mineprocèt'17

Mineral Processing and Technology International Conference 2017

PROGRAM BOOK

"Fresh and bold ideas for sub-economic mineral resources : optimality, sustainability and environmental friendly"

Balai Kartini Jakarta, 23-24 Oct. 2017

LIPI

PUSAT UNGGULAN IPTEK

Welcome to mineprocèt'17

Dear Colleagues,
It is my great pleasure to welcome all presenter and participants to mineprocèt'17, the 1st International Conference on Mineral Processing and Technology in Jakarta, Indonesia. This is the first of conference series devoted to pitch ideas, insight and findings in all aspect of mineral processing, extraction and technology, while the main topic in this first of the series is sub-economic mineral resources. Sub-economic mineral resources always become inspiration to advance mineral processing technology. Limitations encountered by current extraction technology leave out idle sub-economic resources, which also turn into environmental problems. Fresh, bold and even out of the box approaches are necessary, not only to satisfy the increasing mineral demands but also to save the environment, which include recycle technology for sustainable and optimal use of wastes. Based on submission received, we would have interesting discussion on topic of bio-hydrometallurgy, pyrometallurgy, physical metallurgy, beneficiation, separation and purification and others.

The launching of the conference series also coincides with the golden anniversary of Indonesian Institute of Sciences (*Lembaga Ilmu Pengetahuan Indonesia*) as research authority in Indonesia, which intends to bring to the public all the institution's achievements. In this occasion, let me extend my gratitude to the Indonesian Science Expo (ISE) committees for facilitating this conference. Finally, on behalf of the conference committee, I wish you exciting discussion and enjoy your stay in Jakarta.

Erik Prasetyo, Ph.D
Conference Chair/Editor
Research Unit for Mineral Technology
Indonesian Institute of Sciences

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mineprocèt'17
Mineral Processing and Technology International Conference 2017

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General Information

Conference Venue

Balai Kartini - Exhibition and Convention Center
Jalan Jendral Gatot Subroto Kav.37, Kuningan Timur,
Jakarta Selatan 12950 Tel: (+6221) 5213653

Registration and Information

The Registration Desk will be open on Monday and Tuesday, 23-24 Oct 2017 (8 am – 4 pm). During these times, preregistered participants can pick up their name badges and conference materials. Please be prepared to present a proof of your advance payment and, if applicable, a proof of your PhD student status.

On-site registration is possible only for accompanying person by cash payment (USD 100/ IDR 1,000,000).

The conference registration fee includes:
- Attendance to all scientific sessions
- Conference bag with complete conference materials
- Coffee breaks
- Lunches on 23 and 24 October, 2017

The General Terms and Conditions can be found on the conference website:
http://situs.opi.lipi.go.id/mineprocet17/

Name Badges

Participants (presenter and accompanying person) are kindly requested to wear their name badge during all Conference events. Admittance to the scientific sessions and other events might be denied if the required badge cannot be presented.

Certificate of Participation

Participants will be given a Certificate of Participation upon registration.

Special event

The success of Indonesian Science Expo (ISE) 2015 prompted Indonesian Institute of Sciences (LIPI) to relaunch the 2017 Indonesian Science Expo as media to disseminate science and technology under the theme "Science for Sustainable Futute".

The ISE 2017 is also part of LIPI golden anniversary celebration (1967-2017). The celebration includes science expo, exhibitions, talk shows, youth science fairs and many more. As the first science and technology exhibition in Indonesia, opens the opportunity to the exhibitors to publish their latest inventions, research progress or to disseminate their innovation to the stakeholders.

https://ise2017.lipi.go.id/

INDONESIA SCIENCE EXPO
23 – 26 OCT 2017
BALAI KARTINI
JAKARTA

Keynote Speakers

Tsuyoshi Hirajima

Department of Earth Resource Engineering
Kyushu University

Prof. Tsuyoshi Hirajima is specialist in mineral processing, powder and recycling technology, which research interest is to promote the development of an advanced mineral processing technology with a special focus on low emission application and resources recycling, highly required in the present century, for a sustainable development of modern societies.

Currently, his research group is studying the development of advanced mineral processing technology, resources recycling, waste treatment and utilization, and environmental remediation. He had authored and co-authored more than 200 peer reviewed scientific papers and several books. He is member of Society for Mining, Metallurgy and Exploration, The Japan Institute of Energy, The Mining and Materials Processing Institute of Japan, The Resources Processing Society of Japan, The Society of Powder Technology of Japan, Japan Society of Material Cycles and Waste Management and Energy and Resources Institute of Japan.

M. Akbar Rhamdhani

Deputy Chair Dept Mechanical Product Design Engineering
Swinburne University of Technology

Associate Professor M. Akbar Rhamdhani obtained his PhD from McMaster University Canada in Materials Science and Engineering. Akbar's research focuses on advanced metal/material refining and impurities removal, development of new processes for metal production, thermodynamics and kinetics of high temperature metal and chemical processes, and physical chemistry of interface. Akbar's recent research projects include: Thermodynamic behaviour of valuable trace elements during e-waste processing in copper smelting; Oxidation behaviour of rare-earth elements in permanent magnet scrap; Electrically enhanced silicon refining; Impurities control in electronic conductor grade aluminium; Removal of impurities from Titanium ore. Akbar has been a Visiting Professor at Katholieke Universiteit Leuven Belgium and University of Indonesia. He has been working with metals industries in Europe and Indonesia. Akbar is an author/co-author of more than 140 publications. Recently, Akbar has

been awarded a number of international award including the 2015 Mann Redmayne Medal by IOM3 United Kingdom, the 2015 Marcus Grossmann Medal by ASM International USA, and the 2015 MetSoc Award by Metallurgical Society of Canada.

Naoko Okibe

Department of Earth Resource Engineering
Kyushu University

Assoc. Prof. Naoko Okibe specializes in Biohydrometallurgy, Bioremediation, Bioengineering, Environmental Microbiology, which research interest includes bioleaching of waste catalysts, manganese removal from refinery waste waters using Mn(II)-oxidizing bacteria, bioleaching of waste PCBs, nickel laterite and refractory copper sulfides.

She had authored and co-authored more than 35 peer reviewed scientific papers. She is currently member of Japan Society for Environmental Biotechnology, The Society for Biotechnology of Japan and The Mining and Materials Processing Institute of Japan.

Agustinus R. Uria

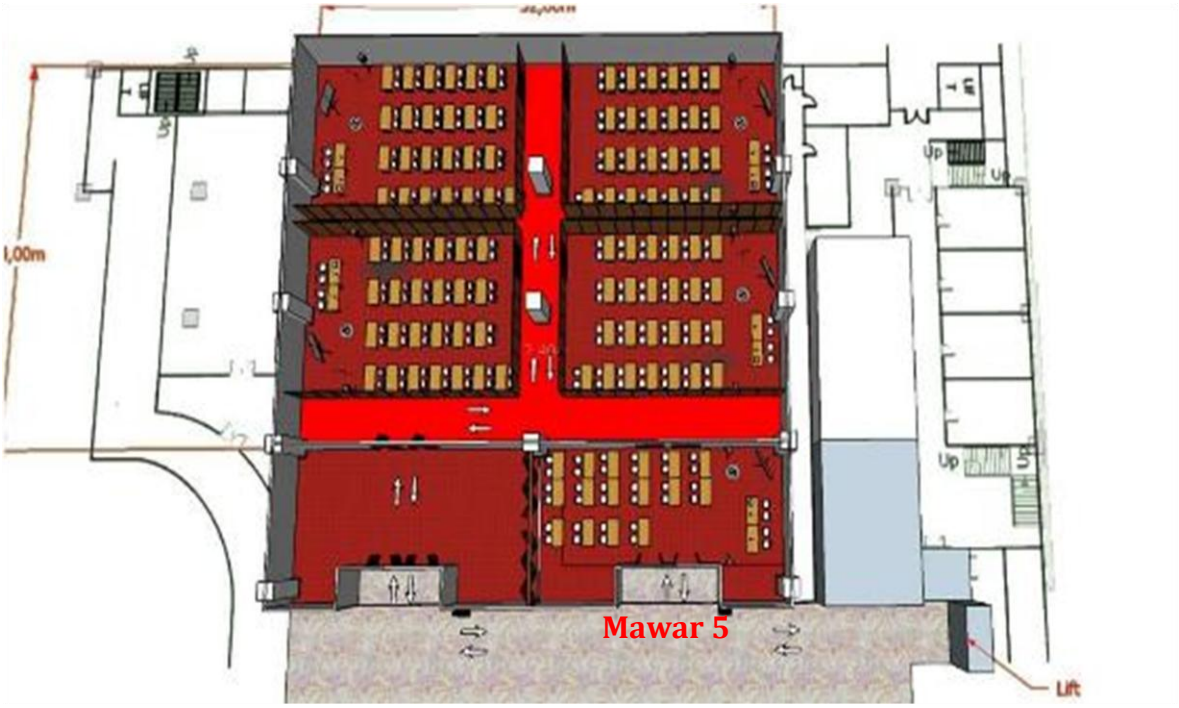
Faculty of Pharmaceutical Sciences
Hokkaido University

Dr. rer. nat. Agustinus R. Uria studied Biotechnology at Wageningen University, Netherlands, obtaining MSc degree on February 2004 through the Netherlands Fellowship Programmes (NFP) (2002-2004). Under the scheme of DAAD long-term research grant (2007-2011), he conducted his PhD project with Professor Joern Piel, developing metagenomics approaches to study natural product biosynthesis in uncultured symbiotic bacteria.

Upon obtaining his doctoral degree (Dr. rer. nat.) on December 2012 from the University of Bonn, Germany, he moved to Swiss Federal Institute of Technology - ETH Zurich, Switzerland, working as a postdoctoral research associate at Institute of Microbiology from February 2013 to January 2015. Some of his research data were published in *Nature*, *Science*, *Nature Chem Biol* and *ACS Chem Biol*. He is currently a JSPS postdoc research fellow under the scheme of Japan Society for the Promotion of Science at Faculty of Pharmaceutical Sciences, Hokkaido University, Japan.

Floor Plan

Balai Kartini, 3rd Floor
Room Mawar 5



Daily Schedule

Monday, 23 Oct 2017		
08:00	**Registration and Coffee Morning**	
09:30	**Opening Remark of mineprocèt'17 by Head of Research Unit for Mineral Technology, LIPI (BPTM, LIPI)**	
Plenary Lectures, Chair: Erik Prasetyo, Ph.D		
09:45	**Prof. Dr. Tsuyoshi Hirajima** **Kyushu University, Japan** "Fine particles processing technology and its applications"	
10:30	**Dr. M. Akbar Rhamdhani** **Swinburne University of Technology, Australia** "Novel impurities removal from weathered ilmenite ores through selective sulfidation"	
11:15	**Discussion (for 2 Keynote Speakers)**	
11:45	**Gifts/souvenirs for Keynote Speakers**	
11:50	**Photo Session**	
11:55	**Lunch Break**	
	PARALLEL SESSION Day 1, Theme 1 **Chair: Yayat Iman** Bio-hydrometallurgy	**PARALLEL SESSION Day 1, Theme 2** **Chair: Fajar Nurjaman** Separation and Purification; Environmental Remediation
13:30	**Invited Talk** **Rudi Subagja** Nickel Extraction from Nickel Matte	**Selected Speaker** **I Gede Wenten** Flue Gas Carbon Capture Using Hollow Fiber Membrane Diffuser-Separator
14:00	**Fang Lian et al.** A Green Preparation of Mn-based Product with High Purity from Low-grade Rhodochrosite	**Erik Prasetyo** Monosodium glutamate for simple photometric iron analysis
14:15	**Fika Rofiek Mufakhir et al.** Leaching of silicon from ferronickel (FeNi) smelting slag with sodium hydroxide solution at atmospheric pressure	**Setyo Widodo, I Gede Wenten** Membrane Separation for non-Aqueous Solution
14:30	**Himawan Tri Bayu Murti Petrus et al.** Effect of Pulp Density and Particle Size on Indirect Bioleaching of Pomalaa Nickel Laterite Using Metabolic Citric Acid	**Erik Prasetyo** Humic Acid Provenance Influence to the Adsorption Capacity in Uranium and Thorium Removal

14:45	**Yesi Aristanti et al.** Decomposition of Banten Ilmenite by Caustic Fusion Process for TiO2 Photocatalytic Applications	**I Gede Wenten** Ceramic Membrane Ozonator for Soluble Organics Removal from Produced Water
15:00	**Coffee Break**	
15:15	**Winny Wulandari et al.** The Effect of Pre-treatments to the Nickel Limonite Leaching Using Dissolved Gaseous SO2-Air	**Dewi Agustina Iryani** Development of Low-Cost Adsorbent from Agricultural Waste for Heavy Metal Removal
15:30	**Widi Astuti et al.** Leaching Behavior of Lanthanum, Nickel, and Iron from Spent Catalyst Using Inorganic Acids	**Tutik Setianingsih** Study of Salt Oxidator Type Influence on Physichochemistry of Patchouli Biochar - Cr2O3 Composite and Organic Contaminant Adsorption
	PARALLEL SESSION Day 1, Theme 1 **Chair: Erik Prasetyo** Mineral Economy and Policy, Mineral Industry Application	**PARALLEL SESSION Day 1, Theme 2** **Chair: Fika Rofiek** Pyrometallurgy; Electrometallurgy
15:45	**Kusno Isnugroho et al.** Characterization and Utilization Potential of Basalt Rock from East Lampung District	**Slamet Sumardi** The Effect of Immersion Time to Low Carbon Steel Hardness and Microstructure with Hot Dip Galvanizing Coating Method
16:00	**Puguh Prasetyo** The Effect of Entry Into Force of the Mining Law 2009 Began January 2014 in The Production of NPI (Nickel Pig Iron) in China	**Fathan Bahfie et al.** The effect of aluminium on the microstructure and hardness of high austenitic manganese steel
16:15	**Muhammad Amin et al.** The Material from Lampung as Coarse Aggregate to Substitute Andesite for Concrete-Making	**Sudibyo et al.** Influences of Magnetic Field on the Fractal Morphology in Copper Electrodeposition
16:30	**Bramantyo Bayu Aji et al.** The Effect of Sintering Time on Recycled Magnesia Brick from Kiln of the Cement Plant	**Widi Astuti et al.** Effect of Basicity and Reductant Amount in the Nickel Pig Iron (NPI) Production from Indonesian Limonite Ore in Electric Arc Furnace
16:45	**Sudibyo** The Effect of Variation of Sintering Temperatures on Used Refractory Towards Physical Properties	**Yayat Iman Supriyatna, Zulfiadi Zulhan** The Ferromanganese Production Using Indonesian Low-Grade Manganese Ore Utilization Charcoal and Palm Kernel Shell as Reductant in Mini Electric Arc Furnace
17:00	**First Day Closing**	

Tuesday, 24 Oct 2017		
08:00	**Registration and Coffee Morning**	
Plenary Lectures, Chair: Dr. Himawan Tri Bayu Murti Petrus		
09:30	**Assoc. Prof. Dr. Naoko Okibe** **Kyushu University, Japan** "New Insights in Bio-Mineral Processing to Enable Utilization of Refractory Low-Grade Minerals"	
10:15	**Dr. Agustinus R. Uria** **Hokkaido University, Japan** "Metagenomic Strategies to Exploit Uncultured Marine Bacteria for Producing Medically Beneficial Metal Nanoparticles"	
11:00	**Discussion (for 2 Keynote Speakers)**	
11:30	**Gifts/souvenirs for Keynote Speakers**	
11:35	**Photo Session**	
11:40	**Lunch Break**	
	PARALLEL SESSION Day 2, Theme 1 **Chair: David Chandra** Mineral Beneficiation	**PARALLEL SESSION Day 2, Theme 2** **Chair: Yayat Iman** Physical Metallurgy and Foundry, Powder and Nanotechnology
13:00	**Selected Speaker** **Rajendra Sane** Beneficiation & Agglomeration of Manganese ore Fines	**Selected Speaker** **Ahmad Zadi-Maad et al.** Additive manufacturing technique for steels: a review
13:20	**Agus Prasetya et al.** Study on Sumbawa Gold Ore Liberation Using Rod Mill: Effect of Rod-Number and Rotational Speed on Particle Size Distribution	**Fajar Nurjaman et al.** Simulation for Grinding Balls Making with Sand Mold-Gravity Casting
13:35	**Winny Wulandari et al.** A Study of Bauxite Tailing Quality Improvement by Reverse Flotation	**Rafly Adiputra et al.** Effect of SiC addition to the characteristics of Al-11Zn-6.7Mg composite produced by squeeze casting for ballistic application
13:50	**Himawan Tri Bayu Murti Petrus et al.** Optimization of Gold Ore Sumbawa Recovery Using Centrifugation Technique by Response Surface Method	**Adry Arisgraha et al.** Effects of Aluminium Addition on the Characteristics of Cu-28Zn Brass Produced by Gravity Casting
14:05	**Siti Mutrofin** Physical-chemistry of Nawangan's phyrophyllite and its prospective as environmental friendly geopolymer materials	**Donanta Dhaneswara et al.** The Structure Heterogeneity of Mesopores Silica of SBA-15 in Respect to the Pluronic 123 Template Concentration
14:20	**Coffee Break**	
14:25	**Closing Remarks by Chairman of mineprocet'17**	

Abstracts

The Effect of Various Sintering Temperature on Used Refractory towards Its Physical Properties

Sudibyo[1a], Y. R. Wulandari[2b], M. Amin[1c] and Azhar[2d]
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Abstract. The used Magnesia refractory from the kiln of cement industry was successfully recycled to new refractory using Kaolin as an adhesive. In this work, the temperatures of sintering were varied from 1000^{o}C to 1500^{o}C. The result shows that the increment temperature effect in sintering process will enhance refractory physical properties such as bulk density, cold crushing strength or pressure strength and thermal conductivity. Meanwhile, the porosity was decreased as the increase of the sintering temperature.

Monosodium glutamate for simple photometric iron analysis

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Abstract. Simple photometric method for iron analysis using monosodium glutamate (MSG) was proposed. The method could be used as an alternative method, which was technically simple, economic, quantitative, readily available, scientifically sound and environmental friendly. Rapid reaction of iron (III) with glutamate in sodium chloride-hydrochloric acid buffer (pH 2) to form red-brown complex was served as basis in the photometric determination, which obeyed the range of iron (III) concentration 1.6 – 80 µg/ml. This method could be applied to determine iron concentration in soil with satisfactory results (accuracy and precision) compared to other photometric and atomic absorption spectrometry results.

The Effect of Entry into Force of the Mining Law 2009 Began January 2014 in The Production of NPI (Nickel Pig Iron) in China

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Abstract. China is the largest producer NPI (Nickel Pig Iron) obtained from the processing of the low grade laterite (oxide ore) with pyrometallurgical process. Furthermore NPI is used as substitute FeNi (Ferro Nickel) to make stainless steel (SS). The low grade laterite are imported from Philippines and Indonesia because China does not have the natural resources of laterite. China mainly imported limonite contains Ni < 1.5 % from Philippines and the low grade saprolite contains Ni > 1.5 % from Indonesia.

The entry into force of the Mining Law 2009 began January 12, 2014 which prohibits the export of the raw materials of mineral, and obliged to process minerals in Indonesia. Applicability of the legislation automatically affects the production of NPI in China. The effects in the short term since the enactment of the Act, the production of NPI declined and imports FeNi increased in China in 2014/2015. So that in anticipation, the NPI producers in China are trying to relocate the NPI plant out of China especially to Indonesia. For the producers who do not relocate the NPI plant, they tried to get the low grade saprolite from the other country especially from Philippines.

If the NPI factory from China is relocated to Indonesia, it seems that China is likely to relocate the NPI plant to Indonesia. So in anticipation of the government must make government regulations (GR/PP: Peraturan Pemerintah) which in principle do not harm Indonesia. The government regulation (GR/PP) is to be mutually beneficial to both parties or win-win solution. This reality will be studied in this paper.

Influences of Magnetic Field on the Fractal Morphology in Copper Electrodeposition

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Abstract. Copper magneto-electrodeposition (MED) is used decrease roughening in the copper electrodeposition process. This technology plays a vital role in electrodeposition process to synthesize metal alloy, thin film, multilayer, nanowires, multilayer nanowires, dot array and nano contacts. The effects of magnetic fields on copper electrodeposition are investigated in terms of variations in the magnetic field strength and the electrolyte concentration. Based on the experimental results, the mere presence of magnetic field would result in a compact deposit. As the magnetic field strength is increased, the deposit grows denser. The increment in concentration also leads to the increase the deposited size. The SEM image analysis showed that the magnetic field has a significant effect on the surface morphology of electrodeposits.

The effect of sintering time on recycled magnesia brick from kiln of the cement plant

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Abstract: This research aim was to investigate the effect of sintering time on reuse waste of magnesia brick from the rotary kiln of the cement plant. Reuse of the magnesia brick was carried out by mixed the kaolin as the binder. Spent refractory was used as aggregate with the composition of 85% spent refractory and 15% kaolin clay, respectively. The reuse brick then was molded with the size of 5x5x5 cm using hydraulic press under a load of 10 tons in order to forms green body. Green body then dried and sintered at 1200 ^{o}C with time variation of 2 hours, 4 hours, 6 hours, 8 hours and 10 hours, respectively. Thus, for comparison reuse brick was tested to its apparent porosity, the bulk density, and Cold Crushing Strength (CCS). The effect of kaolin addition as binder was also discussed.

Simulation for Grinding Balls Production using Sand Mold-Gravity Casting

Fajar Nurjaman, Achmad Shofi, Ulin Herlina, Nurbaiti Marsas Prilitasari
Research Unit for Mineral Technology, Indonesian Institute of Sciences, Lampung-Indonesia
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Abstract. In this present work, the grinding balls from high chromium white cast iron (ASTM A-532) were produced by using sand mold-gravity casting. The simulation casting process was conducted before making these grinding balls by using SOLIDCast™ version 8.2.0. The gating system design and the pouring temperature of hot metal were investigated clearly to obtain grinding balls with no-defect. The sound casting of grinding balls was resulted by using the proper gating system with the addition of vent air on the top of each grinding ball's mold. The dimension of vent air was reduced by the increasing of pouring temperature, thus it resulted on the increasing of the yield production of grinding balls.

Characterization and Utilization Potential of Basalt Rock from East Lampung District

Kusno Isnugroho[1, a)], Yusup Hendronursito[1,b)] , and David C Birawidha [1,c)]
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Abstract. The aim of this research was to study the petrography and chemical properties of basalt rock from East Lampung district, Lampung province. Petrography analysis was performed using a polarization microscope, and analysis of chemical composition using X-RF method. From the analysis of basalt rock samples, the mineral composition consists of pyroxene, plagioclase, olivine, and opaque minerals. Basic mass of basalt rock samples is, composed of plagioclase and pyroxene with subhedral-anhedral shape, forming inter granular texture, and uniform distribution. Mineral plagioclase is colorless and blade shape, transformed into opaque minerals with a size of <0.2 mm, whereas pyroxene present among the blades of plagioclase, with a greenish tint looked and a size of <0.006 mm. Mineral opaque has a rectangular shape to irregular, with a size of <0.16 mm. The chemical composition of basalt rock samples, consisting of 37.76-59.64 SiO_2; 10.10-20.93 Fe_2O_3; 11.77-14.32 Al_2O_3; 5.57-14.75 CaO; 5.37-9.15 MgO; 1.40-3.34 Na_2O. From the calculation, obtained the value of acidity ratio (Ma)= 3.81. With these values, indicate that the basalt rock from East Lampung district has the potential to be utilized as stone wool fiber.

The effect of aluminium on the microstructure and hardness of high austenitic manganese steel

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Abstract. High-strength manganese aluminium and austenitic steels have the reason of their perfect combination of high mechanical properties and good plasticity for the structural elements. They have the microstructure stability, and good strength properties because of the addition of aluminium. The effect of aluminium on high austenitic manganese steel were investigated. The samples was examined with several tests such as microstructure, chemical content, and hardness. The effect of aluminium had been influenced the formation of the Fe-Al-Mn-C phase and the lower hardness of samples.

Additive manufacturing for steels: a review

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Abstract. Additive manufacturing (AM) of steels involves the layer by layer consolidation of powder or wire feedstock using a heating beam to form near net shape products. For the past decades, the AM technique reaches the maturation of both research grade and commercial production due to significant research work from academic, government and industrial research organization worldwide. AM process has been implemented to replace the conventional process of steel fabrication due to its potentially lower cost and flexibility manufacturing. This paper provides a review of previous research related to the AM methods followed by current challenges issues. The relationship between microstructure, mechanical properties, and process parameters.

Leaching of silicon from ferronickel (FeNi) smelting slag with sodium hydroxide solution at atmospheric pressure

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Abstract. The present paper reports the leaching behavior of silicon from ferronickel slag under atmospheric pressure using sodium hydroxide solution. The effect of several experimental variables, namely concentration of leaching agent, operating temperature, stirring speed, and slurry density, was investigated. The leaching kinetic was also investigated by using shrinking core model. It was determined that leaching of silicon from the slag was controlled by diffusion through product layer, although the activation energy was found to be 85.84 kJ/mol, which was unusually high for such a diffusion-controlled process.

The Structure Heterogeneity of Silica Mesopores of Sba-15 in Respect to the Pluronic 123 Template Concentration

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Abstract. The analysis of structure heterogeneity factor of silica mesoporous SBA-15 has been conducted. The structure factor has been found to be different for low and high concentration of Pluronic-123 template. The structure heterogeneity of high concentration of Pluronic-123 has been found less than 1 while for low concentration, the structure heterogeneity was found to be larger than 1. This indicates the dissimilarity of the structure and can be used as a probe to detect the formation of large mesopores. It also was found that the system exhibits type IV and H1 adsorption type which indicates the capillary condensation and interconnected pores.

Effect of SiC addition to the characteristics of Al-11Zn-6.7Mg composite produced by squeeze casting for ballistic application

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Abstract. Aluminium composite material as an alternative to steel used in body of tactical vehicles has been studied. Addition of SiC was expected to have strengthening effect on the composite matrix therefore improving its ballistic performance. Composites of Al-11Zn-6.7Mg matrix and SiC strengthening particles with the fraction of 0, 10, and 15 vol. % were fabricated through squeeze casting process. Composite samples were then precipitation strengthened at 130 ºC for 102 h to further improve their toughness. Final products were characterized by using chemical composition testing, optical microscopy, Scanning Electron Microscope – Energy Dispersive Spectroscopy (SEM-EDS) and quantitative metallography to calculate porosity, hardness test, impact test, and type III ballistic test in accordance with NIJ 0108.04 standard. The results showed that increase in SiC volume fraction from 0 to 10 and 15 vol. % managed to improve the hardness from 73 to 85 and 87 HRB, respectively, while on the other hand reduced the impact values from 12,278.69 to 11,290.35 and 9,924.54 J/m^2. SEM-EDS observation confirmed the presence of $Mg_3Zn_3Al_2$ intermetallic compound which formed during solidification and indicated the precipitation of $MgZn_2$ precipitates during ageing. The ballistic testing demonstrated a promising result of the potential of Al-11Zn-6.7Mg composite strengthened by 15 vol. % SiC to withstand penetration of type III bullet (7.62 mm).

A Green Preparation of Mn-based Product with High Purity from Low-grade Rhodochrosite

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Abstract. The low-grade rhodochrosite, the main resources for exploitation and applications in China, contains multiple elements such as iron, silicon, calcium and magnesium. So the conventional preparation of manganese sulphate and manganese oxide with high purity from electrolytic product is characterized by long production-cycle, high-resource input and high-pollution discharge. In our work, a sustainable preparation approach of high pure $MnSO_4$ solution and Mn_3O_4 was studied by employing low-grade rhodochrosite (13.86%) as raw material. The repeated leaching of rhodochrosite with sulphuric acid was proposed in view of the

same ion effect, in order to improve the solubility of Mn^{2+} and inhibit the dissolution of the impurities Ca^{2+} and Mg^{2+}. With the aid of theoretical calculation, BaF_2 was chosen to remove Ca^{2+} and Mg^{2+} completely in the process of purifying. The results showed that the impurities such as Ca^{2+}, Mg^{2+}, Na^{+} were decreased to less than 20ppm, and the Ni- and Fe- impurities were decreased to less than 1ppm, which meets the standards of high pure reagent for energy and electronic materials. The extraction ratio and the recovery ratio of manganese reached 94.3% and 92.7%, respectively. Moreover, the high pure Mn_3O_4 was one-step synthesized via the oxidation of $MnSO_4$ solution with the ratios of OH^-/Mn^{2+}=2 and Mn^{2+}/H_2O_2=1.03, and the recovery rate of manganese reaches 99%.

The Material from Lampung as Coarse Aggregate to Substitute Andesite for Concrete-Making

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Abstract. Andesite stone is usually used for split stone material in the concrete making. However, its availability is decreasing. Lampung province has natural resources that can be used for coarse aggregate materials to substitute andesite stone. These natural materials include limestone, feldspar stone, basalt, granite, and slags from iron processing waste. Therefore, a research on optimizing natural materials in Lampung to substitute andesite stone for concrete making is required. This research used laboratory experiment method. The research activities included making cubical object samples of 150 x 150 x 150 mm with material composition referring to a standard of K.200 and w/c 0.61. Concrete making by using varying types of aggregates (basalt, limestone, slag) and aggregate sizes (A= 5-15 mm, B= 15-25 mm, and 25-50 mm) was followed by compressive strength test. The results showed that the obtained optimal compressive strengths for basalt were 24.47 MPa for 50-150 mm aggregate sizes, 21.2 MPa for 15-25 mm aggregate sizes, and 20.7 MPa for 25-50 mm aggregate sizes. These results of basalt compressive strength values were higher than the same result for andesite (19.69 MPa for 50-150 mm aggregate sizes), slag (22.72 MPa for 50-150 mm aggregate sizes), and limestone (19.69 Mpa for 50-150 mm aggregate sizes). These results indicated that basalt, limestone, and slag aggregates were good enough to substitute andesite as materials for concrete making. Therefore, natural resources in Lampung can be optimized as construction materials in concrete making.

Beneficiation & agglomeration of manganese ore fines (an area so important and yet so ignored)

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Abstract. Unpredictable changes in demand and prices varying from very attractive to depressing levels have thrown all Manganese ore mines out of normal operating gear. The supply has to be in time-bound fashion, of dependable quality and continuous. With setting-up of numerous small units and with existing ferro-alloy units, ore supply has become extremely sensitive issue. Due to unpredictable swing in price of Mn ore lumps , furnace operators found it economic and convenient to use fines, even at great risks to furnace equipment and operating persons and therefore risks & damages were conveniently & comfortably ignored.

Beneficiation Cost(Operating) approx. – (ferruginous ore) – Roast reduction followed by magnetic separation route-particulars – Water 20/-, Power 490/-,Coal fines-675/-,OH-250/- totaling to Rs.1435/T.(Figures are based on actual data from investigations on Orissa & Karnataka sector ores).Feed Grade Mn- 28 to 32 %, Fe – 14 to 25 %, Concentrate (Beneficiated ore fines)- - Mn- 45 to 48 %, Fe – 6 to 8 %.,Recovery - 35 % , Price of 28-30 % Mn ore fines = Rs. 2400 /T, Cost of Concentrated fines (45/ 48% Mn grade) = Rs. 8300 /T, Price of 47-48 % Mn Lumpy ore = Rs.11,000 /T. Sintering Cost (Operating) – Approx-Rs.1195=00 / T Sinter.

Therefore cost of Sinter produced from beneficiated concentrate is 9130+1195 = Rs. 10325. The difference in cost of 48%Mn ore Lumps & 48%Mn sintered concentrate = 11000-10325 = Rs.675/T. The main purpose of this paper is to show that establishment of beneficiation unit & Sintering unit is economically feasible. There are many misconcepts, still prevailing, about use of Mn ore sinters. Few of the main misconcepts are-1)Sinters bring no benefit – technical or economical.2) Sinters are very friable and disintegrate easily into high fines during handling/transportation. 3) Fines below 100 mesh cannot be sintered. 4) Silica increases to high level during sintering, resulting in to high slag volume thereby higher power consumption. All are false. Sinters have already been proved to bring enormous technical benefits in smelting operation. However small mine owners find it practically impossible to set up a small beneficiation and/or sintering unit at mine site. Recent advances in dry or pneumatic separation which depends on density difference between valuable mineral and gangue/waste rock, are proving to be advantageous & effective because of its small capacity. Capacity is 5 T/hr or 10 T/hr. When applied to low grade high silica Iron ores Iron content has been found to be enhanced by 8 to 10 % from 48% to 58 % , with overall wt. recovery of 60 to 70 %. Recently this technique was applied to low grade siliceous Mn ore with very encouraging results. Mn content has been found to be enhanced from 25 +/- 2 % to 37 +/- 2 % and with 50 to 65% wt. recovery. Size of feed is restricted to (i) 6 to 25

mm and (ii) 2 to 6 mm. Due to Modular design it is possible to put up units from 50 TPD to 800 TPD capacity.

The Ferromanganese Production using Indonesian Low-Grade Manganese Ore utilization Charcoal and Palm Kernel Shell as Reductant in Mini Electric Arc Furnace

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Abstract. The series of ferromanganese production have been conducted using palm kernel shell and charcoal as a reducing agent to replace of coke. The experiment was preceded by the characterization of raw materials. Manganese ore and limestone were analyzed using XRF and XRD. Palm kernel shells and charcoal were analyzed proximate to determine its carbon content. Based on the analysis of raw materials then calculated mass balance to determine the raw material requirements for each experiment. The variations are the use of reductant ratio (1.5 and 2.1 stoichiometry). Products and slag are analyzed using OES and AAS to determine its chemical composition. The results showed that the use of palm kernel shells as a reductant better than charcoal for all use ratio of 1.5 or 2.1 stoichiometric reductants. The percentage of manganese extraction using palm kernel shells as a reducing agent is 49.91% (75.58% Mn, 15.75% Fe, 2.12% C, 5.23% Si, 0.08% P) with the product FeMn is 6,6 kg. The highest percentage of manganese extraction use of charcoal as a reductant is 44.16% (72.35% Mn, 18.44% Fe, 1.93% C, 5.69% Si, 0.02% P) with product FeMn is 6,1 kg. The results showed palm kernel shell and charcoal could potentially be used as a reducing agent in the production ferromanganese although the percentage is still below 50%.

Decomposition of Banten Ilmenite by Caustic Fusion Process for TiO_2 Photocatalytic Applications

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Abstract. Decomposition of Banten ilmenite by caustic fusion process for TiO_2 photocatalytic applications has been done. Caustic fusion process using NaOH to obtain sodium titanate compound which is soluble in sulfuric acid (H_2SO_4) to produces $TiOSO_4$ as a precursor. Synthesis of TiO_2 from $TiOSO_4$ precursors by variations of pH hydrolysis are 1.0 (TiO_2 A), 1.5 (TiO_2 B) and 2.0 (TiO_2 C). XRD pattern identified TiO_2 structures crystals are anatase phase and traces α-Fe_2O_3 as an impurity. Presence of Fe_2O_3 as an impurities give positive effect on TiO_2 photocatalytic activity that is to narrower the band gap energy thus facilitates of electrons excitation from valence band to conduction band and enlarge the specific surface area thus reaction between RhB solution and TiO_2 surface can be faster. TiO_2 A, TiO_2 B and TiO_2 C was compared to TiO_2 M (commercial TiO_2) in RhB solution for the photocatalytic activity where the maximum TiO_2 degradation efficiency was obtained at TiO_2 C ie 80.0 % while TiO_2 M ie 59.8 %.

Humic acid provenance influence to the adsorption capacity in uranium and thorium removal

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Abstract. It is common knowledge that humic acid is organic compound without certain chemical composition since it is derived from different organic materials. Further this raises question whether the different humic acid sample used could lead to different adsorbent properties e.g. adsorption capacity. To address the problem, this paper is aimed to clarify the relation between the provenances of humic acid and synthesized adsorbent properties especially adsorption capacities by quantitative and qualitative functional groups determination including discussion on their effect to the metal ion adsorption mechanism using three humic acid samples. Two commercial samples were derived from recent compost while the other extracted from tertiary carbonaceous mudstone strata.

Effect of Pulp Density and Particle Size on Indirect Bioleaching of Pomalaa Nickel Laterite Using Metabolic Citric Acid

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Abstract. Nickel laterite ores which contain about 72% of the world's nickel deposit have not been sufficiently exploited as it only account for only 40% of the world's nickel production. Indonesia which has one of the largest nickel laterite resource with one of them in Pomalaa, South Sulawesi is still inefficient processing this ore. In Nickel laterite ore contain mainly the oxide of iron, aluminum or both with nickel, cobalt and chromium as minor compound. For the purpose of meeting the world's increasing demand of nickel, there is a need to invent a process to efficiently leach nickel with environmentally friendly process.

This experiment used nickel laterite ore obtained from Pomalaa,South Sulawesi for the leaching process. The leaching agent is metabolic citric acid produced by Aspergillus Niger which was producing the acid under optimum condition. Leaching process was done in three-necked flask in atmospheric temperature and constant stirring speed of 200 rpm. The variable examined in the experiment was pulp density at 5%, 10% and 20% and the particle size of nickel laterite ore at 60-70 mesh, 100-120 mesh and >200 mesh. Samples were taken at 3, 7, 10, 14, and 17 minutes. Samples taken were then filtered and diluted to be analyzed using ICP-AES.

The result of the experiment showed that the maximum recovery of metals increase with the decrease of the pulp density. The maximum recovery of metals for varying pulp density were at 5% solid/liquid ration and the recovery percentage were Ni at 1.63%, Al at 0.47%, Fe at 0.23% and Mg at 1.09%. For the effect of particle size on leaching process, the result showed that the leaching process follows the shrinking core model. The maximum recovery of metals at particle size were at 100-120 mesh with Ni at 1.37%, Fe at 0.10%, Al at 0.72% and Mg at 0.62%.

Study on Sumbawa Gold Ore Liberation using Rod Mill: Effect of Rod-Number and Rotational Speed on Particle Size Distribution

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Abstract. Comminution is one of crucial steps in gold ore processing used to liberate the valuable minerals from gaunge mineral. This research is done to find the particle size distribution of gold ore after it has been treated through the comminution process in a rod mill with various number of rod and rotational speed that will results in one optimum milling condition.

For the initial step, Sumbawa gold ore was crushed and then sieved to pass the 2.5 mesh and retained on the 5 mesh (this condition was taken to mimic real application in artisanal gold mining). Inserting the prepared sample into the rod mill, the observation on effect of rod-number and rotational speed was then conducted by variating the rod number of 7 and 10 while the rotational speed was varied from 60, 85, and 110 rpm. In order to be able to provide estimation on particle distribution of every condition, the comminution kinetic was applied by taking sample at 15, 30, 60, and 120 minutes for size distribution analysis. The change of particle distribution of top and bottom product as time series was then treated using Rosin-Rammler distribution equation.

The result shows that the homogenity of particle size and particle size distribution is affected by rod-number and rotational speed. The particle size distribution is more homogeneous by increasing of milling time, regardless of rod-number and rotational speed. Mean size of particles do not change significantly after 60 minutes milling time. Experimental results showed that the optimum condition was achieved at rotational speed of 85 rpm, using rod-number of 7.

Physical-chemistry of Nawangan's pyrophyllite and its prospective as environmental friendly geopolymer materials

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Abstract. The chemical composition and thermal behaviour of Nawangan-pyrophyllite have been studied using XRF, powder XRD and FTIR. The fourier transfornation infrared was applied to analyze the pyrophyllite after treating by calcinating at variuos temperature. Initial investigation has also been carried out by adding sodium hydroxide and potassium hydroxide to study the possiblity of pyrophyllite as geopolymer materials. The pyrophyllite contains Si(57.7%), Al(16,7%), K (20.6%), Fe (2.47%) Ti (2.33%) and Cu (0.088%). Based on the XRD difractogram, peaks at 2 theta (9^o, 20^o, 21^o, 26^o, 34^o, 36^o and 39^o) were characteristic for pyrophyllite. While, infrared study showed that at 3630 cm^{-1}, 756 cm^{-1} and 938 cm^{-1} are responsible for pyrophyllite's peaks. The hydroxyl bonded to alumina still existed under heating up to 400 ^oC and disappered at 600 ^oC. It indicted that covalent bond of Al-OH was broken. By heating at 600 ^oC, the peak at 1021 cm^{-1} splitted into two peaks, 990 cm^{-1} and 1049 cm^{-1}. It may be due to the displacive transition. By adding NaOH 10 M , the peak intensity of Al-OH (3630 cm^{-1}) reduced to 17% but the peak intensity of Al=O (1661 cm^{-1}) incresed to 14% and the new peak (5%) emerged at 1387 cm^{-1}(O-Al-O). The most reactive pyrophyllite was`obatained by adding KOH 5 M. The present of reactive functional groups (Al=O, O-Al-O and Al-OH) indicates that the local pyrophyllite has a good change as geopolymer materials.

Study of Salt Oxidator Type Influence on Physichochemistry of Patchouli Biochar – Cr_2O_3 Composite and Organic Contaminant Adsorption

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Abstract. Organic wastewater, including drug wastewater, creates serious problems in life due to its risks, such as drug retention and toxicity for both human or animals. Biochar is a porous material which can be used as adsorbent for wastewater remediation. Formation of composite by impregnating the biochar with metal oxides can improve performance of biochar in adsorption. Oxidation of biochar surface before the impregnation was studied in this research. Purpose of this research is to study itseffect on its characteristics and adsorption of paracetamol, as the contaminant model. Synthesis was conducted in some steps,

including preparation of the activated biochar from patchouli biomass through pyrolysis at 450^{o}C using $ZnCl_2$ activator, functionalization of biochar using 3 different salts ($KMnO_4$, $K_2S_2O_8$, $K_2Cr_2O_7$) at 60 ^{o}C, impregnation of the activated biochar using $CrCl_3$ 0.9 M, and calcination of the biochar-$CrCl_3$ composite to form biochar-Cr_2O_3 composite at 600 ^{o}C. X-ray diffraction characterization indicated impregnant structure of Cr_2O_3. Characterization using FTIR spectrophotometry showed different patterns, especially connected to C=O and OH bands by using oxidators in sequence of $K_2S_2O_8$ > $KMnO_4$ > $K_2Cr_2O_7$.SEM-EDX characterization showed different content of Cr(III) in the composites prepared in oxidator sequence of $K_2Cr_2O_7$ > $K_2S_2O_8$ > $KMnO_4$. SEM images of the composites indicated the irregular ball shapes. Adsorption values were obtained more in same sequence of oxidator type based on FTIR spectrophotometry characterization than SEM-EDX.

Ceramic membrane ozonator for soluble organics removal from produced water

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Abstract. In this work, the performance of ozonation for degradation of soluble organic compounds in produced water was investigated. Tubular ceramic membrane diffuser (with and without a static mixer in the lumen side) was used to facilitate contact between ozone and produced water. The ozonation was conducted at ozone flow rate of 8 L.min^{-1}, ozone concentration of 0.4 ppm, original pH of the solution, and pressure of 1.2 bar, while the flow rates of the produced water were varied (192, 378 and 830 mL.min^{-1}). It was found that the reduction of benzene, toluene, ethylbenzene, and xylene were 85%, 99%, 85%, and 95%, respectively. A lower liquid flow rate in a laminar state showed a better component reduction due to the longer contacting time between the liquid and the gas phase. The introduction of the static mixer in the lumen side of the membrane as a turbulence promoter provided a positive effect on the performance of the membrane diffuser. The twisted static mixer exhibited the better removal rate than the spiral static mixer.

INFLUENCE OF JIGGING OPERATING VARIABLES ON INCREASING MONAZITE MINERAL CONCENTRATION FROM TIN ORE PROCESSING PLANT IN BANGKA ISLAND, INDONESIA

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Abstract. In the process of tin mining, cassiterite is the main mineral that has to be separated. Apart from cassiterite, there are some valuable minerals such as monazite containing rare earth elements that is wasted as tailings. The experiments conducted in this study aims to determine the effect of length of stroke, speed of horizontal water flow and type (size) of ragging in the jigging process in order to obtain optimal results in increasing the percentage of monazite mineral. Initial condition of the tin processing at KIP 11 dredge PT. Timah (Persero) Tbk, has not reached the company target due to the monazite mineral participated in the tailings. At the time of observation, the arrangement of the tool and type of ragging was not appropriate in capturing the monazite minerals so that mostly of the monazit disposed as tailings. The study was conducted on 27 samples. The variables are length of stroke; 5, 10, and 20 mm, speed of the horizontal water flow; 0,1; 0,2; and 0,5 m/s, and granite ragging size; 1,5; 2,5; and 3,5 inch. The percentage fraction of monazite and cassiterite minerals in each sample is equal to 15%. By using the Response Surface Method (RSM), the optimal condition is obtained at 20 mm length, 0,2 m/s horizontal flow rate, and 2,5 cm granite ragging. The mineral fraction percentage of monazite and cassiterite in the concentrate is in the average valu of higher than 35% with the highest percentage mineral weight fraction reaches 55%. In case of the the losses in the tailings, the result could be minimized to the percentage of monazite mineral fraction in the range of 0-0.17%. Newton's efficiency for the optimum condition is 98%.

Membrane Separation for Non-Aqueous Solution

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Abstract. Membrane technology has been widely used in a number of applications competing with conventional technologies in various ways. Despite the enormous applications, they are mainly used for the aqueous system. The use of membrane-based processes in a non-aqueous system is an emerging area. This is because developed membranes are still limited in separations involving aqueous solution which show several drawbacks when implemented in a non-aqueous system. The purpose of this paper is to provide a review of the current application of membrane processes in non-aqueous solutions, such as mineral oil treatment, vegetable oil processing, and organic solvent recovery. Developments of advanced membrane materials for the non-aqueous solutions such as super-hydrophobic and organic solvent resistant membranes are reviewed. In addition, challenges and future outlook of membrane separation for the non-aqueous solution are discussed.

Flue gas carbon capture using hollow fiber membrane diffuser-separator

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Abstract. In this work, CO_2 removal from flue gas using membrane diffuser–separator was investigated. Hollow fiber polypropylene membrane was used as the diffuser while pure water was used as the absorbent. Separation performance of the membrane diffuser–separator as a function of CO_2 concentration (6-28%-vol.) and flow rate (gas: 0.8-1.55 $L.min^{-1}$ and liquid: 0.2-0.7 $L.min^{-1}$) was investigated and optimized. It was found that CO_2 removal was significantly affected by CO_2 concentration in the feed gas. On the other hand, CO_2 flux was more influenced by flow rates of liquid and gas rather than concentration. The optimized CO_2 removal (64%) and flux (1×10^{-4} $mol.m^{-2}.s^{-1}$) were obtained at the highest gas flow rate (1.55 $L.min^{-1}$), the lowest liquid flow rate (0.2 $L.min^{-1}$), and 6.2%-vol. of CO_2 concentration. Outlet gas of the membrane diffuser system tends to carry some water vapor which is affected by gas and liquid flow rate. Meanwhile, in the steady-state operation of the separator, the gas bubbles generated by the membrane

diffuser take a long time to be completely degassed from the liquid phase, thus a portion of gas stream was exiting separator through liquid outlet.

Nickel extraction from nickel matte

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Abstract. In present work, the results of research activities to make nickel metal from nickel matte are presented. The research activities were covering **a**) nickel matte characterization using Inductively Couple plasma (ICP), Electron Probe Micro Analyzer (EPMA) and X-Ray Diffraction (XRD), **b**) nickel matte dissolution process to dissolve nickel from nickel matte into the spent electrolyte solutions that contains hydrochloric acid, **c**) purification of nickel chloride leach solution by copper cementation process to remove copper using nickel matte, selective precipitation process to remove iron, solvent extraction using Tri normal octyl amine to separate cobalt from nickel chloride solutions and **d**) Nickel electro winning process to precipitate nickel into the cathode surface from purified nickel chloride solution by using direct current. The research activities created 99, 72 % pure nickel metal as the final product of the process.

Optimization of Gold Ore Sumbawa Recovery Using Centrifugation Technique by Response Surface Method

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Abstract. Most of artisanal small gold mining in Indonesia is using amalgamation, which causes a negative impact to the environment around ore processing area. Other environmental-friendly method for gold processing could be conducted by gravity method. Centrifugation is one of separation equipment of gravity method to increase concentrate based on difference of specific gravity. The optimum concentration result is influenced by several variables, such as water flow rate and particle size. In this present research, the range of flow rate is between 5 lpm and 10 lpm, the particle size between -100 + 200 mesh and -200 +300 mesh. Gold

concentration in concentrate is measured by EDX. The result shows that the optimum condition is obtained at a sparation with flow rate 5 lpm and a particle size of -100 + 200 mesh.

The Effect of Pre-treatments to the Nickel Limonite Leaching using Dissolved Gaseous SO2-Air

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Abstract. Nickel limonite leaching has been subjected to a number of studies, one of the method is by using dissolved gaseous SO2-air. The selectivity of nickel over iron extracted from leaching using dissolved gaseous SO2-air is advantageous, however the nickel that can be recovered is limited. This paper studies pre-treatments that is applied to the nickel ore prior leaching in order to increase the recovery of dissolved nickel from nickel limonite ore. There two pre-treatments that were carried out in this research, roasting and alkali-roasting using Na2CO3. The extraction was carried out for 180 min with pH 2, 3, 4, and 5 and temperature 30, 55, and 80 °C. It is found that the highest yield is achieved at pH 2 and 80 °C with nickel recovery of 61.39%. At pH 2, for alkali-roasting pre-treatment, the nickel yield raised from 28.17% to 100% and for roasting pretreatment the nickel yield increased from 20.42% to 61.39%. However, at pH 2, the nickel to iron selectivity decreased from 96272 to 534 for roasting pretreatment and from 1.8 to 1 for alkali-roasting pre-treatment.

Effects of aluminum addition on the characteristics of Cu-28Zn brass produced by gravity casting

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Abstract. Brass has an attractive combination of strength, ductility, and good corrosion resistance, which are required in many components, such as cartridge cases, valves, and fittings. In all of these components, brasses are usually fabricated through casting, rolling, deep drawing, and other mechanical deformation processes. Alloying elements were added in order to improve strength without sacrificing the ductility of brass. In this research, aluminium was added to Cu-28Zn brass of 1.9, 5.7, and 6.2 wt. % addition. Alloys were fabricated by gravity casting followed by homogenization at 800 oC for 2 h. Material characterizations were done

through microstructural analysis using optical microscope and Scanning Electron Microscope – Energy Dispersive X-Ray (SEM-EDX), Rockwell B and Micro Vickers hardness testing methods, and tensile testing. The results showed that Al addition improved the mechanical properties of Cu-28Zn alloy. Hardness, tensile strength, and yield strength increased, but the elongation decreased.

A Study of Bauxite Tailing Quality Improvement by Reverse Flotation

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Abstract. The pre-treatment of bauxite ore from Tayan, West Kalimantan includes washing and screening fine bauxite particles (-2mm) prior as the feed to the Bayer process for producing alumina. These fine particles are believed to have high content of silica which is detrimental to the process. This washed bauxite tailing still has a significant amount of alumina content. Previous research has indicated that bauxite ore can be upgraded by applying reverse flotation method to reduce its silica content in the ore. Therefore, this study is aimed to utilize reverse flotation method to recover alumina content from washed bauxite tailing. The reverse flotation experiments were carried out at pH of 6 and 8; while the particle sizes were varied at -140+270 mesh and -270 mesh, using a batch and circuit configuration. The result of this study shows that the batch reverse flotation can recover alumina in the tailing up to 81.4%, however the silica content is still significant. The complexity of silica-alumina minerals in the tailing prevents a complete separation of the ores by only using reverse flotation.

EFFECT OF BASICITY AND REDUCTANT AMOUNT IN THE NICKEL PIG IRON (NPI) PRODUCTION FROM INDONESIAN LIMONITE ORE IN ELECTRIC ARC FURNACE

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Abstract. The effect of basicity and reductant amount on the nickel and iron recovery of the nickel pig iron (NPI) production from Indonesian limonite ore was investigated in the experimental study using electric arc furnace (EAF). Indonesian limonite ore used in this study originated from Sulawesi Island with the composition of Ni (1.26%) and Fe (43%). Metallurgical coke was applied as the reductant. This study showed that the the highest nickel and iron recovery as well as metal yield can be resulted from the basicity of 0.8 and reductant amount of 0.23 kg coke/kg limonite ore. Nickel content in the NPI produced was around 3 - 4%. It was concluded that this experiment can produce medium grade NPI.

THE EFFECT OF IMMERSION TIME TO LOW CARBON STEEL HARDNESS AND MICROSTRUCTURE WITH HOT DIP GALVANIZING COATING METHOD

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Abstract. Along with developing necessities of metal materials, these rise demands of quality improvements and material protections especially the mechanical properties of the material. This research used hot dip galvanizing coating method. The objectives of this research were to find out Rockwell hardness (HRb), layer thickness, micro structure and observation with Scanning Electron Microscope (SEM) from result of coating by using Hot Dip Galvanizing coating method with immersion time of 3, 6, 9, and 12 minutes at 4600C. Highest Rockwell hardness test (HRb) was at 3 minutes immersion time with 76.012 HRb. Highest thickness result was 217.3 μm at 12 minutes immersion. Microstructure test result showed that coating was formed at eta, zeta, delta and gamma phases, while Scanning Electron Microscope (SEM) showed Fe, Zn, Mn, Si and S elements at the specimens after coating.

LEACHING BEHAVIOR OF LANTHANUM, NICKEL, AND IRON FROM SPENT CATALYST USING INORGANIC ACIDS

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Abstract. Highly technological applications of rare earth (RE) metals and scarcity of supply have become an incentive to recover the REs from various resources, which include high grade and low grade ores, as well as recycled waste materials. Hydrocracking spent-catalyst contain lanthanum and a variety of valuable metals such as nickel and iron. This study investigated the recovery of lanthanum, nickel and iron from hydrocracking spent-catalyst by leaching using various inorganic acid (sulfuric acid, hydrochloric acid, and nitric acid). The effect of acid concentration, type of acid, and leaching temperature was conducted to study the leaching behaviour of each valuable metal from spent-catalyst. It has been shown that it is possible to recover more than 90% of lanthanum, however the leaching efficiency of nickel and iron in this process was very low. It can be concluded that the leaching process is selective for lanthanum recovery from hydrocracking spent-catalyst.

DEVELOPMENT OF LOW-COST ADSORBENT FROM AGRICULTURAL WASTE FOR HEAVY METAL REMOVAL

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Abstract. This study explored the use of low-cost agricultural waste as alternatives biosorbent to treat effluents from various industrial activities namely mining, refining ores, fertilizer industries, tanneries, batteries, paper industries, pesticides etc. which are posses a serious threat to environment. Biosorption is an effective technology for the removal and/or recovery of metal ions from aqueous solutions. The major advantages of biosorption over conventional treatment methods include: low cost, high efficiency, minimization of chemical or biological sludge, regeneration of biosorbents and possibility of metal recovery. Cellulosic agricultural waste material being highly efficient, low cost and renewable source of biomass can be exploited for heavy metal remediation. Further, in this study cellulose xhantate was prepared from sugarcane bagasse (SB), an agricultural waste by-product, for the adsorption of Pb, Cu and Hg from synthetic wastewater. Preparation of cellulose xanthate was conducted by reacting carbon disulfide (CS2) and cellulose from SB under alkaline conditions. The morphological characteristics of cellulose xanthate were visualized via Scanning Electron Microscope (SEM) and the functional groups present in the biosorbent were characterized by a Fourier Transform Infrared (FTIR) spectrophotometer. The effect of degree of substitution (DS) and degree of

polymerization (DP) to adsorption capacities of cellulose xanthate for Cu^{2+} , Pb^{2+} and Hg^{2+} were also studied.

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