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Abstract Index

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Purification of Pregnant Solution Resulted from Sphalerite Concentrate Extraction Using Sulfate Acid for Zinc Oxyde Production

Pemurnian Larutan Kaya Hasil Ekstraksi Konsentrat Sfalerit dengan Asam Sulfat untuk Pembuatan Seng Oksida

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Purification of pregnant solution from sphalerite concentrate extraction using sulfate acid to produce zinc oxide was meant to prepare zinc oxide production technology utilizing existing internal sphalerite mineral raw material. The pregnant solution used to produce zinc oxide contains 29.84% zinc (Zn), with the biggest impurities iron (Fe) 11.68%. In order to obtain high purity zinc oxide, the pregnant solution should be recovered. It was done through a solvent extraction method, in two process steps: extraction and stripping. The extraction was applying ligan bis di2ethylhexyle phosphate acid (D2EHPA) in toluene solvent, through ligan concentrate variation, pH and comparison of aqueous volume with organic volume (V_A:Vo) and its excess. Stripping was carried out using sulfate acid through variation of concentration, pH and Vo:V_A. To obtain optimum recovery, thus extraction and stripping should be carried out in many steps. The extractions and the strippings were calculated using McCabe Thiele diagram. Furthermore, zinc oxide was resulted from deposition and calcination of pure pregnant solution at temperature 500°C. Purification results show that the best extraction occurred at concentration D2EHPA 1 M, pH 3 and Vo:Va 2:1, through 4 step processes obtained recovery 97.50% with distribution coefficient 77.9; while the best stripping was obtained at H_2SO_4 concentration 2 M, V_O:V_A 2:1 through 3 step processes which obtained stripping percent 98.22% with stripping coefficient 1.51. On the other hand, zinc oxide solution resulted from purification was obtained Zn 93.31% in the form of hexagonal crystals (wurtzite).

Keywords: pregnant solution zinc sulphate, zinc oxide, purification, solvent extraction, tripping, precipitation and calcination

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Study on Reduction of Iron Ore Concentrate in Rotary Kiln to Produce Direct Reduced Iron

***Studi Reduksi Konsentrat Bijih Besi dalam Tungku Putar Menghasilkan* Direct Reduced Iron**

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A direct reduced iron (DRI) was prepared using iron concentrate pellets and a coal as a reductant through three stages, namely, the first: iron concentrate pellets were dried by slow heating at 150°C to remove water content, the second: they were heated at 1,200°C to reduce magnetite into hematite which was treated in two different conditions, namely by oxygen and without oxygen injections; and the third: they were reduced in an atmosphere of CO/CO_2 at various temperatures of 950-1,200°C. In this reduction process of iron oxide would be reduced by CO to metallic iron (Fe). The experimental results showed that the metallization without oxygen injection produced the best metallization at 1,100°C and the ratio of carbon/iron (FC/Fe) of 0.52 to result 84.54%, contained 74.68% Fe and 88.34% Fe_{total}. The metallization by oxygen injection produced the best metallization at 1,100°C, providing result of 96.81%, Fe_{metal} of 87.88% and 90.78% of Fe_{total}. The iron oxides on the DRI were relatively low, namely 2.9%. In this research, prior pellets preparation a magnetic oxidation process on iron ore concentrate was also conducted and changed the magnetite into hematite. The reduction process on its pellets produced 94.15% metallization at 1,100°C, and the DRI contained 97.85% of Fe_{total}, 85.32% of Fe_{metal} and 5.35% of Fe oxides. Furthermore, analyzing a remained carbon of the DRI using microscopy to seek the metal structure formed. The remained carbon was reported around 1-6% C. Next smelting process, it is suggested to have a high residual carbon concentration as there will be a carbon boil mechanism to reduce iron oxides that are still lagging on the DRI.

Keywords: sponge iron, direct reduction iron (DRI), rotary kiln, magnetic, hematite, reduction process, coal

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Low-Rank Coal Gasification Using Bubbling Fluidized Bed Reactor at Low Operating Temperature

Gasifikasi Batubara Peringkatan Rendah Menggunakan Reaktor* Bubbling Fluidized Bed *pada Suhu Rendah

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Coal gasification is one of coal utilizations that produces less CO_2 emission than coal combustion. Coal gasification technology that has been used in Indonesia is generally a fixed bed gasification. Fixed bed is designed for high-rank coal and the majority of Indonesian coal is of a low-rank. Low ash and high moisture content of the Indonesian coal in a fixed bed can affect mechanical and thermal fragmentation, pressure drop, gas and particle flow distribution. The operation of gasifier may cause unstable condition. Another gasification technology is bubbling fluidized bed, which is operated above 1,200°C, so ash can melt. High operating temperature causes agglomeration and makes unstable gasification process. Therefore, in this study, low-rank coal is gasified in bubbling fluidized bed reactor at low operating temperature. The purpose of this study is to determine the optimal conditions of bubbling fluidized bed gasification. The research was conducted in bubbling fluidized bed coal gasification Process Development Unit (PDU) at Coal Utilization Technology Centre of R&D Centre of *tek*MIRA, Palimanan. Coal was fed continuously as many as 20 kg/hour into a gasifier then was gasified to produce gas using air as a gasifying agent and silica sand as a bed material at 850- 950°C. The produced gas from the gasification was analyzed using the Orsat Analyzer. A simulation using a ChemCAD 7.1 CC steady state was applied to validate the experiment result. From the analyzed result of yield gas composition, the produced CO and CO_2 were about 10-15 wt%. Gas compositions that are close to criteria of producer gas, no agglomeration, and stable process condition during study indicate that bubbling fluidized bed gasification at low operating temperature is suitable to be applied as gasification technology for Indonesian low-rank coal.

Keywords: low-rank coal, gasification, bubbling fluidized bed, producer gas

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The Availability of Indonesian Coal to Meet the 2050 Demand

Ketersediaan Batubara Indonesia untuk Memenuhi Permintaan Tahun 2050

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Coal is an important energy source for industry and power plant in Indonesia. Its reserve is quite abundant around 28.5 billion tons. The Government of Indonesia issued the National Energy Policy (NEP) to target 25% of coal use of the national energy mix in 2050. The NEP directs national energy management for the provision and utilization of primary energy. However, there are worries about the ability of coal reserves in accommodating the demand from domestic and export needs. The National Energy Council recommended a coal production restriction policy for anticipation measures. This research investigated the current state of the coal reserves and the government policy to meet the target in 2050 using Vensim program. In the Vensim, a model was built to represent a coal supply-demand system. Several scenarios were simulated to analyze the relationship between government policy and the coal reserve. The result shows that government intervention such as coal production restriction policy is needed to ensure Indonesia's coal reserve can fulfill domestic demand for power generation and industry by 2050.

Keywords: coal supply demand, government policy, dynamic system

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Analysis of the Linkage of Metals Mining Sector with National Economic

Analisis Keterkaitan Sektor Pertambangan Mineral Logam Terhadap Perekonomian Nasional

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Metals mining is one of the sectors that drives the national economy, and produced to meet the needs of human life. Almost all industries need this sector as an Metals mining is one of the sectors that drives the

national economy, and produced to meet the needs of human life. Almost all industries need this sector as an input either directly or indirectly. Each creation of the output from this sector requires an input from many other industries. The role of this sector can be traced by calculating its spreading (downstream linkages) and its degree of sensitivity (upstream linkages) of any other sectors in the country. The data used for supporting this calculation comes from trade transactions among sectors that have been compiled into Indonesian input-output tables. The objective of this study is to find the impact of metals mining sector on the regional economy. The method is conducted through approach of input-output analysis. Based on the calculation using input-output table analysis, it appears that there are four sectors that almost all its domestic outputs are able to fulfill the needs of other sectors in the country, i.e. tin-, gold-, silver- and other metals processing sectors. In other words, these four sectors have a high downstream linkage to other sectors in the country. The upstream linkages of these four sectors are also quite large because almost all other sectors in the country utilize the products of these sectors, either directly or indirectly. While the output of copper processing sector is almost entirely for exports. It indicates that the other industries in the country have not been able to capitalize this sector products due to various constraints such as technologies and investment in the processing and purification. This means that the copper mining sector has a low downstream linkage to the other sectors in the country, while the upstream linkage of this sector is very small, as the sector does not much utilize the product from other available in the country for the production process. The four sectors are more impactful since they have a high level of upstream and downstream linkages to the other industry sectors in the country compared to the copper mining sector.

Keywords: linkage, coefficient, sector, input, output