WELCOME ADDRESS

Distinguished guests, speakers, ladies and gentlemen,

On behalf of organising committees and on my own behalf, I warmly welcome all distinguish speakers and participants to the International Conference on Material Science and Technology (ICMST) organised by the Center of Science and Enginnering, National Nuclear Energy Agency (BATAN) Indonesia.

We are really honored to organise this meeting which has been organised regularly by BATAN. At this time, we are organizing the meeting, where three keynote lectures, three invited lectures and seventy-one poster presentations, covering several topics in materials science and engineering, metallurgy, solid state chemistry or physics, polymers, soft condensed matter, biotechnology, food industry, polymer industry, petroleum and mining industry will be delivered during one-day meeting. Meanwhile more about one houndred people registered in this meeting.

We wish to extend a special welcome to our honorable oversea and domestic speakers and delegates. We appreciate that many of you have travelled a long distance to share your expertise with us and we hope that you enjoy your stay here in Jakarta.

We hope that you find the meeting valuable and that this will represent the beginning of a regular event in your calendar.

We would to thank and appreciate for the great support from our sponsors,

Finally, we sincerely hope that all participants will have a stimulating and productive meeting and apologize for any inconvenience during the interaction of our assistance. We wish you all an extremely successful conference, both personally and professionally.

Thank you.

*International Conference on Material Science and Technology*

*PSTBM-BATAN, Serpong, Indonesia*

*December 13, 2018*
CONFERECE ORGANISATION

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3. Agus Sunardi, S.ST
4. Alfian, S.ST
5. Instanto, S.ST

Food and Beverage
1. Juliyan, A.Md
2. Siti Suprapti, A.Md
One-day conference will be taken place in Building 71, BATAN, Kawasan PUSPIPTEK covering plenary talks by keynote and invited speakers, and poster presentations. Intensive and fruitful discussion in order to develop the knowledge about neutron scattering technique in current and future research of advanced material science and technology and testing will be carried out. The useful information of neutron scattering techniques and its application can also be explored for the industrial interest, such as in medical science industry, biotechnology and pharmaceutical, food industry, polymer industry, petroleum and mining industry, and many others.
KEYNOTE SPEAKER

His expertise is Welding Metallurgy and Welding Technology and has an interest in research in the field of Failure Analysis of Materials. He is currently Chairman of the Material Science Processing Group (KI) of Material Manufacturing Process - Department of Metallurgy and Materials FTUI from 2015 - 2019 as well as Member of Academic Senate (SAF) - Faculty of Engineering UI from 2015-2019.

Prof. Dr. Ir. Winarto, M.Sc
University of Indonesia

The Center for Science and Advanced Material Technology (PSTBM) is a work unit under the Deputy for Nuclear Science and Application of Technology (SATN) which has the duty to conduct formulation and control of technical policy, implementation, and guidance and fostering in the field of nuclear technology based research and development of advanced material, science of nuclear industrial material, and neutron technology.

Prof. Dr. Ridwan
Head of PSTBM-BATAN, Indonesia

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. Besides neutron scattering, Evvy Kartini has expertise on the materials science, especially on lithium ion battery research. She received International Research Grant from the Ministry Research and Technology from 2005 until 2010; and also received the National System Innovation Research Grant from 2011-2015.

Prof. Dr.rer nat Evvy Kartini
PSTBM-BATAN, Indonesia
PRESENTATION

*Poster Presentation*

The poster presenters have to confirm their appearance to the secretariat during the registration time and then hanging the poster from Thursday morning, December 13th.

Posters are listed below poster number. The poster number identifies where the poster is positioned on the day it will be displayed. The boards will have a sign notifying your poster code number; the numbering is provided by the Organizer. Please check the code, poster number and presentation schedule of your poster in the Program & Abstract Book.

All posters should be display during conference where Poster Presentation will be held in poster session. The presenting author(s) must be present close to the poster during all the period assigned, and are expected to be available for questions at posters session.
# PROGRAM SCHEDULE

**Thursday, December 13th, 2018**

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KEYNOTE SPEAKERS
Keynote Speakers 1

Neutron Diffraction Technique for the Measurement of Residual Stresses on the Welded Materials

Winarto* and Muhammad Anis
Department of Metallurgical and Materials Engineering, Universitas Indonesia, Depok - 16424, Indonesia
*Corresponding author: winarto@metal.ui.ac.id

Abstract
Residual stresses occur in many manufactured structures and components. Some research has been carried out to study this phenomenon and its effect on the mechanical and microstructural characteristics of these components. Significant amounts of residual stresses are often generated during manufacturing such as welding and result in critical degradation of the structural integrity and performance of components. Neutron diffraction has become a well-established technique for the determination of residual stresses in welds because of the unique deep penetration, three dimensional mapping capability, and volume averaged bulk measurements characteristic of the scattering neutron beam. Welding technology has gained importance in recent years. The authors reviewed some neutron diffraction measurements of residual stresses in the welded materials and highlighted examples addressing how the material (microstructural and mechanical) properties and residual stresses are interconnected with each other. An example of neutron diffraction measurement result shows the evolution of the residual stresses during welding.

Keywords: Residual Stress, neutron diffraction, manufactured components, microstructure, and mechanical properties.
Abstract

Industry 4.0 holds the guarantee of expanded the adaptability in manufacturing, alongside mass customization, better quality, and improved productivity in our next generation of industry. In this manner, empower public organizations to adapt to the difficulties of delivering progressively individualized items to higher quality. Indonesia plans to become one of the 10 largest economies in the world by GDP in 2030. Indonesia will explore its net export potential as an economic driver, by improving the productivity and application of innovation in the industry. Innovation lies at the core of any solution to the challenges facing our world today. Regardless of whether it’s the making of new innovations that can enable us to extend the limits of what is possible. Industry 4.0 is supported by five key technological advances: Internet of things, artificial intelligence, human-machine interface, robot and sensor technology, and 3D printing. A basic understanding of how a material is formed and understanding the changes that occur in materials due to outside influences becomes very important. The fundamental microstructure parameters and characteristics of a material can be obtained using neutron scattering techniques. Therefore, the availability of neutron scattering facilities at the Center for Research and Technology of Advanced Materials of BATAN is expected to be very useful in supporting the provision of data that is very important in the manufacturing process of a component supporting industry 4.0. For information, BATAN also has a Neutron Activation Analysis (NAA) facility that can be used to determine the content of particulate elements in a material either from the synthesis process or from other living things. This NAA facility will be very useful for example in the determination there is no content of toxic elements in aquaculture products. Because the maritime product business potential such as aquaculture is very large at 16% of the total business of maritime products. Advanced material research in additive manufacturing for 3D printing is an important strategic priority to support the industry 4.0, it will also be an important and next major role in industrial economic competitiveness. Materials discovery and design using machine learning will have good performance for modelling new and hot topics in the field of material science. The skills to win this competition can be done by providing the system thinking, data savviness, collaboration and communication as well as adaptability.

Keywords: Industry 4.0, advanced material research, neutron activation analysis
New Promising Composite Li$_3$PO$_4$-Li$_4$P$_2$O$_7$ for Solid Electrolyte in Lithium Ion Battery

Evvy Kartini$^{1,*}$, Valentina Yapriadi$^2$, Heri Jodi$^1$, Maykel Manawan$^3$, Cipta Panghegar$^4$
$^1$Center for Science and Technology for Advanced Materials, National Nuclear Energy Agency, South Tangerang 15314, Indonesia
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*Corresponding author: kartini@batan.go.id

Abstract

Safety is still the main problem on developing the lithium ion battery (LIB). The used of liquid lithium electrolyte and polymer separator in commercial batteries caused some accident due to leakage or shortcut of flammable materials. In order to solve this problem, researches on solid electrolyte have been significantly increasing. One of the promising solid electrolyte for lithium ion rechargeable batteries is Li$_3$PO$_4$ and Li$_4$P$_2$O$_7$. However, its conductivity is still low ~ 10-9 S/m, therefore Li$_3$PO$_4$ was used in all thin film solid state battery. Several methods have been performed to increase its conductivity of the lithium phosphate, i.e. by excessing lithium ion content. This study aimed to synthesize Li$_4$P$_2$O$_7$ by solid state reaction. The molten mixtures were quenched at 600 $^\circ$C, 800 $^\circ$C and 900 $^\circ$C in Liquid nitrogen. The x-ray diffraction showed all the samples consisted of two phases 46.7% LiPO$_3$ and 54.3% Li$_4$P$_2$O$_7$ for 600 $^\circ$C. Meanwhile, for 800 $^\circ$C and 900 $^\circ$C contained phases Li$_3$PO$_4$ and Li$_4$P$_2$O$_7$ with various compositions depending temperatures. The maximum 93.3 % of Li$_4$P$_2$O$_7$ and 6.7 % Li$_3$PO$_4$ was obtained for sample 800 $^\circ$C, with the particle sizes are 206 nm and 1297 nm, respectively. The best ionic conductivity of ~ 3.85x10-5 S/m was achieved in this composition. The increase in ionic conductivity may due to mixed anion effects related to the phosphate networks. It also corresponds to the existence of new anorthic phase Li$_4$P$_2$O$_7$ with the space group P -1 (2). The crystal lattice of Li$_4$P$_2$O$_7$ consists of diphosphate groups P$_2$O$_7$ arranged by two PO$_4$ tetrahedral having a common corner. The lithium tetrahedral LiO$_4$ are linked to each other and to P$_2$O$_7$ groups by a common vertex or edge and form a continuous framework containing large voids, available for Li$^+$ ion transport. A new composite of Li$_3$PO$_4$-Li$_4$P$_2$O$_7$ is promising solid electrolyte in the future application of all solid state battery.

Keywords: Solid electrolyte, Li$_3$PO$_4$, Li$_4$P$_2$O$_7$, ionic conductivity, lithium ion battery
List of Abstracts
INVITED SPEAKERS
Invited Speakers 1

Neutron Scattering for Materials Science

Ian Swainson
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Abstract

Neutron scattering contributes to a wide variety of materials science research. The penetrating nature, the sensitivity to magnetic moments and to isotopic composition gives neutrons an advantage in many fields from engineered objects to superconductors, to soft materials science. My presentation will give some examples to which neutron scattering has been used around the world in the advancement of materials science.
Invited Speakers 2

Neutron Beam Facility at BATAN

Iwan Sumirat
Center for Science and Technology of Advanced Materials, PSTBM BATAN
*Corresponding author: sumirat@batan.go.id

Abstract
PSTBM BATAN has a neutron beam facility located at Kawasan Puspiptek Serpong Tangerang Selatan. There are 8 instruments for materials characterization, non-destructive evaluation, and elemental analysis that are maintained and operated by the Neutron Beam Technology Division of PSTBM. The facility has 3 diffractometers, 3 spectrometers, 1 radiography-tomography, 1 Neutron Activation Analysis, and a supporting system. A supporting system consists of systems of electrical, mechanical, vacuum, and pneumatic to run the facility. All instruments are utilized by local and foreign users coming from research institutes, universities, and industries. The instruments are always continuously developed to accommodate the experimental demands of the users.
Invited Speakers 3

Latest Innovations for Polymer Characterization with Xenocs SAXS/WAXS Instruments

Fang Yin Lee1, Frédéric Bossan2, Pierre Panine2, Sergio Rodrigues2, Manuel Fernandez Martinez2, Peter Høghøj2, Ronan Mahé2, Blandine Lantz2

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*Corresponding author: Fangyin.Lee@xenocs.com

Abstract

Nanostructured polymer materials hold major expectations for the progress of fundamental & applied research. Understanding their properties requires investigations on a large range of compositions or process combinations demanding characterization over broad length scales. Moreover, one route for new materials is based on a bottom up approach, i.e. self-assembly of complex materials such as block copolymers. Being of significant interest for a wide range of applications, they still require control and better understanding of their morphology, both for fundamental studies and for routine quality controls.

Small Angle X-ray Scattering (SAXS) is a powerful measuring method for investigating nanostructured materials, providing information in the range from 1 nm to beyond 150 nm such as nanoscale morphology, mesoscale phase identification or surface to volume ratio of internal structures as a few examples. The method requires little sample preparation, is non-destructive and unlike microscopy probes a large volume of the sample enabling a statistically meaningful result. The same technique can be applied to surface only in the so-called “grazing incidence geometry”. It can be combined with Wide Angle X-ray Scattering (WAXS) to get information on the material crystalline structure. Different experimental conditions such as temperature, humidity and mechanical stress can also be applied enabling in-situ structural investigation over changing conditions.

Major developments in components and subassemblies have been achieved in the past few years. They are today integrated in the top-of-the-range SAXS/WAXS instruments, offering capabilities for fast routine measurements and enabling high quality data.

With more than 18 years of experience, Xenocs is a leading supplier of SAXS/WAXS/GISAXS laboratory systems.

This presentation will summarize Xenocs latest developments on SAXS/WAXS/GISAXS instrumentation to complement Neutron Source Facility. The new Nano-inXider instrument combines all three techniques and integrates the latest technologies to provide the user with a high performance, easy-to-use and compact system for characterizing polymers. The Xeuss 3.0 system, the laboratory SAXS/WAXS equipment reference for many universities around the world, integrates new advanced features increasing furthermore its versatility. Not only it is today possible to measure simultaneously nanoscale features and crystalline structures during in-situ studies such as temperature controlled measurements, but this can be coupled with an increased sample to detector distance, enabling to extend the sample probe length to several hundreds of nanometers in the UltraSAXS regime. Such capability will be discussed with in-situ stretching application examples. The presentation will also highlight how ISIS Oxford benefits from having NanoInXider in their facility.
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Poster Presentation 01 (PP-01)

Deposition of Yttria-Stabilized Zirconia Ceramic on SS316L by Pulsed Solid-state Nd:YAG Laser

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Abstract
Austenitic stainless steel in general has a limited service temperature up to 600 °C. Nevertheless, service temperature more than that temperature is one of the key features of advanced nuclear reactors to gain higher thermal efficiency which is related to economic beneficial, and also to withstand from abnormal condition. However, austenitic stainless steel such as SS316 class is well-known structure material for nuclear power reactors and other power plants. Therefore, one of the key issues is to modify SS316 so that has capability to service higher temperature. One of the techniques for that purpose is ceramic-coated SS316L. In this preliminary study, thin films of zirconia-based ceramic i.e. YSZ (Yttria-Stabilized Zirconia) have been deposited on a SS316L using Plasma-Pulsed Laser Deposition (PLD) at Center for Science and Technology of Advanced Materials laboratory – National Nuclear Energy Agency of Indonesia (BATAN). The thin film was deposited with the chamber pressure range of 200-225 mTorr, the substrate temperature of 800 °C, and the number of laser shots of 72,000 and 144,000. Afterward, the samples were analyzed using Scanning Electron Microscope – Energy Dispersive X-ray Spectroscope (SEM-EDS) and Atomic Force Microscope (AFM). The results showed that the YSZ could homogeneously and sticker deposited on the surface of the SS316L surface. The surfaces were very smoothly formed with the surface roughness was in the range of 20-30 nm.

Keywords: Zirconia, YSZ, PLD, Plasma, SS316
Iron oxide/titania Composites for Radar Absorbing Materials (RAM) Applications

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The magnetic-dielectric of iron oxide/titania composites (Fe/idTi) was synthesized by precipitation method. Amount of iron oxide (mixing of Fe(III)/Fe(II) (ratio molar 2:1) was various weight ratio: 0%, 10%, 30%, 40% in composites. Further, the samples were calcinated at 500 °C for 3 hours under atmosphere condition. The prepared samples were characterized by various instruments, i.e. X-ray diffraction (XRD), Raman Spectroscopy, Transmission Electron Microscopy (TEM), Vibrating Sample Magnetometer (VSM). The characterization results showed that anatase and magnetic iron oxide phase were detected in composites. The present of iron oxide on titania causes to decrease the anatase crystalline size. The N2 adsorption-desorption isothermal of the samples are identified as IV(a) type isotherms with H2(b) characteristic of hysteresis loop. With increasing Fe²⁺/Fe³⁺ ion content in composite, the specific surface area, total volume volume and BJH volume pore of the sample increase. The pore size distribution approaches the characteristic of mesopores with range 6.5-9.6 nm. The saturation magnetization value of composite increased with increasing of Fe²⁺/Fe³⁺ ion containing. The measurement of The microwave absorbing shows that the 40 Fe/Ti composite was the best reflection loss which shows moreover of -14 dB loss in frequency 10.9 GHz, meaning 80% of electromagnetic wave can adsorb in this frequency. Thus, the developed material can be a promising microwave absorbing agent in radar signature reduct.
Elemental Analysis of NIST SRM 1547 Peach Leaves, NIST SRM 1573a Tomato Leave and NIST SRM 1567b Spinach Samples

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Abstract
In order to validate the analytical results of macro and micro mineral content in foodstuffs, quantitative analysis of elements in the certified standard reference of NIST SRM 1547 Peach Leaves, NIST SRM 1573a Tomato Leaves and NIST SRM 1567b Spinach have been done. The Z-score parameter was used as a validation parameter. Elements with a long half-life were determined quantitatively using the INAA k0 method in the GA Siwabessy reactor. The elements were determined quantitatively through long-lived radioisotopes using the k0 Instrumental Neutron Activation Analysis in the GA Siwabessy reactor. A number of 50 mg - 120 mg samples were weighed and irradiated at the neutron flux of 2.5.1013 n.cm⁻².det⁻¹. Irradiation was carried out for 3 hours on the rabbit system, while enumeration with gamma spectrometry was carried out after cooling time of 2-3 weeks. Quantitative analysis was carried out using a soft IA-IAEA device. The results of quantitative analysis obtained elements of Ca, Cr, Fe, Co, Zn, Sr, Cs, Ba, Ce, Nd, Eu, Tb, Th, SB on SRM NIST 1547 Peach Leaves; elements of Ca, Sc, Cr, Fe, Co, Br, Rb, Ba, La, Ce, Eu and Th on NIST SRM 1573a Tomato leaves 1573a and elements Ca, Sc, Zn, Rb, Sr and Th on NIST SRM 1570a Spinach 1570a. Certified elements are Ca, Sc, Fe, Zn, Rb, Sr, Cr, Fe, Co and Th. All certified elements have a z-score of -3 < z < 3 so that the analysis results of these elements are valid for testing elements in food.

Keywords: AANI, SRM, z-score
Poster Presentation 04 (PP-04)

Influence of Accumulative Roll Bonding (ARB) Processing on Microstructure and Mechanical Properties of Aluminium 6061

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Abstract

An aluminium alloy 6061 was severely deformed using accumulative roll bonding (ARB) up to 3 cycles at room temperature. The mechanical properties were conducted by micro hardness test. The high hardness was achieved of 54.2 HV for sample after processed by ARB within number of 3 cycles. X-ray diffraction analysis showed that formation of Mg$_2$Si phase occurred after ARB processed for n = 3 cycles at room temperature. Microstructural analysis was done by optical microscope (OM) and scanning electron microscopy (SEM). The observation was shown that the grain size decreased when the number of cycles increased. Thus, it is also reasonable that the high hardness of aluminium alloy 6061 was due to the grain size decreases related to the dislocation density increases and also presence of second-phase Mg$_2$Si in the aluminium matrix resulted in the inhibiting of dislocation movement.
Poster Presentation 05 (PP-05)

Rat Blood Profile Evaluation after Fe3O4/Chitosan Colloid Injection

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Abstract

The application of iron oxide (Fe₃O₄) magnetic nanoparticles in the biomedical field is still being explored, mainly related to its toxicity and side effects. This article reported results of the study aimed at analyzing the effect of chitosan-coated magnetic nanoparticles (NPM-C) on rat blood profiles. Magnetic colloid as much as 1 ml (concentration of 5 mg NPM-C / mL aqua-bidest) for 1 kG rat body weight was injected through intra-venous to the treated rat group (4 Wistar rats aged 6 months; weight ± 275 grams; male sex) while another four rats injected with sterile aqua-bidest used as a control group. The blood taking from each group of rats was carried out on 1 day before injection and several days after injection (days 1, 7, 14, 21, 28) through veins in the tail. To these blood samples, a series of blood profile analyzes is carried out including basic hematology, blood chemistry, and fragility of the erythrocyte membrane. The results of the analysis showed no significant differences between blood profiles after treatment and control, which indicated that chitosan-coated magnetic nanoparticles did not trigger cellular stress responses in the blood. The stability of blood magnetism analyzed by VSM (Vibrating Sample Magnetometer) also shows that magnetic nanoparticles are detected in the blood and tend to decrease in number with increasing time, so it is thought that these nanoparticles can be degraded or have been distributed into organs. These stable properties are analyzed due to an existence of chitosan coating around magnetic nanoparticles. Based on this study it can be concluded that up to the given concentration limit, iron oxide nanoparticles coated by chitosan are not toxic and have the potential to be used as drug carriers, MRI contrast agents, and other biomedical applications.

Keywords: Iron oxide, magnetic nanoparticles, blood profiles, Wistar rat, VSM
Evaluating the Effect of ZnO Structure on Electrical Properties using Capacitive Sensor

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Abstract

Capacitive sensor works based on capacitive methods and serves to detect changes in the composition of dielectric materials by determining the capacitance value and dielectric constant. This type of sensor has advantages in convenient manufacturing process, a simple working mechanism, as well as extensive applications in various fields. In this study, capacitive sensors were used to characterize the electrical properties of materials that have several structures. The dielectric material samples used are bulk ZnO with particle (spherical) structure, ZnO synthesized by chemical bath deposition method (CBD) which has a rod structure, and synthetic ZnO results through a vapor phase method with tetrapod structure. The sensors were made by a parallel plate method using two copper plates as capacitors. The sensors were designed in 2x2 cm and 2x4 cm size, with the distance between the electrodes being 1 and 2 mm. The results showed that capacitive sensors proved to be able to distinguish capacitance values and electrical permittivity of ZnO with different structures. From the experiment, it was known that ZnO with a rod structure synthesized through the CBD method gave the highest capacitance and electrical permittivity values compared to other ZnO samples.

Keywords: ZnO, capacitive sensor, capacitance, permittivity
Study of Ceria Stabilized Zirconia Microspheres Morphology by Small-Angle Scattering and Microscopy

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Abstract

Ceria stabilized zirconia microspheres of about 500 microns were prepared by external gelation. The morphology in nano and micro scale of the microsphere was evaluated. The nanostructure of CSZ microsphere after drying was studied by small angle neutron and X-ray scattering (SANS and SAXS). In this state, the existing of the mixture of ceria oxide and zirconia oxide was observed inside the polymer matrix. The roundness and surface properties of the CSZ microsphere were observed under the optical microscopy (OM) and scanning electron microscopy (SEM). The data showed their good size uniformity, smooth surface, but also the imperfect phase of the gelation.
Effect of interlayer on the hardness distribution and wear resistance of stellite Coating deposited on carbon steel A216 grade WCB by GTAW process

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Abstract
In recent years, the industrial use of surfacing technique has grown considerably. Hardfacing, one of the surfacing techniques, is the process of applying a layer or edge of wear resistant metal part to increase its resistance to abrasion, corrosion and impact or any other combined wear, it mainly deals with the preservation of machinery parts from destructive forces in chemical and fertilizer plants, nuclear and steam power plants, pressure vessels etc. This paper deals with the improvement of the wear resistance of carbon steel A216 WCB surface alloyed by a stellite 6. In this regard, the surface was clad with ER309 + Stellite 6 and only Stellite 6 deposited on carbon steel A216 WCB using tungsten inert gas (TIG) surface processing. The microstructure, hardness and wear resistance of surface alloyed layer were investigated using optical microscopy, Vickers hardness and pin-on-plate tests. The results showed that the microstructure of the surface alloyed layer consisted of carbides dispersed in a Co-based solid solution matrix with dendritic structure. This microstructure was responsible for the improvement of the hardness and wear resistance of the coating. Further investigations showed that the dominant mechanism of the wear in the coated and uncoated samples was delamination wear.

Keywords: Stellite 6, carbon Steel A216 Wcb, Er309, wear resistance, hardfacing, hardness.
Poster Presentation 09 (PP-09)

Structural Change of Apoferritin as the Effect of pH Change: Dynamic Light Scattering and Small Angle Neutron Scattering Study

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Abstract
Apoferitin is a complex protein potential for drug delivery application. The advantage of apoferritin lies on its core-shell structure, its nano size, and its sensitivity to pH. Current study aims to characterize the structural of apoferritin due to pH alteration effect in solution using dynamic light scattering (DLS) and small angle neutron scattering (SANS). Both DLS and SANS are able to observe protein size in solution near in its physiological condition. The results show that apoferritin possess core-shell structure with diameter of around 12-13 nm at pH 7. The dissociation of apoferritin occurs at pH 1.9. The SANS data shows the apoferritin at pH 1.9 was dissociated into trimers. The core shell structure of apoferritin in pH 7 was change to trimer new arrangement at pH 1.9.

Keywords: Apoferritin, pH change, Dynamic light scattering, Small angle neutron scattering
Poster Presentation 10 (PP-10)

Microstructure of Oxide Dispersion Strengthened (ODS) Alloy with Chromium Content Variation Sintered by Arc Plasma Sintering

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Abstract
Microstructure and phase distribution of innovative Oxide Dispersion Strengthened (ODS) alloy based on Fe-Cr-ZrO2 particularly for application at high temperature reactor with variation of Cr content was analysed. The alloy was synthesized with Cr concentration variation of 15, 20 and 25 wt.% Cr, while zirconia dispersoid kept constant at 0.50 wt.%. The production of the alloy samples was carried out by mechanical alloying comprising of high energy milling for 3 hours followed by vibrated compression with iso-static load at 20 tonnes to form a sample bottom of 15 mm diameter. The final consolidation was performed via sintering process for 4 minutes using the Arc Plasma Sintering (APS) technique, a new method developed in BATAN especially for synthesizing high temperature materials. The samples were then characterized by means of scanning electron microscopy (SEM) with energy dispersed X-ray (EDX) analysis capability and X-ray diffraction. The mechanical property of hardness was measured using standard Vickers micro hardness tester at 200 g indenter load. The results show that the microstructure of the ODS alloy samples in all variation of Cr content consists generally of cubic Fe-Cr matrix phase with small of porosity and Zirconia particles distributed homogenously in and around the matrix grains. The achievable hardness was between 142 and 184 HVN dependent consistently on Cr content in which Cr element may cause grain refining that in turn increase the hardness.

Keywords: ODS alloy, zirconia, Arc Plasma Sintering APS, SEM, XRD.
Poster Presentation 11 (PP-11)

Investigation of Multiphase Condition in Pipe Using Gamma Computed Tomography (CT)

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Abstract
Deposition of sand particles in pipeline is a problem that often occurs in the production and distribution of oil and gas. It could cause excessive pressure drops, equipment failure, pipeline erosion, and production decline. It is necessary to investigate the condition inside the pipeline without interrupting the operation. Gamma computed tomography (CT) is a technique that can examine the inner structure of an object without interrupting or damaging the object (non-destructive testing). This paper presents a preliminary experimental study of multiphase condition inside a horizontal pipe using gamma CT technique. A collimated Cs-137 source with 3.7 GBq activity emits gamma photons to penetrate a 14 inches horizontal pipe containing sand, water, gasoline, and air. The photons that penetrate object were detected using a scintillation detector at the other side of object. The scanner system performs translation and rotation scans to get 64 projection data which will then be reconstructed into an image. The reconstructed images are able to show the pipe wall and the condition of the inside of pipe which is filled with sand, water, gasoline and air. The result indicates the potential of gamma CT as the suitable technique to be used to investigate the multiphase conditions in pipeline.

Keywords: Gamma CT, industry, multiphase, non-destructive testing, pipeline.
Posters Presentation 12 (PP-12)

Investigation of Indonesian Cultural Heritage Objects using Neutron Radiography

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Abstract
Indonesia has thousands of cultural heritage objects that is interesting to study about its materials. Neutron radiography facility at G. A. Siwabessy Research Reactor has been used for investigation of a cultural heritage object from Kalimantan called mandau and a replica of an ancient ewer containing fossil bones. The neutron radiography system consists of a 30 cm diameter of outer collimator, a Li6-ZnS scintillate screen that visualizes the radiograph of the sample, and an ultranight sensitive CMOS Camera. For tomography reconstruction, the radiography images from the sample position were collected from 0° to 360° with a step of 1°. Tomography reconstruction shows structure and corrosion of the mandau and the materials inside the ewer. Information of this tomography data is very important for conservation treatments of the cultural heritage objects.

Keywords: cultural, heritage, neutron, radiography, tomography.

Fig. 1. Radiography image of Mandau
Fig. 2 Radiography image of ancient ewer replica
The Characterization of AISI 1526 Before and After GMAW (Gas Metal Arc Welding) Weldments

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Abstract

The characterization of AISI 1526 before and after GMAW (Gas Metal Arc Welding) had been performed. Hardness test, metallography, phase composition, and residual stress data had been collected. Neutron diffraction technique had been used for getting internal residual stress data before and after weldment. Two samples with different heat treatment of tempering, 125 °C and 175 °C, are provided as main materials that will be welded with different heat input in the process of welding. With higher tempering, the hardness was decrease as well as martensite phase followed by the increasing of ferrite phase. Moreover, higher tempering decreases retained austenite that appeared because of quenching. The magnitude of the residual stresses was reduced by increasing the heat input. The magnitude of the residual stress in HAZ area is 425 MPa in the axial direction in the sample of Tempering 125°C with heat input 4.09 KJ/mm. Meanwhile, in Tempering 175 °C with heat input 4.22 KJ/mm, the magnitude residual stress in the center of weld metal is 219 MPa in the axial direction.

Keywords: AISI 1526, GMAW, residual stress, neutron diffraction.
Effects of Cellulose on The Properties of Hybrid Bio-Polyurethane Foam

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Abstract

Cellulose is an example of biomass material that usually comes from pulp and paper fabrication’s waste. It is also the main structural constituent component that provides strength and stability for macromolecules of semicrystalline polysaccharides plant’s cell-wall formed from the straight chained d-anhydroglucose (C₆H₁₁O₅) linked by β-(1-4)-glycosidic. In this study, hybrid bio-polyurethane foam was fabricated by reacting the cellulose with the virgin-polyurethane foam. The synthesis of the cellulose used Toluene Diisocyanate 80 (TDI80) and Polypropylene Glycol (PPG) 2000 as the polyol. The cellulose-based bio-polyurethane foam sample was characterized by FTIR, STA, SEM, and some of mechanical properties testing. The result showed that cellulose is able to increase the resilience of the hybrid bio-polyurethane foam in 0.0039 and 0.0084 MPa. This addition also increases the thermal stability at 408.73°C. The morphology of cell for the hybrid bio-polyurethane foam were closed with some particle stick onto the cell wall.

Keywords: Polyurethane, foam, cellulose, hybrid.
The Effects of Starch on Mechanical and Thermal Properties of Synthesis Hybrid Bio-Polyurethane Foam

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Abstract
The properties of a polyurethane foam are greatly influenced by the types of isocyanates and polyols used to make it, and also the crosslinker. As a rich natural polymer (biomass), starch contain high hydroxyl or (R ‘-OH) that can be used as a crosslinker in the making of polyurethane. In addition, starch also has many benefits such as biocompatibility and has a good thermal insulation. Therefore, in this study hybrid bio-polyurethane foam was fabricated by reacting starch with polyurethane. The synthesis of the bio-polyurethane foam used Toluene Diisocyanate 80 (TDI80), Polypropylene Glycol (PPG) 2000 as the polyol, and also starch as a crosslinker. Foam samples was characterized by FTIR, STA, SEM, and some of mechanical properties testing such tensile, elongation, tear strength, ILD, & airflow. The result showed that starch as biomass material can increase the resilience of hybrid bio-polyurethane foam which stood at 0.0023 & 0.006 MPa, and tear strength 0.052 MPa with elongation 202%. It also increasing the thermal stability which stood at 418.75 °C. The cell morphology showed that hybrid bio-polyurethane foam was closed with some particle stick onto the cell wall.

Keywords: Bio-polyurethane foam, crosslinker, starch, mechanical and thermal properties.
Poster Presentation 16 (PP-16)

Synthesis of LiFePO₄/Acetylene Black/Li₄P₂O₇ as Cathode Materials for Li-Ion Battery

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Abstract
LiFePO₄ (LFP)/Acetylene Black/Li₄P₂O₇ cathode materials has been synthesized. The sample was prepared from the raw materials, such as (in weight percent) 85% of LFP, 5% of acetylene black and the mixtures of Polyvinylidene fluorid (PVDF)-Li₄P₂O₇ which is varied from 10-0% (W1), 7-3% (W2), 5-5% (W3) and 2-8% (W4), respectively. The raw materials were mixed and the assembled using Doctor Blade. The purpose of this research is to add PVDF-Li₄P₂O₇ to LFP where the Li⁺ ion can be inserted in reverse and study the properties of the resulting cathode material. Phase identification and microstructure of cathode material products were observed with X-ray diffractometer (XRD) and scanning electron microscope (SEM), respectively. The change in conductivity of cathode material products was measured using the LCR meter. The result show that the lattice constants obtained of a = 10.328 Å, b = 6.006 Å and c = 4.708 Å. The dispersion of acetylene black is distributed almost homogeneously among the LFP particles, having grain size is less than 1 µm. The LCR measurements shows that the DC conductivity phenomenon in the low frequency ranges to 10 kHz occur in W1 and W3 samples.

Keywords: LiFePO₄, Li₄P₂O₇, cathode materials, conductivity, Li-Ion battery
Monitoring Column Flotation Process of Sulfide Ore using Electrical Capacitance Volume Tomography (ECVT) with Particle Size and Air Flow Rate Variation

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Abstract
Metallurgical performance of column flotation process can be expressed by recovery. Recovery of column flotation process is affected by several factors including particle size and air flow rate. Particle size and air flow rate affect the interaction of mineral particles and air bubbles which determine how many valuable minerals are floated. Metallurgical performance of column flotation process can be determined by monitoring. Technology used to monitor column flotation process so far has limitation can monitor froth surface only and cannot monitor zone along the axial direction. Interaction of mineral particles with air bubbles along axial direction has an effect increasing the metallurgical performance of column flotation process. Alternative technology can be used to monitor column flotation process is electrical capacitance volume tomography (ECVT). ECVT used as a monitoring technology by utilizing the difference in permittivity value of objects in the column and produce volumetric and real-time images. Monitoring column flotation process was carried out to observe the effect of particle size and air flow rate on recovery and 3D image resulted by monitoring.
**Poster Presentation 18 (PP-18)**

**Mechanosynthesis, Crystal Structure, Magnetic and Absorption Properties of Al Substituted BaFe$_{12}$O$_{19}$**

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**Abstract**

Mechanosynthesis, crystal structure, magnetic and Absorption Properties of Al Substituted BaFe$_{12}$O$_{19}$. The Aluminum (Al) substituted on M-type barium ferrite is one of the magnetic materials, which can be applied to the microwave band working at high frequencies. The purpose of this paper is the investigation of the effect of Al substitution for Fe$^{3+}$ ions on the structure, magnetic and absorption behavior of M-type barium ferrite. The sample was prepared by mechanosynthesis using high-energy ball milling. In this research, Fe was substituted by Al to form BaFe$_{12-x}$Al$_x$O$_{19}$, for $x = 0.0$, 2.0, and 4.0. The mixing for each the sample was conducted for 5 hours and then followed by heat treated at 1100°C for 1 h. The XRD result indicates that the addition of Al ion lead to the decrease cell parameters, volume, and the particles size. The magnetic behavior such as magnetic coercivity ($H_c$), saturation ($M_s$) and remanent ($M_r$) changed significantly with the substitution of Al ions. The surface of all sample appear to be dense with the large agglomerated particles. The reflection loss (RL) is found to be $-35$ dB at 14 GHz for $x = 4.0$. It is shown that Al substitutions change the particle size, ferromagnetic resonant frequency, and structural and magnetic behavior of M-type barium ferrite.

**Keywords:** M-type barium ferrite, mechanosynthesis, reflection loss, structural and magnetic properties.
Neutron Diffraction Study of Multiferroic 0.6NiFe\(_2\)O\(_4\)/0.4BaTiO\(_3\) Composite

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Abstract

Neutron diffraction study on the 0.6NiFe\(_2\)O\(_4\)/0.4BaTiO\(_3\) multiferroic composite has been carried out. The 0.6NiFe\(_2\)O\(_4\)/0.4BaTiO\(_3\) multiferroic composites have been synthesized by solid reaction method. In this study, 20 g of BaTiO\(_3\) (BTO) and 20 g of NiFe\(_2\)O\(_4\) (NFO) compounds were prepared from the powder raw materials of BaO and TiO\(_2\) for BTO, and NiO and Fe\(_2\)O\(_3\) for NFO. Furthermore, both BTO and NFO were each crushed for 5 hours using High Energy Milling (HEM). Then the BTO and NFO were calcined in the furnace at 950°C/5 hours and 900°C/5 hours, respectively. Both NFO and BTO precursors were manually mixed with a weight percent ratio of NFO:BTO was 100:0, 60:40, and 0:100, hereinafter referred to NFO, NFO/BTO, and BTO, respectively. Then the three samples were pressed into pellets. The pellets were then sintered at 1150 °C/5 hours with a heating rate of about 44.8°C/min. Once cooled to room temperature within the furnace it was obtained NFO, BTO, and NFO/BTO multiferroic composite. The magnetic properties of the material were observed with the aid of the Vibrating Sample Magnetometer (VSM) instrument. The nuclear structure of BTO, and the magnetic structure of NFO, and NFO/BTO multiferroic composite were determined by neutron diffraction technique using the high resolution powder neutron diffractometer. The cations arrangement of NFO was obtained by whole pattern fitting with the Rietveld method based on neutron diffraction data using FullProf software. The cations arrangement was obtained by refining the occupancy of individual cation at tetrahedral and octahedral sites. The results of the analysis show that both NFO and 0.6NFO/0.4BTO samples have a mixed spinel structure, it means that there are cations of Ni\(^{2+}\) and Fe\(^{3+}\) on A-site and B-site. In NFO sample, the cations distribution among the A-site and B-site of NiFe\(_2\)O\(_4\) is \([\text{Ni}_{0.002}\text{Fe}_{0.852}][\text{Ni}_{0.006}\text{Fe}_{0.862}]\)\_2O\(_4\). The cations distribution among the A-site and B-site of NiFe\(_2\)O\(_4\) in 0.6NFO/0.4BTO samples is \([\text{Ni}_{0.025}\text{Fe}_{0.8975}][\text{Ni}_{0.012}\text{Fe}_{0.950}]\)\_2O\(_4\). So, the effect of adding BTO as a composite is to increase Ni\(^{2+}\) occupancy by 12.5 times on A-site and 2 times on B-site. The magnetic moment of multiferroic 0.6NFO/0.4BTO composite is 2.4(5) \(\mu_B\) same as one of NFO. The BTO content in the composite has caused tensile strains induced into the NFO lattice, and at the same time, tensile strains of NFO caused the compressive strain on the c lattice of BTO even though the unit cell volume of BTO is also increasing from 64.100(5) to 64.374(6) Å\(^3\).

Keywords: synthesis, characterization, multiferroic, nickel ferrite, barium titanate, neutron diffraction.
Effect of Sorbitol Plasticizer in Polymer Solid Electrolites Based Chitosan

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Abstract
Solid Polymer Electrolyte (SPE) has great potential in replacing liquid electrolytes. The SPE has many advantages such as high thermal stability, good flexibility, and non flammable. One of the polymers that can be used is chitosan biopolymer from shrimp skin extraction. Generally, polymers are isolators and have low ionic conductivity, so that modification to the structure of chitosan is needed to increase the ionic conductivity. One way to modify the structure of chitosan is by plasticizer addition. In this study the addition of sorbitol plasticizer composition was carried out with a variation between 20, 40, 60 and 80 (in weight percent) which is called as CA, CA1, CA2, CA3, CA4 and CA5 respectively. The synthesis of chitosan electrolyte film was prepared by casting method. Then qualitative and quantitative analysis was carried out by using X-ray diffraction (XRD), electrochemical impedance spectroscopy (EIS), and mechanical properties. Optimal composition was obtained by 40% (in weight percent) sorbitol addition with a conductivity of $3.74 \times 10^{-5}$ S.cm$^{-1}$. XRD measurement shows more amorphous polymers with more sorbitol addition. The sorbitol addition also increases the tensile strength, elongation and Young modulus of film flexibility become 52.3%, and 158.3MPa and 19.8MPa, respectively.

Keywords: Solid Polymer Electrolyte, chitosan, sorbitol, shrimp skin, LiCF3SO3
The Ability of Compound Palm Fibers-1% B$_4$C as candidates for Thermal Neutron shielding

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Abstract
The preliminary study towards the ability of compound palm fibers-1% B$_4$C as candidates for shielding materials of thermal neutron radiation has been carried out. This study was based on the previous results of the ability of the palm fibers as shielding for thermal neutron radiation, where the attenuation coefficient obtained from the palm fibers was 0.9538 cm$^{-1}$. The material activation method due to neutron exposure was used to analyze the ability of the compound palm fibers-1% B$_4$C to absorb thermal neutron radiation. Gold foil was activated at the Radiography Neutron Facility of PSTBM, National Nuclear Energy Agency - BATAN. Thermal neutron flux at gold foil for both before and after passing through the samples of compound palm fibers-1% B$_4$C have been analyzed in the laboratory of Neutron Activation Analysis - NAA PSTBM BATAN. Based on the analysis of thermal neutron flux data, the attenuation coefficients of compound palm fibers-1% B$_4$C was 0.9928 cm$^{-1}$ respectively. It can be concluded that palm fibers-1% B$_4$C is good candidates for thermal neutron shielding.

Keywords: Palm fibers, neutron shielding, neutron radiography, NAA.
Monte Carlo Simulation and Experimental Characterization of UHMWPE/Borax Pentahydrate Composite for Thermal Neutron Shielding

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Abstract

The use of nuclear radiation sources such as gamma and neutron increased rapidly both for industrial and medical purpose, such that improvement in the shielding materials is necessary. Many works in this field have been intensively carried out in order to have effective, safe and reliable shielding. Although present shielding is sufficient for most applications, there is a need to have a more effective and economical neutron shielding material. In this work, we simulated and develop a thermal neutron shielding based on ultrahigh molecular weight polyethylene. Borax pentahydrate as a thermal neutron absorber additive was mixed into polyethylene to become a composite. Borax pentahydrate was used because it is easy to find and readily available. Investigation on the effectiveness of the composite as a thermal neutron shielding at G.A. Siwabessy research reactor was simulated using Monte Carlo method along with an experimental characterization work using our neutron radiography facility. Five weight ratio of additive at four different thicknesses of shielding materials were examined. The results showed that the use ultrahigh molecular weight polyethylene/borax pentahydrate composite can improve the thermal neutrons attenuation characteristics of the shielding. It was found that the best thermal neutrons attenuation was achieved at the composite shielding thickness of 1.5 cm and at the optimum addition of 40% borax pentahydrate into the UHMWPE. The experimental measurement has been found to be in good agreement with that of the Monte Carlo simulation.
Tunable Surface Plasmon Resonances of Au@TiO$_2$ Core-Shell Nanoparticles on the DSSC (Dye Sensitized Solar Cells) Performance

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Abstract

Plasmonic core-shell nanoparticles, i.e. gold can improve the efficiency of Dye-sensitized Solar Cell by increase the light harvesting due to the strong near-field effect LSPR (Localized Surface Plasmon Resonance). To achieve maximum enhancement, the morphology of core-shell need to be optimized with coated either by insulator such as semiconductor, i.e. TiO$_2$. These shells provide resistance to degradation in the presence of the iodide/triiodide ($I^−/I_3^-$) corrosive liquid electrolyte. In this paper, morphology of Au@TiO$_2$ core-shell precisely control by various TiO$_2$ volume fraction study on the plasmonic enhancement effect. A gold solution was prepared using Turkevich method. Au@TiO$_2$ core-shell nanoparticles were prepared by the hydrolysis of the mixed solution of titanium(IV)isopropoxide (TTIP) and triethanolamine (TEOA). Enhancement mechanism was found to vary with the Ti$^{4+}$ shell volume fraction in Au@TiO$_2$ nanoparticles core-shell structure on DSSC loaded with Ru-based dye. The crystal structure of the powders was determined by powder X-ray diffraction (XRD) using a Phillips X'pert MPD (40 kV, 30 mA) with Cu Kα radiation ($λ = 0.154$ nm). Diffraction patterns were obtained for $15^\circ$ – $90^\circ$ ($2\theta$). The optical properties were measured by UV-Vis absorption spectroscopy using UV-Vis Lambda 750. The photocurrent action spectra or IPCE in visible light spectrum was obtained by adjusting wavelength of incident light, i.e. series connection of halogen lamp (GR-150 Halogen Flood Light 150W) and monochromator (CT-10T, JASCO). From XRD characterization it was found that core-shell contains TiO$_2$, Au, and traces NaCl. UV-Vis absorption spectra of core-shell showed the position of the surface plasmon Au band in the range of 500–550 nm. According to UV-Vis characterization (Figure 1a), all samples studied show weak surface plasmon resonance response (~520 to 550 nm) as indicative of the thick TiO$_2$ shells for individual core-shell Au@TiO$_2$. All samples reveal a strong peak belongs to TiO$_2$ at ~320 nm which are attributed to strong interaction between Au and TiO$_2$, resonance absorption, and interband electronic transition, respectively. An increase in the local refractive index around the nanoparticles (i.e. TiO$_2$) has caused the Au peak to shift to a longer wavelength. Fig 1b. illustrate the results of IPCE as a function of wavelength. The DSSC using Au@TiO$_2$ core-shell have incident photon to current conversion higher than that without gold. This is attributed to the effect of LSPR of gold. In general, the spectra consist of additional peak located at ~450 nm. This peak is likely related to modification of electronic states Au-TiO$_2$ due to a heterojunction-induced charge transfer interaction. Our results on incident photon-to-current conversion efficiency indicates that the presence of TiO$_2$ depending on its volume fraction tends to shift to longer wavelength.

Keyword: Au@TiO$_2$, core-shell, plasmonic, DSSC
Figure 1. (a) UV-Vis absorption spectra of the of Au@TiO$_2$ core-shell nanoparticles synthesized under various TiO$_2$ volume, (b) Incident photon to current conversion curves for Au@TiO$_2$ core-shell nanoparticles various TiO$_2$ volume.
Poster Presentation 24 (PP-24)

Simulation Study on the Profiles of Digital Image Correlation of Multiple Radiography Images Obtained from a 3D CTScan System

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Abstract

Digital Radiography-Computed Tomography (DR-CT) image development comprises of three main process, namely 3D object scanning, sinograms constructions and image reconstructions. The 3D-scanning process yields a set of multiple radiographs from sequential angle from 0o to 360o. The sinogram constructions is carried out by selecting certain horizontal projection line on every radiographs. Those projections are then rearranged to be a sinogram. Every sinogram represents the Radon Transform of the associated cross-section of the object. The reconstruction process will reconstruct the cross section by back-projection process of the associated sinogram. The process repeated for all sinogram so that all cross-sections are obtained. Then all cross-sections are ready to be glued to form a 3D image that represents the real object being scanned.

One of the main component in a DR-CT system is its mechanical system. Under ideal condition, the centroid of the system arrangement, rotation plain and beam alignment are perfect, as well as there is no backlash during the scanning process. Due to mechanical disorder, the multiple radiographs may be misaligned each other. The center of the image may deviate from the center of rotation. Since such defects of the system is hard to be identified practically, this paper reports our aim to find the way to know whether the system has such mechanical disorder. A simulation study was carried out at the very beginning in order to understand the problem and its impact. In this manner, we study the consistence of the digital image correlation values of each radiograph relative to the radiographs at the origin.

In this methods, the DIC values are calculated. Then the value is plotted as a function of angle of view as the radiograph obtained sequentially. As a result, a profile of DIC values can be shown. By using a controlled numerical object, we can obtain a normal profile when the system is mechanically perfect. However, when we change the object, we may find different profiles. We found that the DIC profiles from multiple radiographs that was obtained from simulation numerical object under ideal condition is obtained. In this simulation, we also found that the DIC profiles of the controlled objects may be used for justifying the mechanics of the DR-CT system. In special case, when a cylinder object is put at the center of rotation, then the DIC profile tends to be 1.0. On the other hand, when the cylinder object is put out of the center of rotation, then the DIC profile forms a certain pattern. From the pattern we may able to justify the mechanics of the system.

Keywords: DR-CT, radiography, tomography, digital image correlation
Poster Presentation 25 (PP-25)

The Effect of Current Variation on MMA Welding to Mechanical Properties and Microstructure of Mild Steel

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Abstract

Industrial development is increasingly rapid, demanding technological progress. One of the necessary technologies in the manufacturing industry is welding technology. Welding on low carbon steel is often used in the construction, furniture and furniture industries. MMA welding is the most commonly used welding in connecting low carbon steel. Low carbon steel which is often used in this case is St. 37. To find out the best MMA welding results on low carbon steel connections, it is necessary to observe the variation of current used, namely 65 Ampere, 70 Ampere, 75 Ampere, 80 Ampere, and 85 Ampere. The electrode used is E7016 Ø 2.6 mm.

Table 1. Recommended Current for E7016 Ø 2.6 mm

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Length (mm)</th>
<th>One Side Welding</th>
<th>Flat</th>
<th>Polarity of Electrode</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td>30 – 60</td>
<td>60 – 90</td>
<td>AC or DC ±</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Messler, Wiley & Inc, 1988)

Tensile test specimens using ASTM E8 standard. Each variation of current was carried out three times. Experiment results are made on average. Based on the results of tensile tests, obtained data regarding tensile strength, graduation strength, and strain as shown in Table 2.

Table 2. Tensile Strength Test Results

<table>
<thead>
<tr>
<th>Result</th>
<th>Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (N/mm²)</td>
<td>Raw</td>
</tr>
<tr>
<td>Average</td>
<td>26.72</td>
</tr>
<tr>
<td>Elongation (%)</td>
<td>64</td>
</tr>
<tr>
<td>Average</td>
<td>26</td>
</tr>
</tbody>
</table>

Based on Table 2 the average tensile test results are made graphs, then we get a graph as shown in Figure 1 and Figure 2.

Figure 1. Tensile Strength Diagram of MMA Welding Results
Based on Figure 1, the lowest tensile strength is in the current of 65 A, which is 35.097 N/mm² and the highest tensile strength is at the current of 75 A which is 36.636 N/mm².

**Keywords:** MMA Welding, current, tensile strength, microstructure, mild steel.
**Poster Presentation 26 (PP-26)**

**Synthesis of LiFePO$_4$/C/Clay by Solution Casting Method Using Ppy**

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**Abstract**

LiFePO$_4$/C/Clay composites is prepared by mixing LiFePO$_4$ and clay by solution casting method using Ppy. Conducting polymers have been utilized previously as conducting materials or carbon sources in various sol–gel and solid state methods to LiFePO$_4$. In this research paper, we report on an in-situ synthesis of LiFePO$_4$/C-Clay composite electrode materials aiming to achieve homogenous microstructures and better battery behavior. The incorporation of LiFePO$_4$ with zeolites composites in order to achieve three dimensional porous LiFePO$_4$ architectures also to achieve fast electronic and ion conduction, while keeping an acceptable tap density. Considering simple carbon coating or additive is excluded to obtain perfect rate performance, an electrode consisting of carbon-coated, submicro-sized crystalline LiFePO$_4$ with 3D porosity is appealing since it can provide fast electronic conduction in the solid phase and ion conduction at reasonable rates in both solid and liquid phases.

**Keywords:** LiFePO4, clay, composites, Li-Ion battery.
**Poster Presentation 27 (PP-27)**

**Study of High Tensile Strength 4340 and Front Drive Axle Steel for Substitution of Gun Barrel Caliber 5.56 Material**

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**Abstract**

Study of High Tensile Strength 4340, and front drive axle 1 and 2 for substitution of gun barrel material have been done. Special imported material (round bar) for a gun barrel material application is chosen as a comparison. The data collected from each material include chemical composition, mechanical properties test (impact, hardness, tensile), and metallography. Each material (HTS 4340, front drive axle 1, and 2) is coated with 25 µm hard chromium by the electroplating method. The experimental method used is the representation of factual shooting, where combustion of OAW tools until temperature approximately 1000 °C, and mechanical erosion by the copper wheel with rotation speed 2900 rpm, is applied to the sample. Based on heat generation, and friction (with the projectile which made of copper) which occur in the gun barrel. And the number of cycle of shooting varies from 20, 50, 100, 200, and 500. Temperature history is recorded using thermocouple type K, which connected to laptop by microcontroller Arduino Uno and module MAX 6675K, the result obtain from the simulation is that there was no significant increase temperature, so there was no change in the dimensions of the samples, and the sample weight decreases due to friction with copper.

**Keywords:** HTS 4340, Front Drive Axle, Gun Barrel Caliber 5.56 Material, Shooting simulation.
**Poster Presentation 28 (PP-28)**

**Preparation of Cathode Materials LiMn$_2$O$_4$/Ppy/Prflt in PMMA/SAN Resin by Solution Casting Technique**

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**Abstract**

Development of the cathode materials has been carried out using LiMn$_2$O$_4$ composited with Polypyrrole (Ppy) and Pyrophylite (PrFlt) by solution casting technique in poly methyl metacrylic acid (PMMA)/styrene acrylonitril (SAN) resin. The result of materials structure and its morphology are characterized with X-ray diffraction (XRD) and electron microscopy (SEM). For the soaked samples, only two weak broad diffraction peaks were identified, displaying its poor crystallization. According to the previous report, this pattern can be assigned to MnO$_2$ phase (JCPDS No. 42-1169). After hydrothermal treatment, all the diffraction peaks of the sample can be assigned to LiMn$_2$O$_4$ with a well-crystalline spinel phase (JCP5 card no. 35-0782). No diffraction peak from impurity phases was detected, indicating that the template has no effect on the purity and crystallinity of the LiMn$_2$O$_4$ phase. The surface morphology for LiMn$_2$O$_4$ shows the porosity between the particles. The size of these LiMn$_2$O$_4$ particles ranges from 2-10 microns and some particles are also agglomerated. Electrochemical test shows the proper interest one especially for composition materials of 2.5 gr LiMn$_2$O$_4$/1.3 gr Ppy/ 0.2 gr Prflt in 10 mL resin having conductivity 1.0 X 10$^{-1}$ S/cm.

**Keywords:** LiMn2O4, ppy, pyrophylite, Li-ion battery.
**Poster Presentation 29 (PP-29)**

**Synthesis Super Absorbance Polymer Composites (SAPC) using Differ sizes and fillers with \(\gamma\) Irradiation of 40 Kgy**

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**Abstract**

Has been synthesized Super Absorbance Polymer Composite (SAPC) as a material for daily using. The SAPC was prepared by polymerization of the row material acrylic acid (AA), with crosslinker N-N’-methylenebisacrylamide (MBA) and acrylic amide (AM) using dose irradiation of 40 kGy. Some of the clays using in this work are kaolinite, pumice fly ash, bentonite, zeolite, pyrophylite, and starch as the filler in varies sizes. The water absorbance measurement showed SAPC-kaolinite is 0.727, SAPC-fumice 0.410; SAPC-fly ash 1.081; SAPC- bentonite 0.164; SAPC- zeolite 0.205, SAPC-pyrophylite 1.078; and SAPC- starch 0.607. The SAPC-fly ash has the maximum water absorbance but not stable enough dipping at a longer time and hot media.

**Keywords:** SAPC-kaolinite, SAPC-fumice, SAPC-fly ash, SAPC-bentonite; SAPC-zeolite, SAPC-pyrophylite; and SAPC- starch absorption rate, water absorption, water absorption capacity
Poster Presentation 30 (PP-30)

Evaluation of Pangium Ebule Reinm (Kluwak) Extract as Green Corrosion Inhibitor Alternative for API 5L Steel in 0.2 M HCl Solution

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Abstract

Pangium Ebule Reinm (kluwak) Extract is a potentially candidate as green corrosion inhibitor alternative for low carbon steel. Electrochemical analysis of the corrosion inhibition of the Pangium Ebule Reinm on API 5L steel in 0.2M HCl solution was evaluated by using potentiodynamic polarization technique, electrochemical impedance spectroscopy (EIS) and FT-IR spectroscopy. Results obtained show that optimal inhibition efficiency occurred at 4000 ppm of inhibitor extract concentration with efficiency is 57.0%. Potentiodynamic polarization curve shows that mixed type inhibition. Testing EIS shows the corrosion process is controlled by the passivation mechanism indicated by an increase in the surface resistance of corrosion.

Keywords: Pangium Ebule Reinm, API 5L, potentiodynamic polarization technique, EIS, FT-IR, HCl.
Poster Presentation 31 (PP-31)

Effect of variable concentrations of Moringa oleifera leaf extract as green corrosion inhibitor for API 5L steel in 0.2M HCl solution

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Abstract
Moringa oleifera is known to be rich in nutrients, antioxidants and antimicrobial so that it is widely used in pharmacological and food industries, as well as a promising alternative to eco-friendly corrosion inhibitor. In this study, the corrosion inhibition of API 5L steel in 0.2 M HCl by Moringa oleifera leaf extract with concentrations ranging from 1000 to 5000 ppm was investigated by conducting FTIR characterization in inhibitor extract and potentiodynamic polarization measurements in steel specimens. FTIR spectrum indicated that the Moringa oleifera extract contains amino acid and mixture of different organic molecules. While the polarization curve exhibited an increase in corrosion protection efficiency along with extract concentration. Optimal inhibition efficiency of 70.11% and lowest corrosion rate of 33.13 mpy is achieved at the highest inhibitor concentration of 5000 ppm.

Keywords: Moringa oleifera, green corrosion inhibitor, API 5L, potentiodynamic polarization, FTIR, HCl
**Poster Presentation 32 (PP-32)**

**Effect of Growth Temperature on the Performance of AuAg Nanospherical Catalysis for Enhanced Hydrogenation of Acetone to Isopropanol**

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**Abstract**

This work reports a simple technique to control the growth of bimetallic gold-silver (Au-Ag) nanostructures and linked to their catalytic properties in hydrogenation of acetone. Bimetallic Au-Ag alloy nanocatalysts were synthesized directly on the surface of glass substrates through a hydrothermal method with several of growth and annealing temperatures. The conversion of acetone to isopropanol was carried out under microwave radiation then it was evaluated through the degradation of characteristic absorption spectra of acetone at a wavelength of 265 nm. The EDS elemental mapping and X-ray Diffraction (XRD) analysis confirm the growth of bimetallic Au-Ag nanoparticle that is dominated with {111} crystal plane. The growth temperature can control the composition of Au–Ag that is indicated by the blue shift of localized surface plasmon resonance absorption peak and EDS analysis. The Au-Ag nanocatalyst prepared at 100 °C and annealed at 400 °C shows the highest catalytic activity with 62% conversion that may be due to the high density Au-Ag nanocatalyst that offered high percentage of Au and Ag species for greater surface reaction and finally accelerate the diffusion of acetone to produce isopropanol.
**Poster Presentation 33 (PP-33)**

**Tailoring the Active Surface Sites of ZnO Nanorods on Glass Substrate for Photocatalytic Activity Enhancement**

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**Abstract**

The urgent need for inexpensive, efficient, ease in use and reusable photocatalyst has attracted the attention of many researchers. Here, the photocatalyst ZnO nanorods were synthesized with a simple, low cost and rapid ultrasonic spray pyrolysis method and then grown with hydrothermal method for 2, 4, 6 and 8 h. The ZnO nanorods grown for 6 h shows the highest photocatalytic efficiency although it does not have the largest surface area. This is probably due to its surface is dominated by (002) facets as indicated by the highest texture coefficient (TC) value. The (002) polar facets consisting of a positive Zn-terminated (002) facets and a negative O-terminated (00-2) facets may play an important role for more efficient UV absorption and photogenerated charges separation. Moreover, the highest crystallite size as shown in XRD result provide pathways for electrons and holes for redox reactions on the surface of ZnO nanorods. The synthesized ZnO nanorods may also contain high concentration of oxygen interstitial as a source of holes that react with OH− ions that easily adsorbed on (002) facets.

**Keywords:** ZnO, nanorods, facets, ultrasonic spray pyrolysis, photocatalysts.
Poster Presentation 34 (PP-34)

Lammps Simulation of FeCr Alloy as the Basic Component of Stainless Steel for a High Temperature Nuclear Reactor Material

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Abstract

At present, nuclear reactor technology that is widely used because of its proven reliability is the gen-III + nuclear reactor. Even if it is seen from the aspect of safety and reliability of this generation reactor, it has been proven, but because nuclear energy plays a vital role to meet the growing world energy needs, it is necessary to have a type of nuclear reactor that is tailored to those needs. The next generation of nuclear reactors must meet the requirements of fulfilling safety requirements, be flexible, a longer operating life (more than 60 years), more economical. In order for a reactor to produce higher power, a longer operating life and more economical, reactor structure materials which are capable of being operated at high temperatures are needed. The types of materials that are expected to meet these requirements include various types of ferritic / martensite steel, austenite, alloy steel containing nickel, and metal glass materials and ceramic materials. FeCr metal alloys are alloys that form the metals mentioned above, so it is important to conduct research both in simulation and experiment. Molecular Dynamics simulation of FeCr alloys using Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) has been done to explore their thermodynamic characteristics such as heat treatment, solubility of Cr, atomic radial distribution function (RDF).
**Poster Presentation 35 (PP-35)**

**Effect of 1-step sintering on consolidation of ultrasonically pre-microalloyed FeCrY₂O₃ powders**

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**Abstract**

ODS (Oxide Dispersion Strengthened) Steel is one of the Advanced Material that has a stabilized structure and Heat Resistance as Nuclear Application. ODS steel as classy material which resist on high temperature and maintain its mechanical properties on 15% Cr composition. With the basic Element Fe-Cr-Y₂O₃, ODS Alloy Steel obtain standard of processing consisting pre-alloy, mechanical alloying, and mechanical/thermal treatment. This experiment is focused on synthesizing Fe-Cr-Y₂O₃ by consolidation of the ultrasonically pre-microalloyed Fe-Cr-Y₂O₃ powders followed 1-step sintering. In the type of powder metallurgy processing, ODS Steel indicated obstacles that need to discuss in concerning of homogeneity and mechanical properties with investigating ODS Steel characterization after microalloying treatment with ultrasonic in Toulene solution. The ultrasonically treatment was done at various Amplitude, and then gained the compacting pressure of 8000 Psi followed 1-step sintering process to 1300 °C with 2 hours of holding time. The results of the processes being characterized by using SEM-EDS, XRD, microhardness. The result of this research prove that the range of hardness are from 133,28 HVN to 149,66 HVN. The bulk morphology, as a result of 1-step sintering process, describes ferrite phase with cubic structure, high homogeneity and has the highest Fe-Cr phase of 94.5% at 40% amplitude on ultrasonically pre-microalloyed Fe-Cr-Y₂O₃ powders.

**Keywords:** ODS, Ultrasonic, microalloy Fe-Cr-Y₂O₃, powder metallurgy, sintering, microhardness.
Effect of Nd-Dopant on the Structure, Magnetic and Absorption Properties of NiFe$_2$O$_4$

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Abstract
Effect of Nd-dopant on the structure, magnetic and absorption properties of NiFe$_2$O$_4$ have been studied. The NiNdxFe$_{2-x}$O$_4$ system (x= 0.0; 0.005 and 0.01 at mole ratio) was synthesized by using solid-state reaction technique. The NiO, Nd$_2$O$_3$ and Fe$_2$O$_3$ powders were mixed and then milled by using high energy milling for 5 h this milled powder was sintered at 1000 °C for 5 h. The effect of Nd dopants on the structure, magnetic, and absorption properties was investigated by using XRD, VSM, and VNA. The XRD analysis showed that the Nd addition have formed of two phases of NiFe$_2$O$_4$ and NdFeO$_3$. Magnetic properties of samples were analyzed by vibrating sample magnetometer (VSM) shows ferromagnetic behaviour, where the Ms value decrease (around of 59.5 to 45.4 emu/g) and value of $H_c$ increased (around of 160 to 182 Oe) along with the addition of the Nd content. While the ability of microwaves absorption measured by using Vector Network Analyzer (VNA) indicates that the value of reflection loss (RL) decrease (around – 10.04 dB to -12.3 dB) at a frequency of 10.20 GHz with the addition the Nd content. It means the absorption ability of NiNdxFe$_{2-x}$O$_4$ increase with increased of Nd content, wit maximum value is around 94% (for x=0.01).

Keywords: NiNdxFe$_{2-x}$O$_4$ system, magnetic properties, microwave absorption ability.
Study on Phases Development and Mechanical Properties in a Fe-Ni-Al Carbide Free Bainitic Steel Based on Lateritic Steel After Warm Rolling

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Abstract
The abundant reserve of lateritic ores in Indonesia is currently processed and studied to fulfill the national steel demand in several sectors, one of which is for railway application. The development of lateritic steel (Fe-Ni) as carbide free bainitic steel is carried out by adding Al to the Fe-Ni alloy. This study was conducted to examine the effect of warm rolling and Al addition to the formation of carbide, phases development and mechanical properties. The warm-rolled thermomechanical process (TMCP) was carried out by heating the material at 945 °C for 20 minutes followed by second heating to 400 °C, 450 °C and 500 °C with holding time for 30 minutes. The materials then warm rolled with 50% and 70% reductions using 20 tonnes capacity roller machine and then air cooled outside the furnace chamber. The microstructure of the as-rolled materials were characterized using optical microscope (OM) and scanning electron microscope (SEM), while the phases, the chemical distribution and the possibility of carbide formation were examine using X-Ray Diffraction (XRD) pattern and energy dispersive X Ray spectroscopy (EDS). The mechanical properties of the material were observed using macro Rocwell hardness test. It was revealed that the addition of Al altered the phases of Fe-Ni lateritic steel significantly. Furthermore, Al addition gives positive effects to the Fe-Ni lateritic steel by increasing hardness. The reductions applied during warm rolling were observed to have effect on the growth of the grains in the Fe-Ni-Al lateritic steel.

Keywords: Lateritic steel, carbide free bainitic steel, warm rolling, bainite formation, mechanical properties.
Effect of Porogen Agent on Microstructure of CaP Granules using the Gelation of Alginate Droplet Formation

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Abstract

Abstract- CaP granules are used for open defect of bone. The important feature in the physical structure of a synthetic ceramic is its porosity. Pore structure is great importance for osteoconduction. The main objective of this study is to investigate the Effect of adding carbon black as porogen agent on microstructure of CaP granules of droplet CaP. According to that, certain carbon black (325 mesh) has added into composition of microspheres CaP-alginate gelation with ratio CaP: carbon black was 0.5, 1, and 1,5 weight ratio respectively. Scanning Electron Microscope (SEM) was used to investigate microstructure of droplet and shown that Irregular shape grain. Internal microstructure appears more open for samples produced without a presence of alginate after sintering process, it was confirmed by XRD pattern for whole samples. The diameter of grain has decreased by adding CB. So that, it can be consider that CB can serve as a porogen agent.

Keywords: CaP granule, microstructure, bone defect, droplet formation.
Microstructure Deformation of Austenitic Superalloy Steel after Arc Plasma Sintering

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Abstract
Microstructure deformation of 56Fe16.6Cr25Ni0.9Si0.5Mn austenitic superalloy (AS) has been investigated in this study. The superalloy was produced from a mixture of granular ferro-scrap, ferrochrome, ferrosilicon and ferromanganese raw materials by casting method and then annealed using arc plasma for 4 and 8 minutes. The superalloy has been proposed in nuclear as well as fossil power plant facilities such as vessels and heat exchangers. A combination of microscopy investigations by means of the Optical Microscope (OM), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) techniques was carried out in order to get detail information about the microstructures especially fine structure and its deformation of superalloy steel. It can be resumed that the austenitic superalloy microstructure is composed by dendrites of $\gamma$-austenite, separated by eutectic structure of Fe-Cr-C alloy. APS for 4 to 8 minutes leads to form microstrain, $\varepsilon$, from $4.60x10^{-3}$ to $5.39-4.06x10^{-4}$.

Keywords: austenitic superalloy, microstructure, microstrain, arc-plasma sintering, OM, SEM, TEM, XRD, HRPD.
Poster Presentation 40 (PP-40)

The Effect of Platinum Nanoparticles on The Photocatalytic Properties of ZnO Nanorods Prepared on Glass Substrates

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Abstract

The synthesis of nanocomposite metal-semiconductor material has become the focus of current research because it has many advantages as a heterogenous photocatalyst material. Pt is one of the best candidate element for improving the photocatalytic efficiency of ZnO photocatalyst. The electron sink effect of Pt nanoparticles could enhance the production of electrons and holes that depends on the size and shape of Pt nanoparticles on ZnO nanorods surface. In this work, ZnO nanorods were synthesized on the glass substrate by ultrasonic spray pyrolysis and hydrothermal method, then followed by the deposition of Pt nanoparticles on the surface of ZnO nanorods through a reduction process. The photocatalytic activity ZnO/Pt nanocomposites was observed through the degradation process of methyl blue under UV light irradiation. The structure and optical properties of ZnO/Pt nanocomposites were characterized and analyzed by using X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Absorption and Reflectance UV-Visible Spectroscopy and Photoluminesence Spectroscopy (PL).

Keywords: Pt Nanoparticle, photocatalytic, ZnO nanorods, ZnO/Pt nanocomposite.
Synthesis and Characterization of HPMC/Hap/Fe₃O₄ Composite for Hypertermia Application

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Abstract
Magnetic material become subject of intense research for hyperthermia application, and injectable magnetic hyperthermia for bone cancer is one of this research interest. In this study, composite of hydroxyapatite (HAp) and Fe₃O₄ in Hydroxypropyl-methyl cellulose (HPMC) matrix (HPMC/HAp/Fe₃O₄) has been synthesized in gel form that are expected can be applied for injectable bone substitute (IBS) in hyperthermia therapy. Composites were made using conventional methods by mixing HAp powder with ferrofluid Fe₃O₄ in HPMC solution. The composition of the composites was varied with the mass comparison of HPMC: HAp: Fe₃O₄ was 1:0:0; 1:3:0; 1:2:0.5; 1:1:0.25; and 1:0:3. The physical, chemical, and magnetic properties of the composites were characterized using X-Ray Diffractometer (XRD), Fourier Transform Infrared Spectrometry (FT-IR), Particle Size Analyzer (PSA), and Vibrating Sample Magnetometer (VSM). The XRD characterization results of the HPMC/HAp/Fe₃O₄ composite showed the crystalline phase of the constituent components. Saturation magnetization of the HPMC/HAp/Fe₃O₄ composite was 2.72 emu/g for the composition of 1:2:0.5 and 1.79 emu/g for the composition of 1:1:0.25. HPMC/HAp/Fe₃O₄ composite has superparamagnetic and biocompatible properties, so that they can be applied as IBS in hyperthermia therapy.

Keywords: Hyperthermia, (Hydroxypropyl)methyl cellulose, hydroxyapatite, magnetite, Injectable Bone Substitute
Homogeneous Grain Growth Behavior of Ultrafine-Grained Low C,N Fe-20%Cr Steel by Equal Channel Angular Pressing

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Abstract
The grain growth of an ultrafine-grained low C,N Fe-20%Cr steel has been investigated focusing on the early stage of restoration of strain. Ultrafine-grained (UFG) material which possess high corrosion resistance and good biocompatibility for biomaterial, has been prepared by equal channel angular pressing (ECAP) up to eight passes via route Bc. The post-ECAP annealing process was completed from 473 until 1373K for one hour. The microstructure and hardness were then analyzed by electron back-scattering diffraction, transmission electron microscope, X-ray diffractometer and micro hardness. The hardness after post-ECAP annealing exhibited the typical three-stages softening. Namely, the hardness remained stable after the annealing temperature up to 698K and then declined significantly until the temperature of 973K. Finally, hardness remained stable again at higher temperature. In the second stage, grains grew uniformly, which differ from typical nucleation-and-growth mode of discontinuous recrystallization. It was found by X-ray line broadening analysis that strain was released in early stage prior to the significant softening stage. It was suggested that the homogeneous grain growth was led by the uniform grain distribution with a high angle grain boundaries fraction.

Keywords: Low carbon steel, ECAP, annealing behaviour, grain growth
Poster Presentation 43 (PP-43)

Comparison of 3 Cell Conventional Lead Acid Battery with Dynamic Lead Acid Battery

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Abstract

Primary energy consumption still growing constantly and reach 13,276.3 mtoe in the year 2016. Battery as one of the tools as energy storage have widely used and continue explore to get the better performance. Although lead acid battery (LAB) is unlight, the used of lead acid battery increases every year due to the grow of automobile production. Dynamic battery as known as redox flow battery (RFB) is an electric energy storage system that use another outer chamber fully with an electrolytes and it will flow into the cell during cell activity. Experiment was conducted using Turnigy accucell-6 and ChargeMaster 2.02 as battery management system (BMS) for 5 cycle with current load 1000 mA during charging and 400 mA while discharging process. Initial terminal voltage of conventional LAB grows from 6.50 V to 6.72 V and the same thing happen in dynamic LAB from 6.20 V to 6.76 V while in discharging process show constant value around 6,50 V for conventional and dynamic LAB. Both capacity is decrease approximately 900 mAh and 550 mAh from origin value of 5593 mAh and 6386 mAh sequently for conventional and dynamic LAB. Based on the experiment result, the Dynamic LAB show a better quality in term of capacity and charging duration.

Keywords: Battery, lead acid battery, RFB, capacity, dynamic LAB.
**Investigation on Different Permanent Magnet Configuration in 12 Slot 8 Pole of Permanent Magnet Synchronous Generator**

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**Abstract**

A permanent magnet synchronous generator (PMSG) performance are influenced by design and magnet material. This paper investigates the performance of PMSG by configuration permanent magnet installation and material. A 12 slot 8 poles PMSG are designed and simulated by some configuration and magnet material types. Finite element software used to simulate the performance of PMSG by surface mounted magnet, inset magnet and buried magnet in PMSG. All of the magnetic flux densities and relative permeability’s magnetic material among the design will be compared and analyzed. By this work, it is expected the researcher has a knowledge about the best design for the certain magnet material characteristics.

**Keywords:** PMSG, magnet material, permeability, flux density
**Poster Presentation 45 (PP-45)**

**Determination of Crystal of Structure of Superalloy Steel of F1, A2 and A2-APS Using Bragg Formula Arithmetic**

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**Abstract**

BATAN material engineers have succeeded in producing a series of super alloy steels of Austenitic type (A2) and Ferritic type (F1). Several treatments have been performed using arc plasma sintering (APS) by varying the irradiation time. In this study, X-ray diffraction measurements were performed to find out the shape of the crystal structure and the lattice parameters of ferritic steel F1, A2 austenitic steel and A2-austenitic steel with APS treatments for 2 seconds of irradiation. The calculations were carried out using Bragg formula by comparing the S-arithmetic and the interplanar spacing. Obtained that: ferritic steel F1 has a crystal form of body centered cubic (BCC) with lattice parameter \(a = 2.87 \text{ Å}\). Austenitic steel A2 has a face centered cubic (FCC) structure with lattice parameter \(a = 3.59 \text{ Å}\). Austenitic A2 steel sintered APS for 2 sec has a face centered cubic structure (FCC) with lattice parameter \(a = 3.60 \text{ Å}\). As a comparison, there were also observations of material surface microstructure by using Optical Microscope (OM) and Electron Microscope (SEM). Assuming the same conditions of casting process, both types of test materials have similar cast-structures. The ferric steel F1 exhibits a finer grain boundary when compared to the grain boundary in austenitic steel A2 which tends to be highly visible to the width of its boundaries. While austenitic steel A2 treated sintering APS for 2 seconds, showing the grains pattern structures that previously elongated changed to become slightly rounded (globular). SEM-micrographs show the precipitates on the ferritic steel F1 scattered at the grain boundaries and inside the grain, whereas in A2 autenitic steel lies at the grain boundary only. While EDX spectrums show the precipitate composition of ferritic steel F1 including C, Cr, and Fe. While in A2 austenitic steel is C, Cr, Fe, and Ni. It is possible, because of the dominance of Cr and C elements, chromium carbide (\(\text{Cr}_2\text{C}_6\)) is formed as precipitates at the grain boundaries.

**Keywords:** F1-ferritic steel, A2-austenitic steel, XRD, arithmetica, Bragg formula, microstructures.
Poster Presentation 46 (PP-46)

Effect of Sintering Temperature on The Crystal Structure and Characteristic of Conductivity and Permittivity of Ba\textsubscript{(2-x)}Nd\textsubscript{x}TiF\textsubscript{2}O\textsubscript{5}

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Abstract
Barium diiron tetraoxide Ba\textsubscript{(2-x)}Nd\textsubscript{x}TiF\textsubscript{2}O\textsubscript{5} has been synthesized by mechanical milling method. Ba\textsubscript{(2-x)}Nd\textsubscript{x}TiF\textsubscript{2}O\textsubscript{5} is made from raw material of BaCO\textsubscript{3}, Nd\textsubscript{2}O\textsubscript{3}, Fe\textsubscript{2}O\textsubscript{3} and TiO\textsubscript{2} according to the composition of stoichiometry through weight comparison. The four raw materials are inserted into the vial, then mixed with milling techniques for 2 hours. Then the mixture was sintered using a furnace with a temperature variation of 800 °C, 900 °C and 1000 °C for 5 hours. Phase analysis was tested using XRD (X-ray Diffractometer) which was used to determine the crystal structure and crystallite size. Conductivity and permittivity characteristics of materials are measured using LCR meters. XRD analysis results show that the barium iron tetraoxide phase has been formed with crystallite size rising with increasing sintering temperature. While the characteristics of conductivity and permittivity as a function of frequency decreases and increases with increasing sintering temperature. It was concluded that the effect of sintering temperature can improve the conductivity and permittivity characteristics of the material.

Keywords: Ba\textsubscript{(2-x)}Nd\textsubscript{x}TiF\textsubscript{2}O\textsubscript{5}, crystal structure, conductivity, permittivity.
Controllable SiO₂ Nanoparticle Size Through Ammonia Catalyst as Scattering in DSSC (Dye-Sensitized Solar Cells)

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Abstract

The improvements of DSSC efficiency are carried out through the extending light path or by minimizing the recombination. Addition of SiO₂ particles as good scattering materials is known to increase the light harvesting and inhibit the recombination. Photoanode modification can also be done by adding Au as a plasmonic material. Through the addition of precious metals, the light-harvesting energy appears to increase due to the plasmonic effect and increasing the separation of charge as electron storage. Photoanode modification can increase the absorbance of visible wavelengths, both by adding plasmonic particles and scattering material. Both of these materials have characteristics that can improve the efficiency of DSSC compared to conventional photoanodes. This is due to the Localized Surface Plasmon Resonance (LSPR) effect and the scattering effect carried by each Au and SiO₂.

DSSC was fabricated with Au-SiO₂ photoanodes with catalyst molar variations of SiO₂, i.e. 0.05mM and 5mM. Silica was obtained by facile synthesis Stöber method from tetraethyl orthosilicate (TEOS) as precursor. The obtained silica powder was subsequently grounded up to 325 mesh. The grounded powder was added into the mixture of ethanol, ammonia and aquades. A gold solution was prepared using Turkevich method. SiO₂ with Au nanoparticles were synthesized following previously published method. The addition of silica and Au nanoparticles in TiO₂ photoanodes is expected to improve DSSC efficiency due to scattering effects and reflectance effects.

In this paper, we report the effect of Au-SiO₂ on DSSC performances by varying the size of catalyst molar addition (5mM and 0.05mM). Au-SiO₂ was characterized by XRD, FTIR and UV-Vis. DSSC performance was evaluated by IPCE. According to the XRD pattern, the Au-SiO₂ (5mM) has the main peak of SiO₂ at 2θ = 22.158°, which Au peak cannot be observed. While for Au-SiO₂, the peak visible at 2θ = 22.476° for SiO₂ with an au peak that appears on 2θ = 38.01°. FTIR spectra result shows that Au-SiO₂ was in the range 800-4000 cm⁻¹ by varying the size of catalyst molar addition. The maximum absorption of Au-SiO₂ (0.05 mM) and (5 mM) by UV-Vis Spectra shows at wavelength 317 nm and 320nm respectively. Addition of catalyst with high molar will accelerate the rate of reaction to form a larger size, which are ~680 nm (0.05 mM) and ~5 µm (5 mM). The greater size of the SiO₂ formed, the wider optical band gap energy of Au-SiO₂ that is possessed. It grows from 2.19 eV to 2.89 eV. Incident photon-to-current conversion efficiency measurement values of the DSSCs is shown in figure 1. The IPCE spectra follow the same style as the UV-Vis, which shows enhancement of photon absorption. It should be noted that the reason for the maximum UV-Vis peak is around 317~320 nm due to the absence of interaction with dye. The localized surface plasmon resonance in Au nanoparticles occurs in the vicinity of 525 nm. Thus, it is possible to achieve a maximum in the nanoparticle’s extinction spectrum near the maximum absorbance dye for DSSCs, N719, at 530 nm. The DSSC with smaller molar ratio of SiO₂ showed higher conversion efficiency in the wavelength range 400~750 nm. IPCE results indicated the smaller size obtained can increase the higher value of IPCE, that is 4.88%.

Keywords: photoanode, Au-SiO₂, DSSC, catalyst, scattering nanoparticle
Figure 1. IPCE of the DSSC (a) TiO$_2$ without any nanoparticle's (b) using Au-SiO$_2$ with catalyst molar variations.
Poster Presentation 48 (PP-48)

Polyaniline Electrocatalytic Activation of Reduced Graphene Oxide Composite Counter Electrode using In-situ Polymerization for DSSC Applications

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Abstract
The main drawbacks of Pt-free counter electrodes in DSSC is the lack of their electrocatalytic activity despite of their low cost. A material that commonly applied as counter electrode in DSSC is graphite. It is well-known that graphite provides high electric conductivity but low electrocatalytic activity. Therefore, the graphite electrode has to be covered with a better electrocatalytic active material to facilitate the charge transfers at the electrode/electrolyte interface. In this report, we demonstrate how the combination of reduced graphene oxide and polyaniline enhance the electrocatalytic activity of synthetic graphite counter electrode. Reduced graphene oxide (rGO) was synthesized using sonication-oxidation of graphite with ascorbic acid as reductor. Polyaniline (PANI) were grown on the surfaces of dispersed rGO in aqueous system using in situ polymerization technique. This technique was applied for both types of rGO, the floated and suspended rGOS, resulting low conductive PANI-Floated reduced graphene oxide (PANI-FrGO) and high conductive PANI-suspended reduced graphene oxide (PANI-SrGO). In the composite counter electrode, rGO acts as a bridge between graphite surface and electrocatalytic active materials, polyaniline. The best photovoltaic performance was obtained for cell using a PANI-SrGO composite counter electrode, resulting a better cell with respect to the sole rGO. The optimum short circuit current density (Jsc), the open circuit voltage (Voc), the fill factor (FF), and the overall conversion efficiency under AM 1.5, 100 mW cm⁻² illumination are 4.899 mA/cm², 0.66 Volt, 0.508 and 1.83%, respectively. In conclusion, the application of PANI on rGO composite counter electrode demonstrate a significant enhancement in photovoltaic performance, opening a route for low cost fabrication of Pt-free counter electrode.

Keywords: Composite counter electrode, Dye-sensitized solar cell, electrocatalytic activation, in-situ polymerization, rGO/PANI composite.
Poster Presentation 49 (PP-49)

Synthesis of Lanthanum Manganite (LMO) using Solid Reaction Methods as Absorber Material

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Abstract

Lanthanum manganite that have perovskite structure is an inorganic compound with the formula LaMnO3, usually abbreviated as LMO. This compound is consisting of oxygen octahedra with a central Mn atom. A perovskite LMO is a magnetic material that recently has been developed as an absorbent of electromagnetic waves. The single phase of magnetic material La1-XNdXBa0.2MnO3 (X = 0.0 - 0.8) has been synthesized using a solid reaction method and the effects of Nd3+ ion doping on phase changes and magnetic properties have been studied. Finally, the optimum composition of phase is obtained from this study as an absorbent material for electromagnetic waves. The single phase of magnetic material is formed on the maximum doping composition x = 0.6 with a composition close to the stoichiometric value. The doping treatment of Nd ions causes a decrease in the magnetic properties of the synthesized material, from ferromagnetic to antiferromagnetic. From the results of SEM observations, morphology in the shape of uniformly needle aggregate is seen on all surfaces with particle sizes of 600-700 nm. The material doped with Nd ion with x = 0.6 is the optimum composition, because the radar absorption at this composition is the highest result, with a reflection loss (RL) value reaching -14.29 dB at the bandwidth of 10.68 GHz.
Effect of Ratio Filled of $\alpha$-$\text{Fe}_2\text{O}_3$ on Microstructure and Magnetic Properties of Nano-sized Thin Film of $\alpha$-$\text{Fe}_2\text{O}_3$/MWNT/PVA

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Abstract
$\alpha$-$\text{Fe}_2\text{O}_3$-filled MWNT/PVA thin films were synthesized by dispersing $\alpha$-$\text{Fe}_2\text{O}_3$-MWNT in Sodium Dodecyl Sulfate (SDS) solvent with containing 10% of PVA solution and the samples were then naturally dried all night. $\alpha$-$\text{Fe}_2\text{O}_3$ was prepared from Iron nitrate ($\text{Fe(NO}_3)_3.9\text{H}_2\text{O}$) with purity above 98.5% that already have been through the process of stirring for 27 hours at R.T. and annealing process at 160 °C for 5 hours in order to decompose the $\text{Fe(NO}_3)_3.9\text{H}_2\text{O}$. The weight percentage variation of $\alpha$-$\text{Fe}_2\text{O}_3$ against the MWCNT is 1:1 and 1:7. The nano-sized thin films were analysed by Raman Spectroscopy, and Transmission Electron Microscopy (TEM), and then VSM measurement was performed for characterizing the magnetic property of the thin film. From the analysis of Raman Spectroscopy, all group theoretically predicted Raman-active of seven phonon modes (A1g (1), Eg (1), Eg (2), Eg (3), Eg (4), A1g (2), and Eg (5)) of $\alpha$-$\text{Fe}_2\text{O}_3$ were detected. The relative intensity of the A1g (1) mode and Eg mode (2) in ratio of 1:7 is higher than in ratio of 1:1. The MWCNTs bundles of D band around 1330 cm$^{-1}$ and G band around 1610 cm$^{-1}$ were also identified in both variation, 1:1 and 1:7 of the thin films, which proves the existence of $\alpha$-$\text{Fe}_2\text{O}_3$ on the MWCNT. Raman spectra of $\alpha$-$\text{Fe}_2\text{O}_3$ is more appear at a ratio of 1:1, which shows the success of the formation of a homogeneous thin films. TEM result showed the $\alpha$-$\text{Fe}_2\text{O}_3$ inside the carbon nano tube with inner diameter of about 10 nm and outer diameter of about 25 nm, which also detected in the case of ratio 1:4 as reported by S. Purwanto, et al. The curve of VSM measurement result shows the magnetic hysteresis loops that indicating the presence of ferromagnetic spin ordering of $\alpha$-$\text{Fe}_2\text{O}_3$. Sample with the ratio of 1:7 exhibited a little bit bigger hysteresis loop and high coercivity compared to the ratio of 1:1, where this result is consistent with the analysis result of Raman Spectroscopy that is marked by the increasing of the relative intensity of the A1g (1) mode and Eg mode (2) in ratio of 1:7.

Keywords: Ratio filled of $\alpha$-$\text{Fe}_2\text{O}_3$, Nano-sized thin films, Microstructure, Magnetic properties, $\alpha$-$\text{Fe}_2\text{O}_3$ filled MWNT/PVA
Effect of Na+ Concentration on Luminescence of Phosphor CaO:Ce³⁺ for White LED prepared by Solid State Synthesis Method

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Abstract

the process of making yellow phosphor CaO: Ce³⁺, Na⁺ with variation of Na⁺ flux concentration for white LED application surgery lamp has been done by solid state synthesis method. Raw material of Calcium oxide (CaO) used as a matrix, Cerium (IV) oxide (CeO₂) as an activator, and Sodium hydrogen carbonate (NaHCO₃) as a flux. The raw materials are mixed with composition CaO:Ce³⁺, xNa⁺ (x = 0.0035 M, 0.007 M, and 0.014 M). HEM (High Energy Milling has been used to mix the material according the exact proportions for a particular chemical reaction a stoichiometric mixture. The material is then burned with a sintering temperature of 1300 °C rate 40 °C/h for 3 hours. CaO: Ce³⁺, Na⁺ phosphor tested its performance by embedding the phosphor produced on the blue InGaN LED chip after it observed the resulting emission. Then the phosphor material produced after sintering was characterized by 3 devices XRD (X-Ray Diffractometer) to investigate presence of phases, PL (Photoluminescence) flux concentration to investigate energy band gap and phosphor emission spectrum CaO: Ce³⁺, Na⁺ with variation of Na⁺ flux concentration, and Fourier FTIR (Transform Infrared Spectroscopy). The results showed that the optimum flux concentration of Na⁺ was 0.007 M by emitting a yellow color spectrum with a wavelength of 503.94 nm.
Design of Microfluidic-GMR Measurement System for Sensing Ferrofluid: a Performance Test

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Abstract
Design of microfluidic-GMR measurement system for sensing ferrofluid. Home made design microfluidic systems using giant magnetoresistance (GMR) sensor from NVE company has been performed. The measurement system consists of a microfluidic channel flanked by a permanent magnet and a GMR sensor. The signals from ferrofluidic sample have been read by GMR sensor and then processed by using a personal computer via the ADC module interface. The volume and flow rate of ferrofluid through a microfluidic channel have been control by syringe- pump that can be programmed automatically. At present experiment the distilled water and ferrofluid with code FF-TPP2-A5000 have been used as a fluidic object. The experiment has been performed with a flow rate of 30 µL/second for 1 mL ferrofluid. The signal voltage from distilled water is 139,071 µV, while the signal of ferrofluid is 140,306 µV. This voltage discrepancy between distilled water and ferrofluid is 1,236 µV.
Synthesis and Characterization of Magnesium Diboride Prepared by Solid State Reaction

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Abstract

Synthesis of magnesium diboride MgB₂ has been done by using conventional solid state reaction. The influence of temperature sintering on phase formation, and superconductivity of MgB₂ were studied. By using crystalline magnesium and boron powders as starting elements, the synthesis of MgB₂ was done. With stoichiometric ratio of Mg : B = 1 : 2, the powders were mixed, compacted, and sintered at 600, 700, 800, 850, 900°C for an hour. The phase formation, surface morphology, and electrical resistivity were then investigated by means of XRD, SEM, and Cryogenic magnet. The XRD pattern showed the MgB₂ phase begins to form at sintering temperature of 700°C and the volume fraction of MgB₂ phase increased with increasing the sintering temperature. From the resistivity measurement, we reported that the samples sintered at 800, 850 and 900°C have superconductivity phenomena with the critical temperature value at 43 K.
**Influence of Catalyst Concentration on Characteristics of SiO$_2$ Synthesized by Sol-Gel Method**

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**Abstract**

Silica (SiO$_2$) nanoparticles have been synthesized by so-gel method using tetra ethyl orthosilicate (TEOS) as precursor and HCl as catalyst. Based on experiment concentration of catalyst was hold an important role in synthesis of SiO$_2$ by sol gel method, because it affected to characteristic of SiO$_2$ produced. In this experiment, concentration of the HCl catalyst was varied 5.0 ml; 7.5 ml and 10 ml per 150 mL of total solution) with the purpose to obtain amorphous SiO$_2$, which have a nano size particle, high surface area and high porosity. The optimum dosage of HCl was obtained at 7.5 ml for 25 ml TEOS and 50 ml ethanol. Based on experiment, SiO$_2$ good characteristic has been synthesized with properties of particle size of 16.84 nm, a surface area of 740.616 m$^2$/g, pore volume of 0.6460 cc/g, and a pore size of 18.97 Ao.

**Keywords:** Silicon dioxide (SiO$_2$), sol-gel method, nanoparticle, amorphous.
Electrochemical Study of Printed Circuit Board Leaching Process Using Sulfuric Acid Solution with Variation of Sulfuric Acid and Immersion Time

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Abstract
The purpose of this research is to know electrochemical studies of copper metal on Printed Circuit Board (PCB) in sulfuric acid solution ($\text{H}_2\text{SO}_4$) with concentrations of 0.1 M, 0.2 M and 0.5 M using leaching testing method accompanied by linear corrosion polarization testing and Electrochemical Impedance Spectroscopy (EIS) testing. Linear linear polarization testing was performed to determine the corrosion rate of the samples used. The result of corrosion linear test showed that the solution of sulfuric acid with a concentration of 0.5 M has the highest $i_{corr}$ value which means the fastest corrosion rate is 3.7669 mm/year. Furthermore, the testing of Electrochemical Impedance Spectroscopy (EIS) which aims to determine the resistance of charge transfer ($R_{ct}$) or sample resistance to corrosion. The results obtained by testing using 0.5 sulfuric acid solution have the worst resistance that has a $R_{ct}$ value of 179 $\Omega$ and means the highest leaching rate. This test uses immerse time variable to know the behavior of the sample against time variable. The copper sheets were carried out the same tests for the comparison variables in this test.

Keywords: Printed Circuit Board, tembaga, Electrochemical Impedance Spectroscopy (EIS), Protective Layer, effect of concentration, effect of immersion time.
**Poster Presentation 56 (PP-56)**

**Effect of Zirconia Nanoparticle Addition into Chitosan for Solid Polymer Electrolyte**

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**Abstract**

The effect of Zirconia (ZrO₂) nanoparticle addition onto the structure and properties of chitosan as solid polymer electrolyte (SPE) has been studied. The chitosan film was prepared by solvent casting method. The micro-structure and segmental mobilities were studied by using X-ray diffractometer and mechanical test measurement, respectively. The conductivities were studied using electrochemical impedance spectrometer. The results showed that the addition of ZrO₂ nanoparticle, decreased the chitosan crystallinity as well as the tensile strength. However, there was an optimum addition, i.e. 4 wt%, for increasing the elongation at break which can be considered as molecular motion flexibility. The addition of ZrO₂ into chitosan seem to increase the molecular mobility but mostly did not change the chitosan conductivity significantly. In contrast, the addition of ZrO₂ into lithium salt containing chitosan clearly increased the conductivity and reach at maximum value at 4 wt% addition. The increase in conductivity shows a similar tendency with the increase in molecular motion flexibility. This result clearly shows the relationship between chitosan molecular flexibility and the ionic conductivity.

**Keywords:** Chitosan; Ionic Conductivity; Lithium-Ion Battery; Lithium Salt; SPE.
Poster Presentation 57 (PP-57)

Synthesis and Characterisation of Magnetic Nanoparticles Fe/Fe Oxide od Sodium Borohydride Reduction Results within Chitosan Hydrogel

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Abstract

Nanoparticles Fe/Fe oxide coated by chitosan hydrogel have been successfully synthesized through the diffusion process of Fe²⁺ ions into chitosan hydrogel followed by chemical reduction process using sodium borohydride (NaBH₄) as a reducing agent. The ratio of Fe²⁺ ions to NaBH₄ concentrations and chitosan hidrogel size were varied to obtain samples with a high value of magnetization. The phase formation of chitosan, Fe and Fe oxide nanoparticles were identified by X-Ray Diffractometer (XRD). Distribution pattern and morphology as well as the concentration of nanoparticles formed within hydrogel were characterized by Scanning Electron Microscope-Energy Dispersive Spectroscopy (SEM-EDS). The total amount of diffused Fe²⁺ ions was also measured by atomic absorption spectrophotometer (AAS). Characterisation by Vibrating Sample Magnetometer (VSM) indicates the formation of superparamagnetic samples with values of saturation magnetization (Ms) maximum of 23.6 emu/g obtained at Fe : NaBH₄ concentrations ratio of 1 : 5 and 1 mm sized of chitosan hydrogel. This optimum condition is achieved with the total amount of diffused Fe²⁺ ions of 27.04 % from its initial amount. The typical peak shift of the Schiff base observed in Fourier transform infrared spectrophotometer (FT-IR) from 1629 cm⁻¹ became 1 cm⁻¹ 1174 (C-N vibration strain) and 1653 cm⁻¹ (N-H secondary vibration) ensure the bond between nanoparticles Fe/Fe oxides with chitosan hydrogel.

Keywords: Hydrogel, Chitosan, Nanoparticles, Fe/Fe oxide, NaBH₄
Synthesis of Nanohydroxyapatite based on Limestone by Double-Stirring Method

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Abstract
Nanohydroxyapatite based on Limestone synthesis has been carried out with a double stirring method. Limestone has a high calcium content, be used as a source of calcium. Calcium is extracted from limestone, through a heating process at 900 °C for 4 hours. The result of heating is calcium oxide, then hydrated into calcium hydroxide. Hydroxyapatite synthesis is carried out by mixing calcium hydroxide with phosphorus diamonium. Mixing is done by double-stirring method, which is vibrating material using ultrasonic waves at a frequency of 20 kHz and at the same time, both materials are stirred using a magnetic stirrer. The purity of the hydroxyapatite produced was determined by XRD and FTIR and the crystal size was determined by TEM. The hydroxyapatite produced has 100% purity with grain size in the range of 10-50 nm.
Elemental quantification of Wepal Sample under the 2017 IAEA Proficiency Test Program using Neutron Activation Analysis

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Abstract
Elemental quantification of Wepal Sample under the 2017 IAEA Proficiency Test Program using k0 Neutron Activation Analysis. Quantitative determination of Wepal sample has been done using Instrumental Neutron Activation Analysis under Proficiency Test Program. Eight samples of ISE and IPE obtained from Wepal. Water content has been determined using the gravimetric method at 100-105 °C for IPE sample, and 105-110 °C for ISE sample. Three irradiation scheme has been carried out, short, medium and long irradiation. Irradiations were carried out at rabbit facility of GA Siwabessy reactor at 15 MW power reactor which has a thermal neutron flux of about 2.3x10^{13} n.cm^{-2}.s^{-1}. Elemental analysis has been done using k0 and comparative method of INAA. On k0-INAA method the Al-0.1%Au alloy of IRMM-530R have been used as flux monitor. Short half life radionuclide was calculated using Excel program for the comparative method with applied a correction for dead and counting time. Quantitative analysis has been carried out based on dry weight. The moister content of IPE sample was higher than that of ISE sample. The moister content of IPE sample in the range of 8% to 10%, meanwhile the the ISE sample has the moister content in the range of 2% -6%. A number of the element determined on IPE sample was less than that on the ISE sample. The elements of Mn, Na, Ti, V, Cl, Sc, Fe, Co, Zn, As, Br, Rb, Zr, Sb, Cs, Ba, La, Ce, Sm, Eu, Tb, Yb, Lu, Th, and U have been determined on ISE sample. In the mean time for IPE sample, the elements of K, Na, Mn, Cl, Mg, Al, Ca, Cr, Fe, Co, Zn, Br, Rb, Sr, Mo, Sb, Cs, La, and Th can be evaluated quantitatively. Al, Mg and Ca were quite difficult to determine at routine reactor operation which has the flux of about 10^{13} n.cm^{-2}.s^{-1}. Most of the elements evaluated have Z scores in the range of -3 to +3 which indicate good analytical performance for some elements. Further studies need to be done for elements with a short half-life.

Keywords: Profeciency Test, k0-NAA, Z-Score
**Poster Presentation 60 (PP-60)**

The synthesis of PbZr$_{0.52}$Ti$_{0.48}$O$_3$ PbZr$_{0.58}$Ti$_{0.42}$O$_3$ powder and Its Intermediate Products by Use Molten Salt Method

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**Abstract**

Lead zirconat titanate, Pb(Zr$_{1-x}$Ti$_x$)O$_3$ is a material with high piezoelectric properties and many studies have been carried out in development, in order to improve the materials quality in various applications. One of them is the development of synthesis with the molten salt method in this study. Choice of the molten salt method is simply and not expensive. The salt ratio of NaCl / KCl at 1: 1 in moles as a solvent medium was carried out in synthesizing Pb(Zr$_{1-x}$Ti$_x$)O$_3$. Likewise, the salt ratio with reactant/basic material was 1: 1 in heavy percentages. To identify intermediate products in the synthesis process, the sintering temperature has been varied to 575, 675 and 775 $^\circ$C for samples A, B and C, respectively. The results of these syntheses have been identified and characterized using X-ray diffraction (XRD) methods. The Highscore program using the Rietveld method to identify the intermediate product content and each crystal structure has been applied in the refinement process on the XRD intensity profile with a statistical error of less than 6%. Intermediate products have been obtained as follows, PbTiO$_3$, PbZrO$_3$ and Zr$_{0.4}$Ti$_{0.6}$O$_3$. Whereas sample C has obtained two phases namely PbZr$_{0.52}$Ti$_{0.48}$O$_3$ and PbZr$_{0.58}$Ti$_{0.42}$O$_3$ with tetragonal (P4mm) and rhombohedral crystal structures (R3c).

**Keywords:** Molten Salt Method, intermediate product
Prediction of Distortion Behavior due to Load Thermal Laser Welded Low Carbon Steel with Stainless Steel 304 Based on Numerical and Computation Simulation

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Abstract
The purpose of the study is to predict deformation of a weldment in dissimilar laser welding process of low carbon steel and stainless steel 304 based on numerical and computation simulation approach. Different characterization of material on heat expand result influent distortion direct. The temperature rated effect of welding process direct to low carbon steel that caused heat expansion value of stainless steel 304 less than low carbon steel. Finite element analysis (FEA) and computer simulation or finite element model (FEM) used to understand the response and behavior of weldment during the welding process. Thermal expansion of weldment often leads to thermal stress in the weldment. The resulting temperature distribution, heat flux distribution and structural response under different arc current constitute knowledge in assuring design success of welding product. The calculation results used FEA, and FEM shows heat rated direct to low carbon region and high distortion occur there. Stainless with low expansion value have slow heat estimated expansion and low deformation.

Table 1: Chemical composition of parent metals (in % wt)

<table>
<thead>
<tr>
<th>Element</th>
<th>C</th>
<th>Mn</th>
<th>P</th>
<th>Si</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>Nb</th>
<th>Fe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless steel</td>
<td>0.030</td>
<td>2.000</td>
<td>0.013</td>
<td>0.033</td>
<td>1.000</td>
<td>18.020</td>
<td>10.150</td>
<td>2.3</td>
<td>0.098</td>
</tr>
<tr>
<td>Low carbon steel</td>
<td>0.120</td>
<td>0.600</td>
<td>0.041</td>
<td>0.041</td>
<td>0.011</td>
<td>0.008</td>
<td>0.035</td>
<td>0.003</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Based on Figure 2 obtained the maximum value of displacement at Y direction due to thermal stress after the welding process. The highest value displacement occurs at stainless steel material.
Stainless steel material has low heat expansion character. Heat input of welding at stainless region tends to high residual stress. It can be seen figure

Based on Figure 3-5 the highest displacement value at stainless steel is 0.282 mm. Mechanical properties of the material are a very influence of thermal stress behavior.

**Keywords:** Dissimilar, low carbon steel, stainless steel, finite element analysis, distortion.
Low Temperature Phase Transition in Lithium Manganese Oxide Spinel

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Abstract
Phase transition in lithium manganese oxide spinel compound at low temperature has been investigated. It is found that the cubic structure of LiMn₂O₄₋δ with space group Fd-3m at room temperature was distorted to orthorhombic symmetry with space group Fddd at 290 K and become more obvious down to 10 K, where the splitting indicates the structural transition close to tetragonal. The equal proportion of coexisted Mn³⁺ (Jahn-Teller) and Mn⁴⁺ ions is associated with partial charge ordering. The extent of orthorhombic distortion is related to oxygen vacancy, δ, which is affected by synthesis method such as the choice of starting materials, mixing method and annealing temperature.

Keywords: low temperature phase transition, lithium manganese oxide spinel, oxygen vacancy, synthesis method, annealing temperature
Prediction of Heavy Metals Pollution Level in Sediment of Ciliwung River using Pollution Index Calculation

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Abstract

The Ciliwung River is one of the 13 rivers that flow in Jakarta. This river flows through settlements, offices, industries and factories. Activities that exist around the river can cause rivers to become polluted. River sediments can be used as indicators for pollution monitoring of the river. For the prediction of the quality of the Ciliwung river, measurements of metal levels in river sediments have been performed. Sampling was carried out at 4 sampling locations, namely in Depok, Kelapa Dua, Condet and Kalibata. Analysis of heavy metals in the sample was carried out using neutron activation analysis techniques. The analysis shows that the detected elements in sediments include: Al, As, Br, Ca, Ce, Cr, Co, Cs, Eu, Fe, Hf, K, Mg, Mn, Na, Sb, Ta, Tb, Sc, Sm, Th, Yb and Zn. The results of the assessment based on the value of the enrichment factor indicate that there has been an increase in the concentration of heavy metals Cr, Zn, As and Sb in moderate levels due to anthropogenic factors. Based on the geo accumulation index value, it is known that the sampling location is not polluted to moderate contamination. Heavy metals Cr, Zn, As and Sb in sediments provide a low level of ecological risk to the aquatic environment. Based on the pollution load index value (PLI), all sampling locations are in no pollution conditions. So from the evaluation it can be seen that even for some heavy metals there has been an increase in the concentration value but has not yet reached the polluted level and the ecological risk of heavy metals in the sediments also still provides a low ecological risk.

Keywords: Sediment, Ciliwung, River, heavy metal, pollution.
Textures Characterization of Duplex Stainless Steel 2205 using Neutron Diffraction Method

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Abstract
Duplex stainless steel (DSS) is a type of stainless steel that’s used in the medical and industrial such as petrochemical, oil and gas, and pharmaceutical because it has an excellent corrosion resistance and high strength. Some characterization has been carried out to know the characteristic of DSS. Characterization using neutron diffraction method by means of BATAN’s texture diffractometer DN2 was performed on a DSS series 2205 sample. From crystal structure and phase analysis, the sample has dual phases, ferrite α-phase BCC and austenite γ-phase FCC as it is well known. It is found that lattice parameters of ferrite and austenite are 2.8736 Å and 3.6076 Å, respectively. Preferred orientation (G1) for ferrite and austenite are (-2.14 ± 0.03) and (0.35 ± 0.03), respectively. Pole figures refinement was calculated using triclinic to the orthorhombic sample symmetrization. From the calculation, some results are obtained. By using pole figures (110), ( 200), and (211), it is found ferrite α-phase component is oriented to {110} <001> Goss orientation., and using the pole figures (111), (200), and (220), the austenite γ-phase component is oriented to {100} <001> Cube orientation. Orientation distribution function (ODF) is calculated using Arbitrarily Defined Cells (ADC) method or direct method in the Euler angle space (φ1, Φ, φ2). From the ODF calculation, the ferrite α-phase components, {110} <001> Goss orientation has (ODF)̅ = 30,737 m.r.d. The largest ODF = 32,108 m.r.d. has orientation in the basic region (110)[001] in the Euler angle space (φ1, Φ, φ2) = (90,90,45). For the austenite γ-phase components {100} <001> Cube orientation, the (ODF)̅ = 5,149 m.r.d. is obtained. The highest ODF values, in the basic region of (010) [100] and (100) [0-10] orientation have the Euler angle space (φ1, Φ, φ2) = (0, 90, 0) and (0, 90, 90), respectively, both have ODF = 5,224 m.r.d

Keywords: duplex stainless steel, neutron diffraction, crystallite orientation (texture), orientation distribution function (ODF)
Poster Presentation 65 (PP-65)

Synthesis and Characterization of the Smart Magnetic Structure of Bi$_2$La$_x$Fe$_4$O$_9$

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Abstract

Investigations have been conducted on the multiferoic crystal structure Bi$_2$Fe$_4$O$_9$ due to the substitution of La$^{3+}$ ions in Bi$^{3+}$ (Bi$_2$La$_x$Fe$_4$O$_9$) ions with the value x=0; 0.2; 0.5; and 1.0. Bi$_2$La$_x$Fe$_4$O$_9$ Polycrystalline is prepared by solid-state method using High Energy Milling (HEM). For characterization of the phase formed and crystal structure used X-ray diffraction (XRD). To determine the morphological structure, the size of the granules and their composition are used SEM-EDS, while the Particle Size Analyzer (PSA) is used to know the distribution of particle size. The substitution of La$^{3+}$ ions in Bi$^{3+}$ ions does not affect the crystal structure. Both substitution and substitution, both have the same crystal structure, orthorhombic. The size and shape of the particles are still heterogeneous, varying between 170-570 nm.

Keywords: Crystal structure, multiferoic, milling.
Assembly and Characterization of LiFePO$_4$-Graphite Pouch Cell

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Abstract
A new cylinder pouch cell of Lithium ion rechargeable battery has been assembled at the Integrated Battery Laboratory, National Nuclear Energy Agency (BATAN), Indonesia. The cathode sheet was prepared from double sided coated LiFePO$_4$/C on aluminum foil with the thickness of 180 μm. The anode sheet was prepared from double sided coated artificial graphite on the copper foil with thickness of 197 μm. Both aluminum and copper foils are functioned as positive and negative current collectors, respectively. The cathode and anode sheet was cut using slitting machine with a dimension of 6.7 cm x 17.0 cm. The composition, crystal structure, of coated LiFePO$_4$/C was measured by an XRD. A separator was put between the cathode and anode sheet to prevent the short circuit. Battery cells are constructed by rolling thin layers of cathode, separator, and anode material to cylindrical shapes by using a winding machine. The cylindrical cell was inserted into aluminum pouch case then sealed at 180 °C with one side left open. The positive and negative connectors made from aluminum and nickel tab were welded on the top of aluminum and copper foil, respectively. The new cylinder pouch cell (c-pouch cell) was put into Glove Box then filled with ~ 2.5 ml liquid electrolyte LiPF$_6$. Liquid electrode makes up the internal space. A vacuum sealing machine was used to seal the rest of pouch case at 180°C. The electrochemical properties of lithium ion battery (c-pouch cell) were characterized by using a BST8 Battery analyzer. The LiFePO$_4$ exhibited a discharge capacity of 250 mAh, with the specific capacity of 120 mA h g$^{-1}$. The c-pouch cell showed good performance after 100 cycles with the efficiency of 99%.

Keywords: Pouch cell, LiFePO$_4$; Graphite, Lithium ion batteries


Poster Presentation 67 (PP-67)

Influence of La and Co Ions Content on Magnetic Properties of M-Type Barium Hexaferrite Synthesized Using Mechanochemical Method

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Abstract

Influence of La and Co Ions Content on Magnetic Properties of M-Type Barium Hexaferrite Synthesized Using Mechanochemical Method. The lanthanum and (La) and cobalt (Co) substituted on M-type barium hexaferrite has been done with mechanochemical method using high energy milling (HEM). The purpose of this paper is the investigation of the effect of La and Co substitution on the structure and magnetic behavior of M-type barium hexaferrite. The sample was prepared by mechano-synthesis using high-energy ball milling. In this research, Ba and Fe was substituted by La and Co respectively, to form Ba$_{1-x}$La$_x$Fe$_{12-x}$Co$_x$O$_{19}$, for x=0.0, 0.1, 0.2, 0.3 and 0.5. The mixing for each the sample was conducted for 5 hours; the sample was calcined at 800°C for 2 hours and followed with sintering at 1200°C for 5 hours. The XRD refinement result indicates that the substitution of La and Co ion lead to the change cell parameters, volume, the density and the particles size. The magnetic behavior such as magnetic coercivity (Hc) and energy maximum (BHmax) increased with the addition of La and Co ions. The optimum magnetic coercivity and energy maximum (BHmax) was reached of 1130.97 Oe and 0.905 MGOe respectively, in Ba$_{1-x}$La$_x$Fe$_{12-x}$Co$_x$O$_{19}$ for x=0.3.

Keywords: Barium hexaferrite, mechanochemical, energy maximum, magnetic coercivity, refinement.
Effect of La-Dopant on the Structure and Microwave Reflection Loss of Fe$_{2-x}$La$_x$TiO$_5$

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Abstract

Study of effect La doping on the structure and microwave reflection loss of pseudobrookite Fe$_{2-x}$La$_x$TiO$_5$ with co-precipitation method has been carried out. The synthesis of Fe$_{2-x}$La$_x$TiO$_5$ system aims to create material that can function as a absorber for microwave reflection loss in electronic and telecommunication applications. The Fe$_{2-x}$La$_x$TiO$_5$ system (x = 0.01, 0.04 and 0.2) was synthesized from a mixture of FeCl$_3$, LaCl$_3$ and TiCl$_4$ according to the ratio of each mole. This material mixture was added a NH$_4$OH solution to pH 12. The precipitate formed was washed with demineralization water to pH 7 and then dried at 120 °C, then sintered at 1000 °C for 5 hours. All samples were characterized by using XRD (X-ray diffractometer) to perform phase identification, SEM-EDS (Scanning Electron Microscopy-Energy Dispersive Spectroscopy) to observe surface morphology and VNA (Vector Network Analyzer) observations to measure the microwaves reflection loss. Phase identification results show that the composition of x = 0.01 and 0.04 was formed in 2 phases, namely Fe$_7$TiO$_5$ and FeTiO$_3$ phases, while the composition of x = 0.2 was formed in 3 phases, namely Fe$_7$TiO$_5$, FeTiO$_3$ and La$_2$Ti$_2$O$_7$. Meanwhile the results of the reflection loss measurement show that the microwaves absorption is smaller along with the increase in the composition of x. Maximum absorption is obtained at the composition x = 0.01 (Fe$_{1.99}$La$_{0.01}$TiO$_5$) with a reflection loss about ~ 90% at a frequency of 10.68 GHz.

Keywords: Pseudobrookite, Fe$_{2-x}$La$_x$TiO$_5$, co-precipitation method, microwave, reflection loss.
Poster Presentation 69 (PP-69)

Effect of Nd Concentration on the Structure and Microwave Absorption of Nd\(_{2-x}\)Fe\(_x\)O\(_3\) System

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Abstract

Effect of Nd-concentration on the structure and microwave absorption of Nd\(_{2-x}\)Fe\(_x\)O\(_3\) system have been studied. Nd\(_{2-x}\)Fe\(_x\)O\(_3\) system is one of perovskite based system which has a relative high permittivity. Nd\(_{2-x}\)Fe\(_x\)O\(_3\) (x = 0.5; 1.0 and 1.2) samples were synthesized by Fe(NO\(_3\))\(_3\) and Nd(NO\(_3\))\(_3\) in mole ratio using sol – gel method and then sintered at 800 °C for 5 hours. All of the samples were characterized using XRD to identify the phase and VNA was used to measure the microwave absorption. Phase identification of XRD data shows that single phase of NdFeO\(_3\) have been formed for x=1.0 composition. While multiphase have been formed which is indicated by the appearance of NdFeO\(_3\) and Fe\(_2\)O\(_3\) phase for x=0.5, and then NdFeO\(_3\) and Nd\(_2\)O\(_3\) phase for x=1.2. The samples of Nd\(_{2-x}\)Fe\(_x\)O\(_3\) have homogenous morphology with particle size is about 200 nm. The results of microwave absorbing properties measured by using VNA (Vector Network Analyzer) shows the ability of microwaves absorption increased with increasing Nd concentration, with maximum absorption by x = 1.0 composition is around 96.27 % at frequency of 10.46 GHz.

Keywords: Nd\(_{2-x}\)Fe\(_x\)O\(_3\) system, Perovskite system, sol-gel method, microwave absorption.
Effect of Li₄Ti₅O₁₂ on Graphite Battery Anode of Lithium Battery

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Abstract

Research on the manufacture of anode material from Li₄Ti₅O₁₂-graphite has been carried out to determine the effect of adding Li₄Ti₅O₁₂. The addition of Li₄Ti₅O₁₂ with a concentration variation of 0%, 2.5%, 5%, 7.5%, 10%, uses a vacuum chuck based tape casting method. The observation of impedance capacitance resistance meter shows the highest dc conductivity value at 2.5% Li₄Ti₅O₁₂ (LTO) which is 1.52x10⁻³ S.cm⁻¹. The highest theoretical capacity of the material is 5% LTO which is 5,903 mAh. The observation results of x-ray diffraction showed that at the addition of 5% and 10% LTO formed two crystalline phases, while the LTO particle size of ± 4 µm and 10-25 µm graphite was obtained from scanning electron microscope observations. Coin batteries produced with the LFP/Li₄Ti₅O₁₂-graphite system have the lowest bulk resistance of 7.42x10⁻³ ohm at 10% LTO composition. The highest charge capacity on a 10% LTO battery is 3.7614 mAh.

Keywords: Li₄Ti₅O₁₂, graphite, casting tape.
**Poster Presentation 71 (PP-71)**

**Synthesis and Characterization of Colloidal Nanoferrogel Fe₃O₄-chitosan Potential as Contrast Agent MRI**

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**Abstract**

Fe₃O₄-chitosan Ferrogels had been successfully synthesized through the assembly process of iron ions into the chitosan hydrogel. Chitosan hydrogel, synthesized using glutaraldehyde crosslinker, was soaked in saline solution of Fe²⁺ and Fe³⁺ to induce iron ions to form ferrogel. Ferrogels were then dried by heating at temperature of 60 °C with varying drying time of 2, 3, 4 and 5 hours. Analysis of functional groups from FTIR spectra showed that variation of drying time hasn’t changes any chemical structure of ferrogel and will only result in decreasing the water content within ferrogel. This water decreasing gives more significant effect to ferrogel magnetic properties by increasing ferrogel magnetic saturation value. Maximum magnetic saturation of 6.21 emu/g was obtained for the sample dried for 5 hours. Redispersing ferrogel by step-wise ultrasonic process within acetic acids and DI water give final result of stable colloidal nanoferrogel. Observation using transmission electron microscope (TEM) revealed the formation of single spherical magnetic nanoparticle of ~ 5 nm homogeneously coated by chitosan and establishing ~ 20 nm nano-ferrogel particles disperse within aquabase medium. This nanoferrogel size was also confirm by Particle Size Analyzer (PSA) measurement. VSM measurement on this colloid system showed a good superparamagnetic system. All the result supports the prospect of nanoferrogel colloid to be applied as an MRI contrast agent.

**Keywords:** nanoferrogel, Fe₃O₄, chitosan, iron ion assembly
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