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Abstract Index

Ningrum, Nining S.; Huda, Miftahul and Suganal (R&D Centre for Mineral and Coal Technology)
Effect of Hydrothermal Dewatering on Coke Additive Making from Low Rank Coal (LRC)
Pengaruh Penurunan Kadar Air terhadap Pembuatan Adifit Kokas dari Batubara Peringkat Rendah
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This paper describes a study of the effects of hydrothermal dewatering (HTD) of Jambi, Pendopo and Wahau low rank coals, on additive characteristics. Hydrothermal upgrading and dewatering of the coals were carried out in a batch-type autoclave reactor at temperatures 350°C at a maximum pressure of 30 bar for 30 min. The dried sample resulted from hydrothermal process mixed with liquid fraction tar solvent at 250-350°C with ratio 4:6, was input in the 0,5 l autoclave to conduct hydrogenation process with variation initial hydrogen pressure of 10, 20, 30, 40, 50 bar, and reaction temperature of 400°C for 1 hour. The process of hydrothermal treatment before hydrogenation produced a higher calorific value having an average of >8000 cal/g (air dried basic, adb). Ash content and volatile matter for the coal were increased with the increasing initial hydrogen pressure. Corrected hydrogen content steadily increased after hydrothermal process and hydrogenation while the corrected oxygen decreased drastically after the hydrogenation process. Fuel ratio of Jambi, Pendopo and Wahau coals after hydrothermal process also increase reached 1.58, 1.04 and 1.77 respectively. Overall results indicate the importance of introducing a hydrothermal treatment step for the improvement of the coke additive characteristics.

Keywords: hydrothermal dewatering, low rank coal, corrected hydrogen and oxygen, coke additive

Wahyu, Haifa (Pusat Penelitian Fisika - LIPI)
Computational Analysis of Ash Erosion on Superheater Tubes in Coal Fired Powerplant
Analisis Komputasi Erosi Abu pada Pipa Superheater dalam Tungku Pembangkit Listrik Berbahan Bakar Batubara
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This paper presents a computational analysis of fly ash erosion on superheater tubes of a coal furnace. The investigation was held based on a hypothesis that erosion by coal ash particles have caused an untimely failure of a superheater tube during the initial running of a relatively new coal fired power plant. Material erosion is usually caused by several corresponding factors, therefore, it is necessary to examine the process taken by the coal ash to wear out superheater material before conclusions on the ash factor are drawn. This work applies a combination method of analysis using mathematical model and computational fluid dynamics (CFD) simulation. The mathematical model was used to calculate the amount of erosion by the fly ash particles and CFD simulation was employed to examine the velocity profile of combustion products around the superheater bank. The CFD simulation was based on the real scale and the design parameters of the power plant. The simulation shows that the velocity vector of the combustion products around superheater bank varies from 1 to 20 m/s magnitude with impacting angle varies from 0 to 90o relative to the vertical position of the superheater. Ash data were taken from the actual coal used during the operation and the design specified coal according to the equipment specification. Mathematical model was formulated for a single ash particle and for ash bulk. The results show that differences in the ash particle parameters result in different amount of material removal which means that ash particles affect the wear out of the material. As an overall, for each ash particle, the maximum erosion occurs at impacting angle of 17o. The impacting angle is used further in determining the amount of mass removal by varying the velocity and the abrasiveness of ash particles. At the maximum level of erosion, which is the maximum velocity calculated from the CFD simulation (20 m/s), every kilogram ash particles containing 46.54 % SiO2 with ash particle average diameter 500 micron is capable to remove about 0.0045 miligram alloy steel material. The maximum penetration of the ash particles into the superheater material is found at the maximum velocity obtained from the CFD simulation that is 20 m/s. The maximum penetration is 0.049 mm which is about 1.53 % of the pipe thickness. The superheater pipe is made of alloy steel material type A213-T91 with the thickness of pipe wall 3.2 mm. The magnitude of mass removal is considered relatively trivial to cause the thinning of material in a short period. This proves that coal ash particles will undergo a timely process to wear out superheater material, it is predictable and does not immediately cause erosion or failure. A brief physical examination was carried out to compare the results of the analysis and the causes of failures. It was found out that the failed superheater pipe had undergone clogging which caused overheating followed by pipe burst.

Keywords: coal ash, erosion, superheater tube failure, mathematical model, computational fluid dynamics simulation

Wahyudi, Agus; Amalia, Dessy and Sariman (R&D Centre for Mineral and Coal Technology)
Preparation of Nano Silica from Silica Sand Through Alkali Fusion Process
Penyiapan Nano Silika dari Pasir Silika Melalui Fusi Alkali
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Silica (SiO_2) materials play an important role for industries, especially those in micron or even nano-scale size. The later has better properties and improves its quality. Nano silica is applied widely in building material, notably as a mixture of concrete. The material is also promising to be developed into amorphous nano silicon for solar cell materials. Indonesia has a lot of silica sand resources and faces a challenge to increase its quality into high product such as nano silica. Synthesizing silica nano through alkali fusion is a process that includes using the particles along with sodium hydroxide at temperature of 400-1100 °C then recrystalizing the molecules to get materials in nano size. The recrystalizing process was conducted by water leaching and filtration. The derived nano particles (gel) ranged between 40-60 nm. TEM characterization showed that the products are homogeneous, well dispersed and has specific surface area around 157 m^2/g.

Keywords: nano silica, silica sand, synthesizing, alkali fusion, particle size

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Effect of Oxidizing Agents in Extracting Gold from Anode Slime
Pengaruh Oksidator dalam Mengekstraksi Emas dari Lumpur Anoda
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Anode slime is a byproduct collected from electro refining copper process. The valuable metals present in the slime are Au, Ag, Pt, Pd and Pb. Yet, the slime has not been processed in Indonesia but sent to another country. Extracting the gold from anode slime had been attempted in the laboratory by applying wet chlorination method. Sodium hypochlorite (NaOCl) and hydrogen peroxide (H_2O_2) served as the oxidizing agents. Effects of various parameters such as solvent concentration, leaching time and temperature on the percent extraction of gold were studied. The optimum recovery of gold with NaOCl is 98.86 % Au at leaching temperature of 40°C, solvent concentration 5 M, NaOCl 5 mL and 20% solid after 120 minutes leaching time. Silver loss under this condition is 2–3%. Leaching the gold by H_2O_2 provided the highest gold extraction of 99.99% Au at 7M HCl concentration, temperature 60°C, H_2O_2 0.5 M, leaching time 180 minutes, and 20% solid. The silver loss under this condition is only 0.6%.

Keywords: anode slime, wet chlorination, extraction, gold, oxidation, oxidizer

Wahyudi, Tatang and Damayanti, Retno (R&D Centre for Mineral and Coal Technology)
Effect of Reagent Volume and Concentration on Recoveries of MgO and SO_3 within Synthetic Dolomite-Based Kieserite
Pengaruh Volume dan Konsentrasi Reagen terhadap Kandungan MgO dan SO_3 dalam Kiserit Sintetis Berbahan Dasar Dolomit
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Natural kieserite is usually used for the production of epsom salt and fertilizer. Normally, the mineral is mined from geologic marine deposits and provides a soluble source of both Mg and S for plant nutrition. However, natural kieserite cannot be found in Indonesia. The fact that this country retains a lot of dolomite deposits and such a material can be processed into synthetic kieserite by sulphatization process seems promising for fertilizer industry in Indonesia. Varying the sulfuric acid concentration between 2 and 5 N and its volume from 29.50 to 94.80 ml produces the MgO in $MgSO_4$ filtrate below the specification as stated in Indonesian National Standard (14 – 19%) though its sulfur content has satisfied the requirements. It is assumed that some MgO's (around 1.93 – 7.12%) are still available in $CaSO_4$ deposit. To get the optimum results, an appropriate calculation is required when adding sulfuric acid to the process and the solution should be in neutral condition prior to separating $MgSO_4$ – $CaSO_4$ as well.

Keywords: kieserite, dolomite, sulfuric acid, MgO, $MgSO_4$, $CaSO_4$