Pengaruh basasitas pada proses pembuatan FeMn (Rerro Mangan) dari bijih mangan lokal dengan mini submerged arc furnace (SAF) = The effect of slag basicity on ferromanganese production process FeMn using local manganese ore with mini submerged arc furnace (SAF)

Eka Bobby Saputra, author

Abstrak

[ABSTRAK
Logam ferromangan adalah salah satu unsur paduan penting pada baja untuk meningkatkan sifat mekanis, ketahanan aus, dan kekerasannya. Bentuk ferromangan (FeMn) telah diatur dalam standard ASTM dengan kadar minimal sebesar 75% Mangan (Mn). Tujuan penelitian ini adalah pembuatan logam FeMn dengan kandungan minimal 60%Mn dari bijih mangan lokal dan mempelajari efek dari basasitas terak yang dipengaruhi oleh penambahan kapur sebagai zat aditif dalam proses pembuatan ferromangan terhadap jumlah produk ferromangan yang dihasilkan dan konsumsi energi yang dibutuhkan dalam proses tersebut.
Dalam penelitian ini digunakan bijih mangan lokal kadar menengah dari daerah Jember-Jawa Timur 39.38 Mn ? 2.89 Fe ? 26.58 SiO2 (Medium Grade Ore) dengan teknologi Mini Sub-merged Arc Furnace (SAF) di UPT BPM LIPI, Lampung. Setiap satu kali proses, digunakan 30 kg bijih mangan (Ø ±30mm), 7.5 kg kokas, dan jumlah batu kapur yang bervariasi, yaitu; 8, 10, 12, dan 14 kg. Proses peleburan berlangsung pada temperatur 1200-1500 oC. Kemudian hasil akan dianalisa dengan menggunakan XRF (X-Ray Fluoroscence), XRD (X-Ray Diffraction), AAS (Atomic Absorbtion Spectrometry), dan Proksimat.
Hasil penelitian menunjukan bahwa dengan meningkatnya basasitas terak (dari 0.32 hingga 0.76) akan meningkatkan jumlah produk ferromangan hingga 8.2 kg FeMn, kemudian memaksimalkan kadar % mangan yang tereduksi pada logam hingga mencapai komposisi kimia yang optimal (78,13 Mn-12,65 Fe-8.93 Si), menekan konsumsi energi hingga 9.8 kwh/kg ferromangan, menekan angka konsumsi elektroda, dan menghasilkan prosentase efisiensi proses berupa % yield yang cukup tinggi yakni sebesar 58.61%. Hasil lain yang menunjang proses pengolahan ferromangan dengan meningkatnya hasil basasitas terak adalah tercapainya suhu reaksi yang tinggi yakni sebesar 15940C sehingga membuat reduksi oksida mangan pada terak menjadi mangan pada logam semakin baik, kemudian jumlah terak juga dapat ditekan. Selanjutnya secara tinjauan aspek ekonomi dari keempat kali proses penelitian, maka didapatkan hasil yang paling menguntungkan sebesar Rp 5.731,-/proses.
ABSTRACT
Ferromanganese metal is an important alloying element in steel production industry used to maximize its mechanical properties such as wear resistance and

hardness. The most common form of ferromanganese according to ASTM standard contain min.75%Mn and max.25%Fe inside the product. The target of this research is to obtain ferromanganese metal with min.60%Mn using medium grade manganese ore (39.38 Mn ? 2.89 Fe ? 26.58 SiO2) from Jember district - East Java, yet the effect of its slag basicity will also support the most optimum result. This kind of basicity will determined by the amount of limestone as fluxing agent which added to the furnace. Moreover, this study will focus to the effect of its slag basicity on the number of ferromanganese product and the amoung of energy consumption.
This study was taking place at UPT BPM LIPI Lampung, Sumatera. Using their Mini Sub-merged Arc Furnace (SAF) the process began without any beneficiation processs for its raw material. Manganese ore Ø ±30mm, cokes, and limestones were added at the same time to the SAF and melted at 1200-1450 oC. Processes were repeated 4 times with each process using 30 kg manganese ore, 7.5 kg cokes, and limestones which varied from 8, 10, 12, and 14 kg. Validity of this study supported by the chemical analysis which took place before and after reduction process using some tools such as XRF (X-Ray Fluoroscence), XRD (XRay Diffraction), AAS (Atomic Absorbtion Spectrometry), and Proxymate analysis.
The result of this research showed an increasing trend in product?s quality as the slag basicity and the amount of limestone increased. As the slag basicity increase, the number of ferromanganese metal products were also increased until 8.2 kg FeMn and the amount of manganese element in metal phase also showed the most optimum chemical composition of ferromanganese metal (78,13 Mn-12,65 Fe-8.93 Si). Furthermore, the energy consumption can be reduced until 9.8 kwh/kg FeMn as well as the electrodes consumption and also the efficiency percentage or % yield process can be increased up to 58.61%. Other parameters which used to support these 4-times-research plan was the temperature level which turned out to be as high as 15940C and helped the reduction process of manganese oxide into manganese metal became easier. Not only to obtain more manganese content in metal phase, but also this level of reduction temperature can reduced the amount of slag. Finally, in addition to support the optimum data, economic analysis also showed that this composition was the most profitable process with Rp 5.731,-/process as its profit., Ferromanganese metal is an important alloying element in steel production industry used to maximize its mechanical properties such as wear resistance and hardness. The most common form of ferromanganese according to ASTM standard contain min.75%Mn and max.25%Fe inside the product. The target of this research is to obtain ferromanganese metal with min.60%Mn using medium grade manganese ore (39.38 Mn – 2.89 Fe – 26.58 SiO2) from Jember district - East Java, yet the effect of its slag basicity will also support the most optimum result. This kind of basicity will determined by the amount of limestone as fluxing agent which added to the furnace. Moreover, this study will focus to the effect of its slag basicity on the number of ferromanganese product and the amoung of energy consumption.
This study was taking place at UPT BPM LIPI Lampung, Sumatera. Using

their Mini Sub-merged Arc Furnace (SAF) the process began without any beneficiation processs for its raw material. Manganese ore Ø ±30mm, cokes, and limestones were added at the same time to the SAF and melted at 1200-1450 oC. Processes were repeated 4 times with each process using 30 kg manganese ore, 7.5 kg cokes, and limestones which varied from 8, 10, 12, and 14 kg. Validity of this study supported by the chemical analysis which took place before and after reduction process using some tools such as XRF (X-Ray Fluoroscence), XRD (XRay Diffraction), AAS (Atomic Absorbtion Spectrometry), and Proxymate analysis. The result of this research showed an increasing trend in product's quality as the slag basicity and the amount of limestone increased. As the slag basicity increase, the number of ferromanganese metal products were also increased until 8.2 kg FeMn and the amount of manganese element in metal phase also showed the most optimum chemical composition of ferromanganese metal (78,13 Mn-12,65 Fe-8.93 Si). Furthermore, the energy consumption can be reduced until 9.8 kwh/kg FeMn as well as the electrodes consumption and also the efficiency percentage or % yield process can be increased up to 58.61%. Other parameters which used to support these 4-times-research plan was the temperature level which turned out to be as high as 15940C and helped the reduction process of manganese oxide into manganese metal became easier. Not only to obtain more manganese content in metal phase, but also this level of reduction temperature can reduced the amount of slag. Finally, in addition to support the optimum data, economic analysis also showed that this composition was the most profitable process with Rp 5.731,-/process as its profit.]