Pengaruh campuran reduktor coal-coke dalam proses reduksi biji mangan lokal pada submerged arc furnace = Effect of mix reductant coal-coke in process reductin local manganese ore in the submerged arc furnace

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Abstrak

[ABSTRAK
Mangan merupakan logam yang digunakan untuk berbagai macam kebutuhan seperti untuk campuran logam agar menghasilkan baja dalam industri baja. Kebutuhan bijih mangan juga meningkat seiring dengan peningkatan teknologi dan kebutuhan akan mangan tersebut. Pada penelitian ini akan dilakukan proses pembuatan ferromangan dari bahan baku bijih mangan lokal dengan menggunakan submerged arc furnace (SAF). Proses peleburan dilakukan dengan menggunakan 30kg bijih mangan, 12kg batu kapur, dan jumlah kokas serta batu bara yang bervariasi, yaitu 0%, 25%, 50%, 75%, dan 100%. Kemudian, analisa karaktrisasi akan dilakukan untuk mengetahui kualitas produk ferromangan yang dihasilkan, yaitu analisa XRF (X-Ray Fluoroscence), XRD (X-Ray Diffraction) untuk mengecek kadar mangan dan kadar slag, analisa masa selama proses produksi, dan analisa jumlah pemakaian energi selama proses produksi.
Hasil penelitian menunjukkan dengan peningkatan kadar kokas dibandingkan kadar batu bara dapat meningkatkan kualitas maupun kuantitas produk ferromangan. Dengan penggunaan 9.5kg (100%) coke akan menghasilkan massa/yield tertinggi yaitu 12.8kg / 96.24% karena kokas memiliki unsur yang lebih baik daripada batu bara sehingga proses reduksi dapat menjadi optimal. Selanjutnya, kandungan mangan pada produk ferromangan tertinggi saat penggunaan 9.5kg (100%) coke sebesar 75.19% Mn karena kokas memiliki kandungan unsur pengotor yang lebih sedikit dibandingkan dengan batu bara sehingga proses reduksi berlangsung dengan optimal. Kemudian, konsumsi energy terendah saat penggunaan 9.5kg (100%) coke sebesar 7.03KWh/kg karena kokas memiliki kandungan pengotor yang sedikit, salah satu contohnya volatile matter, jika kandungan unsur tersebut besar maka konsumsi energi akan bertambah. Sedangkan kandungan fosfor dan sulfur terendah pada produk ferromangan ketika penggunaan 9.5 kg (100%) coke, yaitu fosfor dibawah 0.001% dan sulfur 0.18%. Pengaruh kandungan tersebut berasal dari reduktor yang digunakan, kokas memiliki kandungan phosphorus dan sulphur yang lebih rendah jika dibandingkan dengan kokas. Phosphorus dapat membuat rapuh logam karena adanya perbedaan kekerasan, kekuatan, dan keuletannya. Sedangkan sulphur dapat membuat rapuh logam pada saat temperature tempa, sehingga kemampuan tempanya akan menurun. Selain itu berdasarkan aspek ekonomi, diperoleh hasil yang memilik keuntungan tertinggi sebesar Rp62,565 dengan penggunaanreduktor sebanyak 9.5kg (100%) coke dan 0kg (0%) coal.
ABSTRACT
Manganese mineral is one of the metal element which are used in common to produce alloy steel product. Manganese element is important to enhance steel properties such as wear resistance and hardness. Due to high demand of alloy steel, the production of ferromanganese products are also increase. This phenomena leaded to a large number of manganese ore supply. In this present study, the ferromanganese production will be conducted in mini submerged arc furnace (SAF) technology. The process began with 30 kg medium

grade manganese ore from Jember, East Java-Indonesia, 12 kg limestone as its fluxing agent, and with the main variable of mixed reductor from 0%, 25%, 50%, and 100% of cokes and coal as its balance. Along the process, chemical analysis also conducted with some tools to obtain an accurate data of chemical compositions within the raw materials, slag, and ferromanganese product. These chemical analysis were conducted by XRF, XRD, and Proximate analysis. Furthermore, not only the chemical composition but also the number of electricity in each process were calculated to obtain the most efficient process.
The result of this research showed an increasing trend in ferromanganese quality and quantity with a large number of cokes. Instead of coal, cokes are more effective as a reductor agent in this process. This study showed that with 9.5 kg of cokes (100%) the reduction process of ferromanganese will produce 12.8 kg of ferromanganese metal, 75.19% of manganese content, 96.24% of yield ratio, and least number of energy consumption 7.03 kwh/kg ferromanganese product. One of the reasons to support this result is because cokes have lesser number of impurities than in coal such as volatile matter. The amount of phosphor and sulfur content in ferromanganese metal also can be reduced to < 0.001% P and 0.18% S by using 100% cokes as its reductor. These parameters are important because with small number of phosphor and sulfur content the metal will become tougher and hinder the negative effect of short red hardness in metal during further forming activity. The other reason to support the effectiveness of using 100% cokes as the reductor instead of mixing with coal is the amount of profit for each process which is turned to be the highest profit number compare to other mixing composition, it is Rp 62.565,-/process., Manganese mineral is one of the metal element which are used in common to produce alloy steel product. Manganese element is important to enhance steel properties such as wear resistance and hardness. Due to high demand of alloy steel, the production of ferromanganese products are also increase. This phenomena leaded to a large number of manganese ore supply. In this present study, the ferromanganese production will be conducted in mini submerged arc furnace (SAF) technology. The process began with 30 kg medium grade manganese ore from Jember, East Java-Indonesia, 12 kg limestone as its fluxing agent, and with the main variable of mixed reductor from 0%, 25%, 50%, and 100% of cokes and coal as its balance. Along the process, chemical analysis also conducted with some tools to obtain an accurate data of chemical compositions within the raw materials, slag, and ferromanganese product. These chemical analysis were conducted by XRF, XRD, and Proximate analysis. Furthermore, not only the chemical composition but also the number of electricity in each process were calculated to obtain the most efficient process.
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