Li, Co, Ni), future pricing of the required feedstock, and battery safety and waste utilisation. There is a scope to explore alternative battery options, at least for large-scale stationary applications, that can be free of some or all of these perceived limitations. Potassium-ion and dual-ion batteries has recently emerged in the spotlight internationally as some of the candidates for the roles of alternative battery systems to supplement lithium-ion batteries in some applications. This presentation will aim to introduce the concepts of potassium-ion and dual-ion battery chemistries to the Indonesian audience. Some international results in this space will be reviewed, and the presenter will discuss recent results from his group in this space.

M. Firmansyah, SE

Muhammad Firmansyah completed his undergraduate education from Padjajaran University Bandung in 2015 majoring International Business Management. Then, He deepened his knowledge in entrepreneurship. Firman began his career at PT. HM. Sampoerna Tbk in 2015. Initially he got a position as a graduate trainee, then as a Consumer Engagement Supervisor. In 2016, he gained a position as Area Supervisor for Multitasking. In 2018, he held the position of Area Analyst and later became Area Manager. In the same year he founded his consulting company named PT. Infiniti Energi Indonesia and became President Director. In addition, he also became a commissioner of CV. Tridaya Cavali.

ABSTRACT

The Effect of Renewable Energy Policy implementation On Energy Usage

Indonesia is the largest archipelago with 17,503 island where 6000 populated islands and most of the islands are remote area. The 2020 census recorded Indonesia's population as 270.2 million, almost 80,000,000 people in Indonesia use the state electricity company.This condition causes limited access to energy supplies such as electricity and fuel. Meanwhile, Indonesia has a variety of natural resources including renewable energy sources that have not been applied optimally. It is expected that the utilization of local renewable energy sources can guarantee the availability of electricity in urban areas so that it can support national development and security. To optimize renewable energy in urban area, the government made Minister of Energy and Mineral Resources (EBTKE) Regulation number 49 of 2019 ‘concerning the Use of Rooftop Solar Power Generation Systems by PT PLN (Persero) Consumers. Director General of New, Renewable Energy and Energy Conversion (EBTKE) of the Ministry of Energy and Mineral Resources ,the public could take back 100 percent of the electrical energy deposited in PT PLN (Persero). Currently, consumers can only take 65 percent of the electrical energy deposited at PLN.To analyses the regulation and other supports, the SWOT method is used to know the impact of the regulation in market. Coordination is needed between the Central Government and solar home system. Also, control and evaluation of existing policies are required so that people can get Return on investment optimally.

Dr. Mohammad Mustafa Sarinanto, IPU

Dr. Mohammad Mustafa Sarinanto, IPU is a Head of the Center for Energy Conversion and Technology in Agency for the Assessment and Application of Technology (BPPT). He pursue his master degree majoring Electrical and Electronical Engineering on Niigata University Japan. Then he continue his master majoring Applied Electronics on Tokyo Institute of Technology. He graduated from his doctoral program majoring Electronics on Tokyo Institute of Technology Japan.

ABSTRACT

BPPT's Role for Coming Age of Battery Electric Vehicle in Indonesia

Dr. Mohammad Mustafa Sarinanto

National Laboratory for Energy Conversion Technology

Indonesian Agency for the Assessment and Application of Technology

Battery electric vehicles (BEV) are growing so fast recently and are expected to be a disruptive innovation for conventional internal combustion engines (ICE) based road transportation. Various initiatives have been carried out by various research and development institutions as well as educational institutions, which have produced various prototypes. In an effort to build an innovation ecosystem for BEV, BPPT carried out several initiatives such as designing main components such as electric motors, and clearing technology of fast charging station through installations in several places.

Keywords: battery electric vehicle (BEV), electric motor, clearing technology, fast charging station

ORAL CONTRIBUTORS

The Role of Battery Energy Storage System in Supporting the Net Zero Emission Target in Indonesia's Electricity System

Agus Sugiyono [1*], Ira Fitriana [1]

[1]Agency for the Assessment and Application of Technology, Puspiptek, Setu, South Tangerang, Banten 15314

*E-mail : *agus.sugiyono@bppt.go.id*

ABSTRACT

Government of Indonesian has launched a Grand National Energy Strategy that will accelerate the use of new and renewable energy for power generation. Besides that, there are many discourses on implementing a net zero emission target in 2050 or after. Various large-scale power generation options can be utilized to replace coal and gas-based power generation, such as hydropower, geothermal, solar, wind and nuclear power generation towards net zero emissions. The prospects for these various options are evaluated based on generation cost using the LEAP (Low Emissions Analysis Platform) model. The 4 scenarios were evaluated, i.e. business as usual (BAU), coal and gas power plant with carbon capture and storage (CCS), solar and wind power plant with battery energy storage system (BESS) and nuclear power plant (NPP). The development of intermittent solar and wind power plant cannot be carried out on a large scale unless coupled with a BESS. The cheapest generation costs are in the BAU scenario, but cannot reach the net zero emission target. The next three scenarios can be used as an option to achieve the net zero emission target. The NPP scenario has a lower cost than the CCS and BESS scenarios, but there are challenges in public acceptance. The CCS scenario is difficult to implement because it is still based on fossil fuels and the generation costs are also high. The BESS scenario can compete in generation costs with the NPP scenario, if BESS investment costs can continue to decline in the long term.

Li-ion Diffusion Behavior and Electrochemical Performance of Li4Ti5O12 and Na2Li2Ti6O14

Achmad Subhan[1], Edi Suprayoga[1], Gagus Ketut Sunnardianto[1], Ferensa Oemry[1], Indri Badria Adilina[2], Peter Baker[3], Mark Telling[3], Abdulloh Rifai[1*]

[1] Research Center for Physics, Indonesian Institute for Sciences (LIPI), Kawasan PUSPIPTEK Gd. 440 – 442, Tangerang Selatan, Banten 15314, Indonesia
[2] Research Center for Chemistry, Indonesian Institute for Sciences (LIPI), Kawasan PUSPIPTEK Gd. 452, Tangerang Selatan, Banten 15314, Indonesia
[3] ISIS Muon Facility, Rutherford Appleton Laboratory, Didcot, Oxfordshire, OX11 0QX, United Kingdom
*E-mail: *rifai.a.aa@protonmail.ch; mysubhan27@gmail.com*

ABSTRACT

Rechargeable lithium-ion batteries (LIBs) has been widely utilized as power sources in electric vehicles and hybrid electric vehicles.Graphite is still being used in most lithium-ion but have same limited performance since it can be polarized when a high discharge rate is applied, resulting in the formation of highly reactive dendritic lithium on the electrode surfaces. The dendritic lithium may penetrate through the porous separator, causing an internal short circuit and posting significant safety concern. To overcome the shortcomings of graphite anode, spinel lithium titanate (Li4Ti5O12) has been developed and commercially available. Its high thermal stability and negligible volume change with zero strain during charging and discharging ensure a long cyclic stability and lifetime.[a,b] Due to its lithium insertion/extraction voltage at 1.55 V vs. Li/Li+,[c] which is above the potential for formation of an SEI from the reduced organic electrolyte and dendritic lithium, Li4Ti5O12 offers the potential for high rate capability and safety. However, its higher Li+ insertion/extraction potential results in a lower output voltage of lithium-ion batteries, which leads to a reduced energy density.[d] To increase the energy density within the electrolyte stability region, several titanate-based anode materials with a lower lithium insertion/extraction potential than 1.55 V vs. Li/Li+ have been proposed as alternative to Li4Ti5O12, such as the orthorhombic structure of MLi2Ti6O14, with M = Sr, Ba, Pb, 2Na.[e, f, g, h] Among MLi2Ti6O14 materials, Na2Li2Ti6O14 exhibits the lowest operating potential of 1.25 V versus Li/Li+. In our work, to examine whether Na2Li2Ti6O14 has potential to replace Li4Ti5O12 as an anode material, the electrochemical performance and Li+ diffusion behaviour of Na2Li2Ti6O14 are compared to those of Li4Ti5O12. Their cyclic voltammogram, charge-discharge, and rate capability were tested by automatic battery cycler. The Li+ diffusion behaviour was studied by muon spin (□+SR) spectroscopy. This muon technique has been applied to study the nature of Li+ diffusion behaviour due to the ability to detect changes in the nuclear dipole field due to Li+ movement. Two important parameters which explains Li+ diffusion can be obtained, including field fluctuation rate (v) and local field distribution at the muon stopping site (Δ) by fitting the zero-field (ZF)- and longitudinal-field (LF)- spectra with a dynamic Kubo-Toyabe function.

Keywords: *muon spectroscopy, lithium-ion battery, Li4Ti5O12, Na2Li2Ti6O14*

Analysis of Stand-alone Street Light Installation in Tekno Area by Monitoring System Powered with Polycrystalline PV Panel and LiFePO4 Prismatic Battery

Mohammad Ridho Nugraha[1*], Evvy Kartini1[2]

*[1]National Battery Research Institute, Edu Center Building 2nd Floor Unit 22260 Kav Commercial International School Lot 2, South Tangerang, Indonesia**

[2]National Nuclear Energy Agency of Indonesia, Jl. Kw. Puspiptek, Muncul, Kec. Setu, Kota Tangerang Selatan, Indonesia

*E-mail: *ridho.nugraha@n-bri.org*

ABSTRACT

The use of street light in Indonesia, many of them still use street light with Alternating Current (AC) because it is considered cheaper and easier to install. Using renewable energy sources such as solar energy that can reduce carbon emissions is the right choice for regions in Indonesia that are also located on the equator. The system consisted of a solar panel, solar charge controller, monitoring system, 12V LiFePO4 prismatic battery, and 30W LED Light. To improve the usage of PV street lights, analysis with a monitoring system has been done. The supporting data are collected from My Solar Panel Apps to collect the solar irradiance real-time value. Other data such as input energy, output energy, % energy loss were collected from the Solar Charge Controller with the monitoring system.

Keywords: *Solar Panel, Photovoltaic, Li-ion Battery, Solar Street Light, Monitoring System, Solar Charge Controller, Renewable Energy*

Increasing energy storage capacity by using liquid hydrogen

I Gusti Bagus Wijaya Kusuma*, Aris Budi Sulistyo

[1]*Master Degree Program of Mechanical Engineering,* Faculty of Engineering, *University of Udayana, Jl. PB Sudirman, Denpasar, Bali, Indonesia, 80114*

[2]*Automotive Mechanics Technology, Polytechnic of Land Transportation, Jl. Cempaka Putih, Kerambitan - Tabanan, Bali, Indonesia, 82161*

*E-mail: *wijaya.kusuma88@gmail.com*

ABSTRACT

Solar power is one method in energy generation that is classified as renewable energy. Energy that comes from solar power, for now, has not reached level of commercialization due to the price of solar cells. In addition, this energy is affected by weather conditions, where the radiation intensity will get smaller when the sky is cloudy or rainy or during winter time. In order to minimize this lack, a research has been conducted to increase performance of solar power system by using liquid hydrogen as the working fluid. This method will repaired heat or energy storage and can be used when sun radiation is dropped or not at all. Shortwave electromagnetic radiation from the sun will penetrate a transparent walls that made by tempered glass. Through this material, electronic radiation from the sun is transmitted into the interior space collectors. These collectors produce high heat inside the space, thus causing the occurrence of radiant heat transfer to the hydrogen pipes. Heat transfer from the hydrogen pipes into the hydrogen change its phase from liquid into vapor with high temperature and pressure. The results showed an increase in the capacity of energy generating by 40% and increasing capacity of storage energy by 45%.

Keywords: *Solar power, renewable energy, hydrogen*

Tin-Hard Carbon Composite Anode Materials for Sodium-ion Batteries

Evangelin Hutamaningtyas[1*], Hande Alptekin[2], Jorge Pavel Victoria[1], Ana Belen Jorge Sobrido[1], Magdalena Titirici[2], and Alan J Drew[1]

[1]School of Physics and Astronomy, Queen Mary University of London, Mile End Road, London, E1 4NS, United Kingdom

[2]Department of Chemical Engineering, Imperial College London, London, SW7 2AZ, United Kingdom

*E-mail : *e.hutamaningtyas@qmul.ac.uk*

ABSTRACT

Sodium-ion batteries are considered as a promising alternative to lithium-ion batteries with advantages of sodium abundance, relatively low cost material, and potential safety benefits. Tin (Sn) anodes exhibit a high theoretical capacity of 874 mAh/g (Na15Sn4) and perform stable cycle performance. The problem with tin sodium alloy is the large volume changes (420%) resulting in capacity decay after cycles and energy loss. The pulverization problem can be solved by creating nanostructure and introducing carbonaceous matrices. Considering the matrices to buffer volume expansion, hard carbons are an excellent choice as it is sustainable and environmentally friendly. Combining tin and hard carbon as composites make a possible for sodium to be stored in anode via both insertion and alloying. Tin-carbon composites were produced by hydrothermal carbonization methods. Performing several temperatures during carbonisation have a result for different characteristics of tin-carbon composited produce. Moreover, small angle scattering was used to study microscopic and nanoscopic pores in carbonaceous materials.

Keywords: *Sodium ion battery, tin-hard carbon, small angle scattering, hydrothermal*

Effect of pulse current on morphology and crystal structure of electrolytic manganese dioxide

S.S. Rosyad[1], M.Z. Mubarok[1,*]

[1]*Department of Metallurgical Engineering, Faculty of Mining and Petroleum Engineering, Institute Technology of Bandung, West Java, Indonesia*

*E-mail: *zaki@mining.itb.ac.id*

ABSTRACT

Electrolytic manganese dioxide (EMD) is a material which has been used for depolarizing agent in zinc-carbon and alkaline batteries. In this paper, the effect of pulse current on morphology and crystal structure of electrolytic manganese dioxide (EMD) is discussed. Pulse current electrolysis method is proposed to enhance a better morphology, indicates by finer particle size, and crystal structure. Series of electrolysis experiment which comprises of two electrolysis methods, namely using direct current and pulse current have been done to study the effect of pulse current on the morphology and crystal structure of EMD. For both methods, the electrodes used in this experiment were titanium anode and carbon cathode. The electrolyte consists of [MnSO4] 90 g/L in 500 mL H2SO4 0.5 M. After 4 hours electrolysis, the anode is rinsed using distilled water and dried in an oven for 24 hours. The deposits of EMD are further analyzed using SEM and XRD to observe their morphology and crystal structure. The results of direct current electrolysis experiment showed that higher current density tend to reduce current efficiency and producing finer particle size. Higher temperature than 90°C resulted in lowering current efficiency and larger grain size of EMD. For pulse current electrolysis, the results showed that higher frequency and duty cycle reduces grain size. The finest grain size was obtained by the experiment with 75% duty cycle and frequency of 185 Hz. Although both EMD produced by direct current and pulse current were consist of similar crystal structure of γ-MnO2 and ε-MnO2, EMD produced by pulse current electrolysis has a better crystallinity.

Keywords: *electrolytic manganese dioxide, electrolysis, pulse current, morphology, grain size*

The Conductivity Enhancement of 1.5Li2O-P2O5 Solid Electrolytes by Montmorillonite Addition

Heri Jodi[1*], Anne Zulfia[2], Muhammad Fakhrudin[1], Evi Yulianti[1], Evvy Kartini3

[1]Center for Science and Advanced Material Technology - National Nuclear Energy Agency of Indonesia, Puspiptek, Setu, South Tangerang, Banten 15314

[2]Department of Metallurgy and Materials Engineering, Faculty of Engineering, Universitas Indonesia

[3]National Battery Research Institute, Edu Center Building Lt 2 Unit 22260 BSD City, South Tangerang 15331, Indonesia

*E-mail : * herieldi@gmail.com*

ABSTRACT

The solid electrolyte is interesting because of its potential to be applied in a wide variety of electrochemical devices. Most of the solid electrolyte material has low enough conductivity to be applied to a device such as an electrolyte of a battery. The previous study has reported that the mixture of 1.5Li2O-P2O5 has a conductivity greater than the conductivity of Li3PO4. In this study, Montmorillonite clay was added to the mixture of Li2CO3 and NH4H2PO4 to make composite prepared by solid-state reaction. The composites were characterized using Scanning Electron Microscopy, and Electrochemical Impedance Spectroscopy, in order to investigate the morphology and electrochemical properties. The Micrographs showed that as the MMT content is added, the shape of glassy like flake is reduced, and the granular lumps are getting larger in size. The whole Nyquist plot consisted of only an imperfect semicircular arc, indicates the relaxation process in response to the bulk material. The conductivity of the mixture with MMT content up to 20 wt% was in the order of 10-4 S/cm which is higher than that of Li4P2O7 and Li3PO4. The slope of dielectric loss of the samples indicates that the conduction in the samples was more predominantly dc conduction.

Keywords: *Lithium Phosphate, solid electrolytes, Montmorillonite, conductivity*

Synthesis and Characterizations of LiMn2O4 Sheet over Al Foil as Cathode Material for Li Ion Baterry.

Deswita[1], Yulia Indriani[2], Indra Gunawan[1], Sudaryanto[1], Evvy Kartini[1].

[1] Center for Science and Technology of Advanced Materials

Gd. 71 Kawasan PUSPITEK, Serpong - Tangerang.

[2] Faculty of Mathematics and Natural Science,

Universitas Sebelas Maret - Surakarta

ABSTRACT

The synthesis of LiMn2O4 cathode was began by manufactured a slurry with consisting of 90% LiMn2O4, 5% Acetylene Black (AB) and 5% PVDF. The sample was dissolved in 3 ml of NMP solution that had been mixed with 5% PVDF, then stirred with a vacuum mixer for 15 minutes until the sample become a slurry. The slurry is placed on top of aluminum foil to be used as a cathode using a dactor blade. Characterization was done using XRD, PSA, SEM and LCR meter. It was found that the diffraction peaks were the strongest in the LiMn2O4 powder sample. The average particle size of LiMn2O4 is in the range between 214.64 nm - 318.18nm. The LiMn2O4 cathode is seen if there are nets that bind between the particles which is caused by the addition of PVDF polymer. So that PVDF causes one particle to bind to another, which will create gaps in the LiMn2O4 cathode. The conductivity of LiMn2O4 was obtained of about 3.00 x 10-5 S.cm-1.

Keywords : *synthesis, characterizations, LiMn2O4, manufacture, electric conductivity*

The Impact of Growing Electric Vehicle Battery Production to Nickel Supply Chain in Indonesia Using System Dynamics Approach

Putu Indy Gardian[1], Ardhi Rasy Wardhana[2*], Rio Pramudita[3]

[1]*Low Carbon Development Initiatives Indonesia, Lippo Kuningan Building 15th Floor Jl. H. R. Rasuna Said Kav. B-12, Jakarta 12940, Indonesia*

[2]*Department of Mining Engineering, Faculty of Mining & Petroleum Engineering, Bandung Institute Technology Bandung, Jl. Ganesa 10, Bandung 40132, Indonesia*

[3]*Akuo Energy, Menara Sentraya 17th Floor Jl. Iskandarsyah Raya 1A, DKI Jakarta 12160, Indonesia*

*E-mail: gardian.indy@gmail.com,*ardhirwa@gmail.com, riopramudita@gmail.com*

ABSTRACT

Battery utilization is projected to be rapidly growing in next years due to sales increase of BEV and BESS. First class nickel is one of the most looked after material to produce Lithium-Ion Battery for BEV and BESS. Indonesia, as a country with the biggest nickel reserves in the world, shall properly calculate nickel demand and supply projections to ensure maximum nickel utilization and adequate smelter capacity in the future. This study provides a method for developing model to forecast nickel supply to suffice future demand considering the emerging market of battery and BESS. Since the supply-demand for nickel is affected by several intertwining factors, system dynamics model is used as it is considered as an effective approach to analyze complex system. The system projects nickel demand from BESS, two-wheeled EV, and four-wheeled EV based on RUPTL PLN and estimated EV sales. Meanwhile, the system projects nickel supply based on current reserve and smelter capacity for 30 years up to year 2050.

The scenarios chosen are moderate scenario, where half of VRE penetration from RUEN model and 50% of transportation market share will be EVs at 2050, and optimistic scenario, where VRE following RUEN and 100% transportation market share will be EV. Both scenarios present results that the nickel reserve will fully deplete in 2040. The moderate scenario projected the demand growth at 3% annually, while optimistic scenario at 3.8% annually. Eventually, the Government of Indonesia and business sector shall take measures to ensure the continuity of nickel supply, such as stimulating exploration activities to prevent nickel shortage in year 2040 and developing supporting infrastructures.

Keywords: *Battery, Electric Vehicle, Nickel Supply Chain, Smelter Capacity, System Dynamics*

POWER CONSUMPTION ANALYSIS OF A BRUSHLESS DC MOTOR 48V 500W ELECTRIC BIKE ON AN ASSEMBLED LITHIUM-ION BATTERY PACK

Setiawan Nur Ikhsan[1], Evvy Kartini[2]

[1]*Department of Electrical Engineering, Faculty of Engineering,* University of *Diponegoro,*

Jl. Prof. Sudharto, SH, Kampus UNDIP Tembalang, Semarang 50275, Indonesia

[2]*National Battery Research Institute, Gedung Edu Center Lt 2 Unit 22260, BSD City, Tangerang Selatan 15331, Indonesia*

E-mail : ikhsan.sn1412@gmail.com , evvy.kartini@n-bri.org

ABSTRACT

Based on Central Bureau of Statistics data as of 2019, the number of motorcycles recorded is 112,771,136 units or about 84 percent of the total vehicles. Moreover, the pollution caused by motor vehicle exhaust has a very bad impact on air quality in Indonesia, and innovation is needed to overcome this wider impact. Electric bicycles are environmentally friendly transportation because they do not cause exhaust gas and pollution. This study aims to assemble lithium-ion batteries as a power source for electric bicycles and analyze the power consumption of batteries used in electric bicycles with several variations of speed. This study uses an experimental method with the data obtained in the form of battery capacity, battery voltage, the maximum speed of the bicycle, and the distance of the bicycle from full battery to exhaustion. The test was carried out on an electric bicycle with a Brushless DC 48V 500Watt motor drive. The battery used is an assembled lithium-ion type with a total capacity of 48 Volt 15Ah. After three tests, it was found that there was an effect of speed conditions on battery consumption. The initial voltage of the battery is 48V, the lowest voltage is at 41V, and the battery will be discharged at a voltage of 39V. This test concludes that there is an effect of speed conditions on battery consumption, where at high speeds it requires a larger battery voltage than at lower speeds, the higher the speed, the more the battery voltage will drop to move the electric bicycle.

Keywords: *Electric Bike, Lithium ion Battery, Power Consumption, Brushless DC Motor*

An Axial and Lateral Battery Crushing using Non-Linear Finite Element (NLFE) approach.

Dzaky Roja Pratama[1], Ubaidillah[1*], Aditya Rio Prabowo[1], Muhammad Nizam[1]

[1]Department of Mechanical Engineering, Universitas Sebelas Maret, Surakarta 57126, Indonesia

E-mail : ubaidillah_ft@staff.uns.ac.id

ABSTRACT

Since the battery is the most crucial part of an electric vehicle, its safety level has attracted researchers. This work focused on the computational approach of several batteries using non-linear finite elements. The battery types simulated were Lithium-Iron-Phosphate (LFP) 18650 and Lithium-Nickel-Manganese-Cobalt-Oxides (NMC) 18650, which were produced in a laboratory. A mechanical load simulation scenario follows a condition when an electric vehicle experiences a collision. Here, the battery pack was axially and laterally crushed. The simulation approach is carried out using the LS-DYNA software. The mechanical properties of the battery are obtained from several experimental approaches. The battery cell is crushed from the axial and lateral directions with a non-linear finite element approach based on the obtained mechanical properties. This parameter will be used in the future to predict the failure of the battery pack due to dynamic loads.

Keywords: *Lithium battery, battery pack; axial crush, lateral crush; electric vehicle*

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