

# Pengaruh kokas dalam proses reduksi bijih mangan lokal kadar menengah pada submerged arc furnace menjadi ferromangan = Effect of coke in the local medium grade of manganese ore reduction process into ferromanganese with submerged arc furnace

Robby Krisnaldo Elvin, author

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## Abstrak

Mineral mangan merupakan salah satu mineral yang paling banyak ditemui di kerak bumi. Sebagian besar produksi mangan dan paduannya di dunia saat ini diserap oleh industri baja. Ferromangan merupakan salah satu logam paduan dengan kandungan mangan yang sangat tinggi, yaitu sekitar 65 - 90%. Sebanyak 90%, ferromangan digunakan untuk menambahkan unsur mangan kedalam material baja untuk memperbaiki sifat-sifat mekanik dari material baja, seperti kekuatan, hardenability, dan ketahanan terhadap aus. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan kadar kokas terhadap keefisienan proses reduksi bijih mangan lokal kadar menengah menjadi produk ferromangan. Proses reduksi dilakukan pada tungku submerged arc furnace tiga fasa dengan kapasitas 100 Kg/Batch dilengkapi dengan tiga buah elektroda grafit. Setiap percobaan menggunakan 30 Kg bijih mangan lokal, 12 Kg limestone, dan kadar kokas yang bervariasi, yaitu 5,5 Kg (18,33%), 7,5 Kg (25,00%), 9,5 Kg (31,67%), dan 11,5 Kg (38,33%). Hasil penelitian menunjukkan bahwa kuantitas dan kualitas produk ferromangan yang dihasilkan meningkat seiring dengan bertambahnya kadar kokas yang digunakan. Dimana kandungan mangan pada ferromangan dan massa/yield produk ferromangan cenderung meningkat. Kandungan mangan pada produk ferromangan tertinggi sebesar 78% pada pengujian menggunakan kokas sebanyak 7,5 Kg (25,00%). Sedangkan massa produk ferromangan tertinggi terdapat pada pengujian dengan menggunakan kokas sebanyak 9,5 Kg (31,67%), yaitu 12,8 Kg. Dan pada penggunaan energi selama proses berlangsung cenderung menurun dengan penambahan kokas, dimana penggunaan energi terendah selama proses reduksi berlangsung pada pengujian menggunakan kokas sebanyak 9,5 Kg (31,67%) sebesar 7,03 KWh/Kg. Namun konsumsi elektroda cenderung meningkat. Sehingga konsumsi elektroda grafit terendah pada saat menggunakan kokas 5,5 Kg (18,33%), yaitu sebesar 0,75 Kg. Berdasarkan aspek ekonomi, pengujian dengan keuntungan tertinggi terdapat pada pengujian menggunakan kokas sebanyak 9,5 Kg (31,67%) yaitu sebesar Rp 62.565 pada tiap satu kali pengujian.

.....Manganese is one of the most common minerals in the earth's crust. Manganese plays an important role in the development of various steel making processes and its continuing importance is indicated by the fact that about 90% of all manganese alloys consumed annually goes into steel production as an alloying element in the form of ferromanganese. Ferromanganese is one of the metal alloys with a high content of manganese, which is about 65 - 90%. Manganese has four functions to steel such as desulphurizing agent, deoxidation agent, enhancing hardness, and wear resistance. This research, studies have been made to obtain the most optimum raw material composition to produce ferromanganese metal based on local medium grade manganese ore with various amount of cokes as its main variable. The process is conducted four times by smelting manganese ore into ferromanganese metal in mini submerged arc furnace (SAF) technology using three graphite electrodes. The process begin with using 30 kg of medium grade manganese ore from Jember, East Jawa-Indonesia, 12 kg of limestone as its fluxing agent, and various number of cokes from 5,5 kg

(18,33%), 7,5 kg (25%), 9,5 kg (31,67%), and 11,5 kg (38,33%). Influence of various amount of cokes being used in this study have been investigated. The experiment conducted by increasing number of cokes carried out good results. Higher consumption of cokes will produce bigger number of ferromanganese metal and also the manganese content inside it. The most optimum composition of cokes shown by this study is 9,5 kg (31,67%), producing the biggest number of product at 12,8 kg of ferromanganese and consuming the least energi at 7,03 kwh/kg FeMn. The other result also showed that adding 7,5 kg (25%) of cokes will produce 78% manganese content inside the metal which was the highest manganese content. However, with an increase of cokes, the electrode consumption will also increase. The experiment with 5,5 kg (18,33%) of cokes carried out the least electrodes consumption at 0,75 kg/process. Moreover, to support the optimum raw material composition, economic evaluation has been conducted. The biggest profit is Rp 62.565,- /process for 9,5 kg (31,67%) of cokes.