

Studi pengaruh ukuran partikel, temperatur, waktu tahan, dan kadar reduktor terhadap proses pra-reduksi Bijih Nikel Laterit = Study of the effect of particle size, temperature, reduction time, and reductor concentration on the pre-reduction process of Nickel Laterite Ore

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Abstrak

Kandungan nikel pada bijih laterit tergolong rendah, namun kelimpahannya mencakup 70% jumlah total sumber daya nikel dunia. Indonesia sebagai negara dengan cadangan nikel laterit terbesar kedua dunia memanfaatkan saprolit dan limonit untuk memproduksi feronikel melalui proses pirometalurgi. Kualitas yang dihasilkan bergantung pada perilaku difusi nikel menuju matriks besi, hal ini dipengaruhi oleh derajat reduksi dari senyawa-senyawa pengotor yang terkandung selama proses roasting. Aspek-aspek yang mengontrol antara lain ukuran partikel, temperatur, waktu tahan, dan kadar reduktor. Dehidroksilasi dan rekristalisasi bijih laterit yang berasal dari Pomaala, Sulawesi, Indonesia diamati dengan metode Differential Scanning Calorimetry-Thermogravimetry (DSC-TG). Sampel-sampel berbentuk briket batubara/laterit diteliti menggunakan Energy Dispersive X-ray (EDX) dan X-ray Diffraction (XRD) setelah dipanaskan pada berbagai kondisi reduksi. Pembentukan tetratenit tampak sangat peka akan pengaruh peningkatan temperatur dari 600°C hingga 1200°C. Intensitas tertinggi 672 counts tercapai pada temperatur 1.200°C, di mana munculnya peak tetratenit di 2 74,45° mulai terdeteksi. Pengamatan menggunakan Scanning Electron Microscopy (SEM) pada temperatur ini juga mendeteksi keberadaan senyawa berbentuk gelembung diduga hasil pertumbuhan tubular halloysit. Senyawa forsterit dan enstatit hanya ditemukan pada temperatur 1000°C. Intensitas tetratenit berhasil ditingkatkan hingga 469 counts pada sampel dengan ukuran partikel #270, sedangkan peningkatan waktu tahan hingga 90 menit menghasilkan intensitas 227 counts. Di lain pihak, pada batubara:laterit = 1:1, nilai intensitas tetratenit hanya mencapai 185 counts.

The abundance of laterite ore with low nickel content covers 70% of total world nickel reserves. Indonesia as the country with the world's second largest nickel laterite reserves recovers feronickel from saprolite and limonite through pyrometallurgical processes. Its quality will depend on the behaviour of nickel diffusion into ferrous matrix that is influenced by reduction degree of the ore gangue during roasting. Controlling aspects include ore particle size, temperature, reduction time, and reductor concentration. Dehydroxlation and recrystallization of laterite ores from Pomaala, Sulawesi, Indonesia were investigated using Differential Scanning Calorimetry-Thermogravimetry (DSC-TG) method. Samples in briquette coal/laterite form were examined by Energy Dispersive X-ray (EDX) and X-ray Diffraction (XRD) after reduction under various conditions. The formation of tetratenite is highly sensitive to temperature increase from 600°C to 1200°C. Highest intensity of 672 counts was reached at 1200°C, at which the peak at 2 74,45° was detected finally. Observation using Scanning Electron Microscopy (SEM) at this temperature also revealed a bubble-shaped like compound supposedly the result of halloysite growth. Forsterite and enstatite were only found at temperature 1000°C. The tetratenite intensity was succesfully raised until 469 counts on sample with particle size #270, while increase of reduction time up to 90 minutes yielded intensity of 227 counts. On the other hand, with coal/laterite ratio = 1, the tetratenite intensity only attained 185 counts.